UNIVERSITA' DELLA CALABRIA - FACOLTA' DI ECONOMIA

DIPARTIMENTO DI ECONOMIA E STATISTICA

Dottorato di Ricerca in Economia Applicata - XXI Ciclo

Fixed-term Jobs, Skills and Labour Market Performance

Settore Scientifico Disciplinare: SECS-P/02

Relatore

Prof.ssa Patrizia ORDINE

Coordinatore

Prof. Vincenzo SCOPPA

Candidato

Dott. Leandro ELIA

ANNO ACCADEMICO 2007/08

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Chapter 1

Introduction

In response to the dramatic rise in unemployment faced since the end of the 1970s, many European countries have made use of several policy instruments. On the one hand, they have been directed at relaxing the systems of employment protection by reducing the mandated costs to firms of firing workers and, on the other hand, at enhancing the use of fixed-term employment contracts. Temporary workers represent a growing share of the employed workforce in many European countries. Between 1997 and 2004 the percentage of fixed-term jobs has grown by about 2% in the EU25, reaching 13.7% in 2004 (European Commission, 2005). Each country has experienced different growth rate. The highest figures concern Spain (32.5%), Portugal (19.8%) and Poland (22.7%). The empirical evidence shows that the flows into temporary employment are all but negligible: during the nineties, over 90% of new hires in Spain have been signed under fixed-term contracts (Dolado *et al.*, 2002; Guell and Petrongolo, 2007); in Italy, in the same period, the figure amounts to about 50% (Berton and Pacelli, 2007).

These reforms, mainly reflect a desire to maintain protections for workers in permanent jobs while giving to firms an incentive to create new, temporary jobs, which may ultimately become permanent. This is especially true for Italy, where, in the last decade, the introduction of several new contractual forms for fixed-term employment has aimed at both boosting the flexibility of the labour market and fostering job creation, leaving largely unchanged

the legislation applying to the stock of workers employed under long-term contracts. This has given rise to a dualism in the labour market, wherein only permanent employees benefit from all the rights and job protections provided by law (see Boeri and Garibaldi, 2007; Francesconi *et al.*, 2002).

The introduction of fixed-term contracts have raised concern among both academics and policy-makers. On the academic ground, some consensus has been achieved, namely, that intensifying the use of such contracts does not necessarily lead to an increase in employment. The effects of such a partial reform might be perverse, leading to higher unemployment, lower output and lower welfare for workers (Bentolilla and Dolado, 1994; Blanchard and Landier, 2002; Cahuc and Postel-Vinay, 2002). On the political ground, concerns are mainly about whether fixed-term contracts act as a truly "stepping stone" to permanent employment or whether they just turn out to be a trap. It is well known that fixed-term contracts allow firms to better discriminate workers with respect to ability (see chapter 6 in Cahuc and Zylberberg, 2004): after a period of screening, firms are able to assess flawlessly workers' ability and then decide to keep them whether talent is high enough or, conversely, to laid them off without incurring firing costs. Hence, long-term contracts may be considered as a "reward" to the ablest workers. Ultimately, they also help to improve the quality of any match both for employer and for employee.

However, in a world with high firing costs, a substitution effect may arise. Employer might be induced by the introduction of fixed-term contracts to substitute long-term jobs with fixed-term ones, since the latter are less onerous than the former and, in particular they are not subject to firing restrictions. This, in turn, may weaken the role of fixed-term contract in increasing employment.

Lastly, intensive use of such contracts may also affect the fixed-term employees in terms of wage raising: first, by weakening worker's threat to quit the current temporary jobs for a better outside option (because of the absence of firing costs), and, second, by deferring any wage-tenure effect up until an open-ended contract is achieved.[1]

[1]This statement trivially holds for Italy, where wages raising is strictly linked to job tenure.

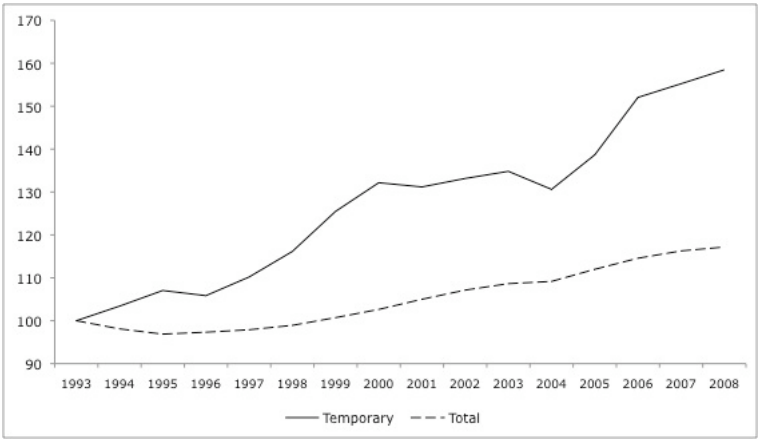


Figure 1.1: *Evolution of temporary and total employment 1993-2008 (1993=100). Source: ISTAT.*

The aim of my dissertation is to explore this argument, both theoretically and empirically; in particular, the goal is to shed light on the duration pattern of fixed-term contracts and the determinants of their conversion into permanent ones, and on the effect of temporary contracts upon wage dynamic of skilled and unskilled workers. In doing this, I focus on one country, Italy, mostly because recent introduction of such contracts and their intense use by firms has raised concerns about the effectiveness of short-term contracts to reduce unemployment and, in particular, to represent a springboard into permanent jobs. Indeed, in the last decade, young workers have been going through many spells of unemployment and low productivity short-term jobs before obtaining a regular (permanent) job, and this succession turns out to be a trap for some of them.

Fig. (1.1) depicts the evolution of fixed-term and total employment from 1993 to the second quarter of 2008, in Italy. Total employment growth is about 1.1% per year in that period; the evolution of temporary employment is even higher: the total growth amounts to 55% (3.2% on average per year). The time period 1996-2000 and 2004-2008 show the higher growth, 5.7% and 5.9% per year respectively. These remarkable increases are likely ascribed to the law 196/1997, which has introduced the agency contracts in 1998, and

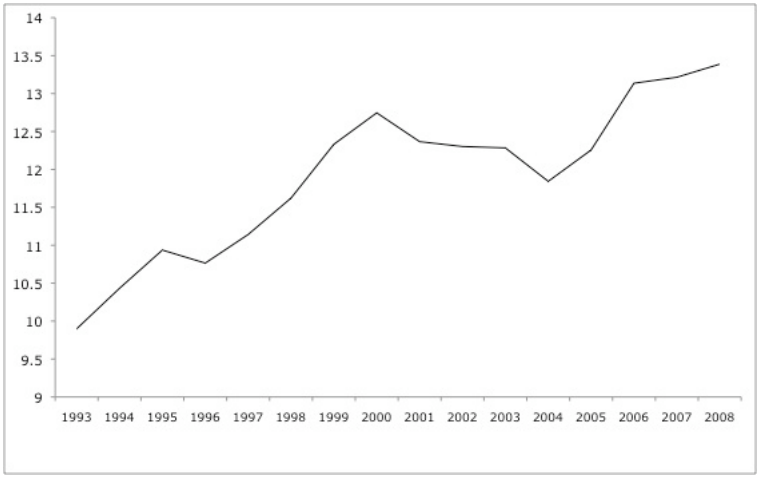


Figure 1.2: *Evolution of the share of fixed-term contracts in total employment 1993-2008. Source: ISTAT.*

to the 30/2003, which has reformed all the previous fixed-term contracts and introduced new contractual forms (see Appendix 1 for an overview of the main features of these laws). Fig. (1.2) emphasizes this trend, showing that only between 2000 and 2004 there has been a decrease of about 1%, likely induced by the global economic slowdown. At the end of the observational period the share of fixed-term contracts amounts to 13.2%. Moreover, age is one of the main discriminant factor in the use of such contracts: 40% of workers aged under 25 and 22% of workers aged 25 to 29 is employed with a temporary contract. The opposite holds for older workers, most of them are employed with an open-ended contract (see fig. 1.3). This last figure seems to corroborate the aforementioned role of fixed-term contract, that is, a device to overcome the asymmetric information about workers' ability. In addition, the incidence of fixed-term contracts is increasing in the educational level attained: graduate workers are more subject to be employed with a temporary contract (see for details Ministero del Lavoro, della Salute e delle Politiche Sociali, 2008).

In this work, I am interested to study how the route towards skilled (unskilled) long-term employment can be heterogeneously affected by a change in the institutional legislation upon fixed-term contracts, pointing to create

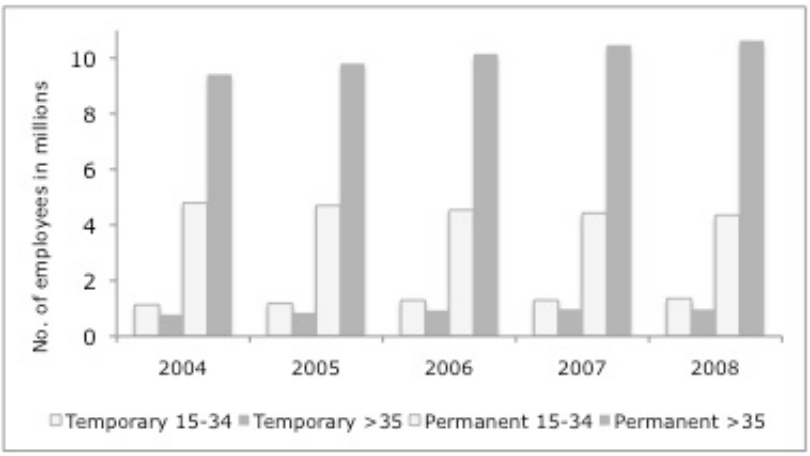


Figure 1.3: *Evolution of temporary and total employment by age groups 2004-2008. Source: ISTAT.*

more flexibility in the labour market. Moreover, concerns are also about the comprehension of how, subsequent to such a change, labour market equilibrium alters, both in terms of unemployment rate, wage distribution and flows into and out fixed-term (long-term) employment.

The theoretical framework is based on Mortensen and Pissarides (1994), though I borrow part of the setup from Cahuc and Postel-Vinay (2002), where I introduce firing costs, learning process about workers unobservable ability and two types of contracts, fixed-term and open-ended contracts, to capture the case of interest. Moreover, I consider two submarkets, in which only jobs with a specific skill requirement and unemployed workers fulfilling such requirement participate.

The novelty is the introduction of a process of learning (screening) about workers innate ability, for only skilled positions, in the conventional matching and searching model. I treat such process as a decision theoretic optimal stopping problem *á la* Mortensen and Pisarrides (1999b). Knowledge of ability is achieved through successive observations of workers' performance. Idiosyncratic shocks to the workers specific productivity (ability) modify the value of the match and, conditional on that, firms decide whether to continue the match or destroy it. The probability of switching contractual form, conditional

on having observed the ability is not explicitly taken into account in the initial Bellman Equations, mostly because of the desire of preserving as simple as possible the analysis of the issue. However, this simplified approach does not preclude to allow for it. It is just a matter of interpretation of the relations derived. As I consider mainly two states in which workers are employed on a temporary basis, entry level fixed-term jobs and renewed short-term jobs, it is obvious that staying in the latter presupposes that firms know the first realization, drawn from the distribution of ability. That is, they have some information about workers' ability. This is made clearer when one looks at the key relations of the model.

Hence, in order to obtain a fixed-term contract renewal the present value of a worker's future ability must be higher than the current one, namely, the new value of ability must be higher than the reservation value that gives rise to a non-renewal. Analogously, in order to see converted a short-term into a long-term job, the realization of ability must be higher than the reservation value that triggers a non-conversion, which, in turn, is also higher than the reservation value of a renewal. This approach enables me to uniquely identify both the determinants of job creation and destruction in terms of job specific (technology) and worker specific productivity (ability).

I further introduce an exogenous policy parameter, p, in the model which is intended to easing restrictions on the use of temporary employment contracts (e.g. renewals of fixed-term contract). Shifts in such parameter allow me to draw interesting conclusions about the key relations of the model, in particular, with respect to job creation and job destruction, equilibrium unemployment rate and wages of skilled and unskilled workers.

It will be shown that easing restrictions on the use of temporary contracts affects differently the two submarkets. In particular, in the skilled submarket, it fosters job creation, induces less frequent transformation of short-term jobs into long-term jobs and increase the *within* wage inequality, i.e., long-term wages push up whereas short-term wages lower for entry-level jobs and rise for the succeeding ones. One of the key effect of such a policy change is that the learning process elapses longer. This is mainly detected by the drop

of reservation value of a renewal. Being now easier to renew contracts on a temporary basis, firms become less demanding about workers' ability, mostly because they can now spread out the assessment about it on a longer span. This, in turn, implies that short-term jobs exhibit a lower productivity in terms of workers' ability. At the same time, the learning process becomes more efficient: firms demand higher ability to upgrade workers with a long-term contract. As a result, it is now more likely that workers are stuck longer in short-term jobs.

Conversely, in the unskilled submarket, firms are entitled to keep short-term jobs longer (by renewing their contracts) and are more exacting about the minimum acceptable productivity, by raising the opportunity cost of long-term jobs. In addition job creation falls and wage differential between fixed-term and long-term workers decreases.

I am further able to draw some conclusion about the *between* wage inequality. By comparing top earners in the skilled labor market and the bottom earners in the unskilled labor market, I can state that, after the policy change, the wage ratio between these two groups turn out to be wider. To some extent, an increase in p might exacerbate workers polarization in terms of earning in the economy.

The empirical analysis is aimed at recovering estimates of two main implications of the model for the Italian labour market, namely, (i) the duration pattern of fixed-term contracts and (ii) the change in wages after the policy implementation. In order to allow for group-specific effects, I carry out two separate analyses for each of the issues of interest, one for skilled workers and the other one for unskilled workers (singled out along the type of occupation).

The main purpose of the duration analysis is to shed light on the duration pattern of fixed-term contract and in particular on the determinants of their conversion into permanent contracts. To conduct the empirical analysis I select a sample of individuals who enters the labour market via fixed-term employment over the period 2000-2004, and followed until they obtained a permanent contract. The sample used is drawn from the WHIP dataset (Work Histories Italian Panel), which is a panel survey of individual work histories,

based on INPS (Istituto Nazionale di Previdenza Sociale, Social Security Institute) administrative archives. The model used in this empirical investigation is a continuos time duration model (Cox proportional hazard). The main findings can be summarized as follows: i) the probability of getting a long-term job is lower at the onset of the working career, then, it increases with the duration of the fixed-term working experience; ii) unskilled workers generally exhibit higher conversion rates than skilled ones; iii) longer span of fixed-term employment than about 48 months seems to affect negatively the transition rates.

Furthermore, irrespective of the population group considered (skilled, unskilled workers), the highest transition rates are shown at very long durations, suggesting that on average workers have to go through a long period of fixed-term employment in order to obtain a permanent job. Had they not, they likely might even experience lower transition rates afterwards.

The goal of the second empirical investigation is to evaluate the effect of the *30/2003* law (fixed-term contract reform) on wage differentials between workers employed with a short-term contract and workers with a long-term contract by skills category. I am concerned with assessing how the differential has been moving on after the introduction of the aforementioned reform. I compare the change in monthly wage of workers employed with a fixed-term contract between 2002 and 2006 in Italy to the change in monthly wage of workers employed with a long-term contract over the same period. Since the *30/2003* reform was effective starting in September 2003, I use the 2002 survey of SHIW (Survey of household income and wealth, Bank of Italy) for the before period and the 2006 survey of SHIW for the after period. To deal with it I make use of three different econometric procedure, namely basic Differences-in-differences, OLS and Difference-in-differences combined with propensity score matching. As reviewed in Abadie (2005), the DnD estimator is based on strong identifying assumptions. In particular, the conventional DnD estimator requires that, in the absence of the treatment, the average outcomes for the treated and control groups would have followed parallel paths over time. This assumption may be implausible if pre-treatment characteristics that are thought to be as-

sociated with the dynamics of the outcome variable are unbalanced between the treated and the untreated. I show that all the identifying assumptions hold and thus the estimates turn out to be reliable, in particular those ones retrieved by DnD combined with propensity score matching.

Results suggests a negative impact of the reform upon fixed-term workers wages. In particular, the overall wage differential is increasing by an amount ranging 2.2% to 8.4%. When I look within skill category, i.e. skilled and unskilled workers, I validate the implications of the theoretical model. Skilled workers employed with short-term contract earn on average 22% to 36% less than skilled workers employed with long-term contract. The differential is shrinking when I consider unskilled workers.

This difference in magnitude validates the contrasting firms behaviour as implied by the theoretical model: in the skilled labor market, long-term jobs can be seen as a 'reward' to the ablest workers and thus they have to pay more than short-term contracts. Conversely, the same does not occur (or it does but to a smaller extent) in the unskilled labor market. As unskilled jobs entail routine tasks and, thus, do not demand substantial individual ability, firms are not concerned to discern workers with respect to ability. This is corroborated by the not sizable effect of the reform on unskilled wages, as showed above.

Chapter 2

Theoretical setup

The theoretical framework is based on Mortensen and Pissarides (1994), though I borrow part of the setup from Cahuc and Postel-Vinay (2002), where I introduce firing costs, learning process about workers unobservable ability and two types of contracts, fixed-term and open-ended contracts, to capture the case of interest. Moreover, I consider two submarkets, in which only jobs with a specific skill requirement and unemployed workers fulfilling such requirement participate.

The goal of the model is to comprehend how positive change in a policy, intended to easing restrictions on the use of fixed-term contract, might heterogeneously affect the labour market equilibrium, both in terms of unemployment rate, wage distribution and flows into and out fixed-term (long-term) employment.

In this chapter I present the model, derive the Bellman equations and characterize the equilibrium conditions for both skilled and unskilled labour market.

2.1 Preliminary Assumptions

Two types of labor contracts exist in the economy: fixed-term contracts and long-term (or open-ended) contracts. Fixed-term contracts require some predetermined duration and can be terminated at no cost, renewed for further

fixed period, or converted into a long-term contracts. Conversely, long-term labor contracts last as long as worker retires, and they can be terminated in any period at a fixed cost f (firing costs), incurred by the firm. For simplicity, I assume that f is equal in each submarket.

The economy has a labor force of mass one. Workers can be in either one of the following states: unemployed and searching, employed with a fixed-term contract in the first period (entry level job), employed with a renewed fixed-term contract and employed with an open-ended contract. Workers differ in two aspects one observable and one unobservable to the firms. I refer to the former as the educational level attained, whereas to the latter as innate ability, indicated with η. In particular, holding at least an university degree allows individuals to participate into the *skilled* submarket, and not holding an university degree allows to search in the *unskilled* submarket (submarkets are indexed by $i \in [k, u]$ where k indicates skilled and u indicates unskilled). η is a random, worker-specific productivity parameter drawn from a continuos cumulative distribution function $G(\eta)$ over the interval $[\eta^l, \eta^h]$. As η is unobservable, workers look alike to the firms when they meet. Once the match starts, information about ability become less imperfect to the firms and a new value of η is drawn from its c.d.f with some probability, equals to the probability that a positive job specific shock occurs. As time elapses, firms get more information about the worker ability and, then, decide to either lay off or keep him. In the following, I discuss this learning process in details. For the time being, it is worth noting that such process concerns only the case of skilled jobs, while unskilled ones are filled regardless workers ability. This assumption is not as strong as it appears; since I regard unskilled jobs as those which entail repetitive and routine tasks, it does make sense to expect that a high ability worker performs as much as a low ability worker. For that reason in the unskilled submarket, state in which worker (job) is employed (operating) with a renewed fixed-term contract is ruled out.

Firms freely enter the market by creating costly vacancies. Every new job is a fixed-term one. Once a vacancy is created, it may be either filled and start producing or keeping open at cost k per unit time. Without loss of generality,

I assume that k is equal in both submarkets.

Vacant jobs and unemployed workers meet at rate determined by the homogeneous of degree one matching function $m(v_i, u_i)$, where v_i is the number of vacancies and u_i is the number of unemployed workers in submarket i. In particular, a vacant job can meet an unemployed worker at rate $m(v_i, u_i)/v_i = q(\theta_i)$ with $q'(.) < 0$, a decreasing function of θ_i. Similarly, a job seeker can meet a vacant job at rate $\theta_i q(\theta_i)$, an increasing function of θ_i. θ_i indicates the labor market tightness ratio in each submarkets i.

It is worth pointing out that not all job contacts will be filled and start producing as in the Mortensen and Pissarides (1994) original model. In Cahuc and Postel-Vinay's model (2002) it is assumed that some jobs may not be productive enough to start producing; as the starting value of productivity is revealed just after the match is formed, it may be too low to compensate worker and employer for their search effort. Following them somehow, I assume that firms decide to transform contacts in jobs with some probability. More precisely, my assumption is slightly different from that one of Cahuc and Postel-Vinay. Instead of assuming, as they do, that every type of job (short-term, new long-term and continuing long-term job) comes along with its specific value of productivity, I suppose that JOB has a specific level of productivity, no matter which labor contract entails. Thus, rather than treating every type of contract as different job, I think of contracts as alternatives of the same job position. Where does exactly such probability comes from will be clear when I derive the Bellman equations.

Once a position is filled, production takes place. The firm's output per unit of time is $\varepsilon + \eta$, where ε is a job specific component and η is worker specific. ε is a random job specific productivity parameter drawn from a continuos cumulative distribution function $F(\varepsilon)$, and probability density function $f(\varepsilon)$ over the interval $[\underline{\varepsilon}, \bar{\varepsilon}]$. Firm may be hit by a shock with instantaneous probability δ, that changes the job specific productivity; a new value of the job is drawn from its c.d.f. $F(\varepsilon)$.

2.2 The learning process

As mentioned above, in the skilled submarket firms are also concerned with workers innate ability. Given that fixed-term contracts may be interrupted at any point in time at no cost, it enables firms to evaluate the level of workers ability when they are employed. After observing ability, firms decide whether to keep or dismiss workers when his/her level is above or below some critical value respectively. Fixed-term jobs *de facto* reduce the risk of uncertainty about worker's ability borne by firms.

I consider a learning process wherein learning about the expected productivity of particular workers is achieved through successive observations of their performance. Even though the learning process implemented in the model involves both agents, I prefer to stress the employer side of the process, because it makes assumptions more easily-seized. However, it is not awkward to think that even workers might be concerned to learn about their unobservable traits, in order to sort away from things that they do poorly.

Knowledge of ability is achieved through successive observations of workers' performance and such observations refer to workers' performance in different tasks per period. When the match starts, workers are *ex ante* similar in terms of ability to the firms. After one period of employment, having observed how the worker performs in some tasks, firm grasps some information that allows for a first evaluation of worker's ability. Such information is not adequate to unambiguously assess his/her level of ability, but enough to decide whether quitting or renewing with another fixed-term contract the match. Through successive steps, information become less and less noisy and a thorough appraisal upon workers' ability is achieved. By means of that, then, the conversion of temporary jobs into long-term jobs is determined. I deal with such process as a decision theoretic optimal stopping problem *á la* Mortensen and Pisarrides (1999b). These successive stages are detected by idiosyncratic shocks to the workers specific productivity (ability). Idiosyncratic shocks modify the value of the match and, conditional on that, firms decide whether to continue the match or destroy it. The probability of switching contractual form, conditional on having observed the ability is not explicitly taken into

account in the initial Bellman Equations, mostly because of the desire of preserving as simple as possible the analysis of the issue. However, this simplified approach does not preclude to allow for it. It is just a matter of interpretation of the relations derived. As I consider mainly two states in which workers are employed on a temporary basis, entry level fixed-term jobs and renewed short-term jobs, it is obvious that staying in the latter presupposes that firms know the first realization, drawn from the distribution of ability. That is, they have some information about workers' ability.

Hence, in order to obtain a fixed-term contract renewal the present value of a worker's future ability must be higher than the current one, namely, the new value of ability must be higher than the reservation value that gives rise to a non-renewal. Analogously, in order to convert a short-term into a long-term job, the realization of ability must be higher than the reservation value that triggers a non-conversion, which, in turn, is also higher than the reservation value of a renewal. This fact is pinpointed by relations (2.17) and (2.18) in the following. I will show that there exist reservation ability values below which the employer does not want to keep the worker neither with a fixed-term nor with a long-term contract. I pinpoint two values of interest, one for each type of contract.

It is worth pointing out that this process presupposes that job specific productivity is not below some critical value. When negative productivity shocks have not still occurred, the learning process takes place, otherwise the issue turns out to be pointless. The assumption is that job specific productivity shock prevails over worker specific one. The rationale is straightforward: why firms has to be concerned with worker ability when job is not productive enough *per se*? Employers do not actually care about screening whether there is no positive surplus from the trade. Thus, in that case, jobs are simply destroyed. This is taken into account by imposing that the draw of a new value of η takes place with some probability that a positive job specific shock occurs.

Furthermore, I put a condition on the renewals of fixed-term contract by means of the assumption that any renewals must be provided by law. Con-

sequently a fraction p of the fixed term jobs may be renewed with another fixed-term contract, otherwise, whether the firm agrees, they must be turned to a long-term one. p is interpreted as a policy instrument.

2.3 Skilled labor market

In the skilled submarket employers and workers meet following the aforementioned matching function $m(u_k, v_k)$. Decisions about opening a vacancy, destroying an existing job, being unemployed and employed are characterized by the customary Bellman equations. I denote by ${J_k}^i, {W_k}^i, U_k, V_k$ the value of a filled job, of being employed, of being unemployed and of a vacancy respectively, where index $i \in [s, r, p]$ indicates the type of labor contract, s stands for short-term in the first period, r for renewed short-term and p for long-term.

Before deriving the Bellman equations, I define the total surplus of the match to the pair, associated with each type of job, as the sum of the values of the above value functions:

$$\begin{aligned} S_k^i(\eta,\varepsilon) &= J_k^i(\eta,\varepsilon) - V_k(\eta,\varepsilon) + W_k^i(\eta,\varepsilon) - U_k(\eta,\varepsilon) \qquad \text{for } i = s, r \\ S_k^p(\eta,\varepsilon) &= J_k^p(\eta,\varepsilon) - [V_k(\eta,\varepsilon) - f] + W_k^p(\eta,\varepsilon) - U_k(\eta,\varepsilon) \end{aligned}$$

The difference between those surpluses is represented by firing costs. They only enters the total surplus of the long-term job, because firm incurs firing costs upon destroying it.

Match rents are divided between firm and worker by the generalized Nash wage rule, with continuous renegotiation, i.e.:

$$J_k^i(\eta,\varepsilon) - V_k(\eta,\varepsilon) = \beta S_k^i(\eta,\varepsilon) \qquad \text{for } i = s, r \tag{2.1}$$

$$J_k^p(\eta,\varepsilon) - [V_k(\eta,\varepsilon) - f] = \beta S_k^p(\eta,\varepsilon) \tag{2.2}$$

where $\beta \in [0, 1]$ indicates the firm bargaining power.

2.3.1 Bellman equations

A long-term contract returns a flow of output equal to $\varepsilon + \bar{\eta}$ and pays a wage w^p per unit of time. η is taken as a constant because the screening about worker ability has already taken place. Long-term job may be hit by a shock with instantaneous probability δ that changes the job specific productivity. Having observed the new value of ε, the firm and the worker decide whether to keep alive the match or to destroy it at a fixed cost f. Thus, the values of filling a long-term job and of being employed with a long-term contract are given by the following Bellman equations (from now on I omit the subscript k to make notations clearer):

$$rJ^p(\varepsilon,\eta) = (\varepsilon+\bar{\eta}) - w^p + \delta \int \{\max[J^p(x,\eta), V-f] - J^p(\varepsilon)\} \mathrm{d}F(x) \quad (2.3)$$

$$rW^p(\varepsilon,\eta) = w^p + \delta \int \{\max[W^p(x,\eta), U] - W^p(\varepsilon)\} \mathrm{d}F(x) \quad (2.4)$$

A renewed short-term contract returns a flow of output equal to $\bar{\varepsilon}+\eta$ and pays a wage w^r per unit of time. As I assume that the learning process does take place only when job specific productivity is not below some critical value, ε is taken as a constant. Information about workers' ability becomes less noisy as time goes by, and a new value of η is drawn from its c.d.f $G(\eta)$ with probability $[1-F(\varepsilon*)]$. Having observed the new value of η, the firm and the worker decide whether to continue the match as a long-term job or to destroy it at no cost and go back to the search market. Thus, the values of filling a renewed short-term job and of being employed with a renewed short-term contract are given by the following Bellman equations:

$$rJ^r(\varepsilon,\eta) = (\bar{\varepsilon}+\eta) - w^r + [1-F(\varepsilon*)] \int \{\max[J^p(\varepsilon,x), V] - J^r(\varepsilon,\eta)\} \mathrm{d}G(x)$$

$$-F(\varepsilon^*)[J^r(\varepsilon,\eta) - V] \quad (2.5)$$

$$rW^r(\varepsilon,\eta) = w^r + [1-F(\varepsilon*)] \int \{\max[W^p(\varepsilon,x), U] - W^r(\varepsilon,\eta)\} \mathrm{d}G(x)$$

$$-F(\varepsilon^*)[W^r(\varepsilon,\eta)-U] \tag{2.6}$$

A short-term (entry-level) job returns a flow of output equal to $\bar{\varepsilon}+\eta$ and pays a wage w^s per unit of time. ε is constant, the same arguments as before apply. Then, conditional on the new value of η, the firm and the worker decide whether to continue the match or destroy it at no cost and go back to the search market. A fraction p of these matches is renewed with another fixed-term contract and a fraction $1-p$ is converted into long-term job. The value to the firm and to the worker of an entry-level job solves the following Bellman equations:

$$\begin{aligned} rJ^s(\varepsilon,\eta) = (\bar{\varepsilon}+\eta) - w^s + [1-F(\varepsilon*)]\Bigg[p\int\{\max[J^r(\varepsilon,x),V]-J^s(\varepsilon,\eta)\}\mathrm{d}G(x) + \\ (1-p)\int\{\max[J^p(\varepsilon,x),V]-J^s(\varepsilon,\eta)\}\mathrm{d}G(x)\Bigg] \\ -F(\varepsilon^*)[J^s(\varepsilon,\eta)-V] \end{aligned} \tag{2.7}$$

$$\begin{aligned} rW^s(\varepsilon,\eta) = w^s + [1-F(\varepsilon*)]\Bigg[p\int\{\max[W^r(\varepsilon,x),U]-W^s(\varepsilon,\eta)\}\mathrm{d}G(x) + \\ (1-p)\int\{\max[W^p(\varepsilon,x),U]-W^s(\varepsilon,\eta)\}\mathrm{d}G(x)\Bigg] \\ -F(\varepsilon^*)[W^s(\varepsilon,\eta)-U] \end{aligned} \tag{2.8}$$

Firms freely enter the market by creating costly vacancies. A vacancy is kept open at cost k per unit of time, whereas is filled at rate $q(\theta)$ with probability $[1-F(\varepsilon^*)]$. Every new job is a fixed-term one. When meet a worker, a firm decides to hire a worker if the value of a filled short-term job is greater than the value of keeping the slot vacant. The job specific productivity ε *de facto* reveals the profitability of such a choice. The value of a vacancy is given by the following Bellman equation:

$$rV = -k + q(\theta)[1 - F(\varepsilon^*)][J^s(\varepsilon, \eta) - V] \tag{2.9}$$

A job seeker benefits from a flow of exogenous value of leisure or unemployment income b when unemployed. She/he comes in contact with a vacant short-term job at rate $\theta q(\theta)$ with probability $[1 - F(\varepsilon^*)]$. The value of unemployment to the worker solves the following Bellman equation:

$$rU = b + \theta q(\theta)[1 - F(\varepsilon^*)][W^s(\varepsilon, \eta) - U] \tag{2.10}$$

Having derived the Bellman equations for each of the three states, I now turn to characterize the equilibrium conditions.

2.3.2 The Equilibrium

An easy way to derive the equilibrium is first to rewrite the value functions in terms of surplus, with the help of the sharing rules (2.1) and (2.2), then identify the threshold values of productivity and ability as functions of the labor market tightness θ.

Firms post vacancies on the assumption of free entry in the market. Because of free entry, the value of a vacancy must always be equal to zero in equilibrium. From (2.9) and the sharing rule (2.1), I get the following equality:

$$\frac{k}{q(\theta)[1 - F(\varepsilon^*)]\beta} = S^s \tag{2.11}$$

Substituting this relation into equation (2.10), adding it up toghether with the Bellman equations (2.3) - (2.8) and making use of the specific sharing rule, one ends up with expressions of the total match surpluses as follows:

$$(r + \delta)S^p(\varepsilon, \eta) = (\varepsilon + \bar{\eta}) - b + f + \delta \int \max[S^p(x, \eta), 0] \mathrm{d}F(x)$$

$$-\frac{1-\beta}{\beta}k\theta \tag{2.12}$$

$$(1+r)S^r(\varepsilon,\eta) = (\bar{\varepsilon}+\eta) - b + [1-F(\varepsilon^*)]\int \max[S^p(\varepsilon,x),0]\mathrm{d}G(x)$$

$$-\frac{1-\beta}{\beta}k\theta \tag{2.13}$$

$$(1+r)S^s(\varepsilon,\eta) = (\bar{\varepsilon}+\eta) - b + [1-F(\varepsilon^*)]\Bigg[p\int \max[S^r(\varepsilon,x),0]\mathrm{d}G(x)$$

$$(1-p)\int \max[S^p(\varepsilon,x),0]\mathrm{d}G(x)\Bigg] - \frac{1-\beta}{\beta}k\theta \tag{2.14}$$

As each of the above surpluses are monotonically increasing in their current job specific or worker specific productivity parameters (depending on which surplus one is looking at), job destruction satisfies a reservation property. There exists a unique reservation job specific (worker specific) productivity value which makes surplus to drop to zero. As a result, a long-term job that get a job specific productivity shock $\varepsilon <\varepsilon\ ^*$ is destroyed, where ε^* is given by $S^p(\varepsilon^*) = 0$. Similarly, a renewed short-term job is not transformed into a long-term one whether observed worker ability is not at least equal to η^c, coming from $S^r(\bar{\varepsilon},\eta^c) = 0$, and a short-term labor contract is not renewed with another short-term contract whether observed worker ability is not at least equal to η^*, where η^* is given by $S^s(\bar{\varepsilon},\eta^*) = 0$. Note that in case of a new or renewed short-term job, $\varepsilon >\varepsilon\ ^*$ must also be satisfied, otherwise job is destroyed straightaway.

Thus, imposing the condition $S^p(\varepsilon^*) = 0$ and solving the integral term, the equation (2.12) can be expressed as follows:

$$(\varepsilon^* + \bar{\eta}) - b + f + \delta\int_{\varepsilon^*}^{\bar{\varepsilon}} S^{p'}(x)[1-F(x)]\mathrm{d}x - \frac{1-\beta}{\beta}k\theta = 0$$

Noting from equation (2.12) that $S^{p'}(x) = 1/r + \delta$ I obtain the following relation:

$$(\varepsilon^* + \bar{\eta}) = b + \frac{1-\beta}{\beta}k\theta - f - \frac{\delta}{r+\delta}\int_{\varepsilon^*}^{\bar{\varepsilon}}[1-F(x)]\mathrm{d}x \tag{2.15}$$

This is one of the key conditions of the model. It relates the job specific reservation productivity to labor market tightness. As in Mortensen and Pissarides (1994) ε^* is increasing in the ratio of vacancies to unemployment, θ. The rationale behind this upward sloping is well known: briefly, more vacancies than unemployed workers increase the value of being unemployed, because now it is easier to find a job; the higher the value of U, the lower the value of the total surplus, hence match productivity must increase in order to compensate agents for their outside options. Furthermore, as in Mortensen and Pissarides (1999), keeping θ constant, it is easily established by differentiation that ε^* decreases with f, namely, an increase in f reduces job destruction in equilibrium; this is *de facto* what the firing costs aim at. With no particular fancy, I refer to this as the firing relation (FR).

Applying the condition $S^r(\bar{\varepsilon}, \eta^c) = 0$ to equation (2.13) and following the same procedure as before, the second condition of the model comes out:

$$(\bar{\varepsilon} + \eta^c) - b + [1 - F(\varepsilon^*)] \int_{\eta^c}^{\eta^h} S^{p'}(x)[1 - G(x)]\mathrm{d}x - \frac{1-\beta}{\beta} k\theta = 0$$

Note from definition of $S^p(\varepsilon^*)$ that, since η enters as a constant, its derivative with respect to η is zero, so the integral term drops to zero and I end up with the following:

$$(\bar{\varepsilon} + \eta^c) = b + \frac{1-\beta}{\beta} k\theta = 0 \tag{2.16}$$

This relation gives the worker specific reservation productivity (ability) in terms of the labor market tightness parameter, holding ε constant. More precisely, it makes η^c an increasing function of θ. The intuition is as before: a tighter labor market rises the value of U; this lower the total match surplus, hence, for a given ε, worker specific productivity must rise to offset the increase of agents' outside options. I refer to this relation as the Upgrading Relation (UR), because it provides the critical value of worker ability that make firms indifferent between upgrading the worker with a renewed short-term contract to a long-term job and laying him/her off.

The third condition of the model arises employing $S^s(\bar{\varepsilon}, \eta) = 0$ to the equation (2.14). Recalling that $\partial S^p(\varepsilon)/\partial\eta = 0$ and $\partial S^r(\bar{\varepsilon}, \eta)/\partial\eta = 1/1 + r$, I get the following expression:

$$(\bar{\varepsilon} + \eta^*) = b + \frac{1-\beta}{\beta} k\theta - \frac{F(\varepsilon^*)p}{1+r} \int_{\eta^*}^{\eta^c} [1 - G(x)]\mathrm{d}x \tag{2.17}$$

I call this the continuing short-term relation (CSTR). It is an increasing function of the labor market tightness parameter, keeping ε constant. It pinpoints a cutoff level of worker ability η^* below which a short-term job is not perpetuated as a renewed short-term job. The same arguments of equation 2.17 apply.

In order to get a more compact and analytically more convenient form of the upgrading relation, subtract the CSTR from (2.16) to get:

$$\eta^c = \eta^* + \frac{F(\varepsilon^*)p}{1+r} \int_{\eta^*}^{\eta^c} [1 - G(x)]\mathrm{d}x \tag{2.18}$$

Equation (2.18) facilitates comparison between the upgrading relation and the continuing short-term relation. It first clarifies the ranking of threshold values of worker specific productivity, that is η^c is greater than η^*; second, it shows how the policy p (of allowing short-term contract renewals) affects the job dismissal behaviour of the firms. With $p = 0$, the distinction between short-term and renewed short-term contracts vanishes, as a result only η^c is crucial in making decision about dismissals. From now on, equation (2.18) will be used as the upgrading relation instead of equation (2.16).

The last relation left to be derived is the job creation rule (JC). It is easily obtained by substituting equation (2.14) into (2.11), noting that (2.14) can be written down as $S^s(\bar{\varepsilon}, \eta) - S^s(\bar{\varepsilon}, \eta^*) = \eta - \eta^*/1 + r$:

$$q(\theta) = \frac{(1+r)}{\beta[1 - F(\varepsilon^*)]} \frac{k}{\eta - \eta^*} \tag{2.19}$$

For a given value of ε^*, labor market tightness is decreasing in η^*. Analogously, for given η^*, labor market tightness is decreasing in ε^*. In both cases

the intuition is straightforward: the lower the destruction threshold, the higher the expected return of a match. As jobs last longer, firms tend to post more vacancies.

It is worth pointing out, unlike Mortensen and Pisarrides (1999), that firing costs do not enter and seem not to affect directly job creation equation. This is ascribed to the assumptions of the model. Bring to mind that vacancies are only filled with fixed-term jobs, thus firing costs should not apparently affect job creation behaviour of firms (in terms of reducing vacancies posted) because such costs only apply to long-term jobs. Conversely, what it is apparent from equation (2.19) is that more stringent firing restrictions, lowering the value of ε^*, increase the initial expected present value of jobs; in turn, this gives rise to a larger vacancy creation.

The joint determination of θ, ε and η in the skilled labor market is depicted in figure 2.1. The way how the relations are drawn needs some discussion. First, note that job creation rule is a function of both ε^* and η. It can be easily shown by differantiation that it is a decreasing function of both parameters. The proof is as follows:

Proof. Differentiating equation (2.19) with respect to $q(\theta)$ and ε^*, one gets:

$$\left.\frac{\mathrm{d}q(\theta)}{\mathrm{d}\varepsilon^*}\right|_{\eta^*=\text{const}} = \frac{(1+r)f(\varepsilon^*)k}{\beta(\eta-\eta^*)[1-F(\varepsilon^*)]^2} > 0$$

Recalling that $q'(\theta) < 0$, it is evident that θ is decreasing in ε^*.

This result allows to draw the job creation rule downward sloping in the upper panel of fig. 2.1, for given value of η^*. JC moves in the (ε^*, θ) plane as η^* varies, that is, larger (lower) values of η^* shifts the JC curve to the left (right).

Yet, differentiating equation (2.19) with respect to $q(\theta)$ and η^*, one gets:

$$\left.\frac{\mathrm{d}q(\theta)}{\mathrm{d}\eta^*}\right|_{\varepsilon^*=\text{const}} = \frac{(1+r)k}{\beta[1-F(\varepsilon^*)](\eta-\eta^*)^2} > 0$$

θ is decreasing in η^*, as required.

The bottom of fig. 2.1 displays the job creation curve in the (η^*, θ) plane. Note that JC is drawn for given value of ε^*, that means that an increase (decrease) of ε^* shifts JC curve to the left (right).

□

Having disentangled this point, I am now able to illustrate the joint determination of all the parameters of the model. The JC and FR in panel (a) of fig. 2.1 uniquely determine the value of the reservation job specific productivity ε^*, and the labor market tightness θ^*. θ^* is also identified with the intersection between JC and CSTR in panel (b). This, in turn, determines the threshold value of worker specific productivity η^*. Finally, substituting θ^* into the upgrading relation, η^c is unambiguosly identified (it is shown as the intersection of UR and the straight line going through θ^*).

Wages

Wage is the outcome of bilateral bargaining between firms and workers. They share the quasi-rent by the generalized Nash rule (2.1) and (2.2), as a result the wage is derived as follows:

$$w^i = \arg\max(J^i(\varepsilon,\eta) - V)^\beta (W^i(\varepsilon,\eta) - U)^{1-\beta} \quad \text{for } i = s, r$$

$$w^p = \arg\max(J^p(\varepsilon) - V + f)^\beta (W^p(\varepsilon) - U)^{1-\beta}$$

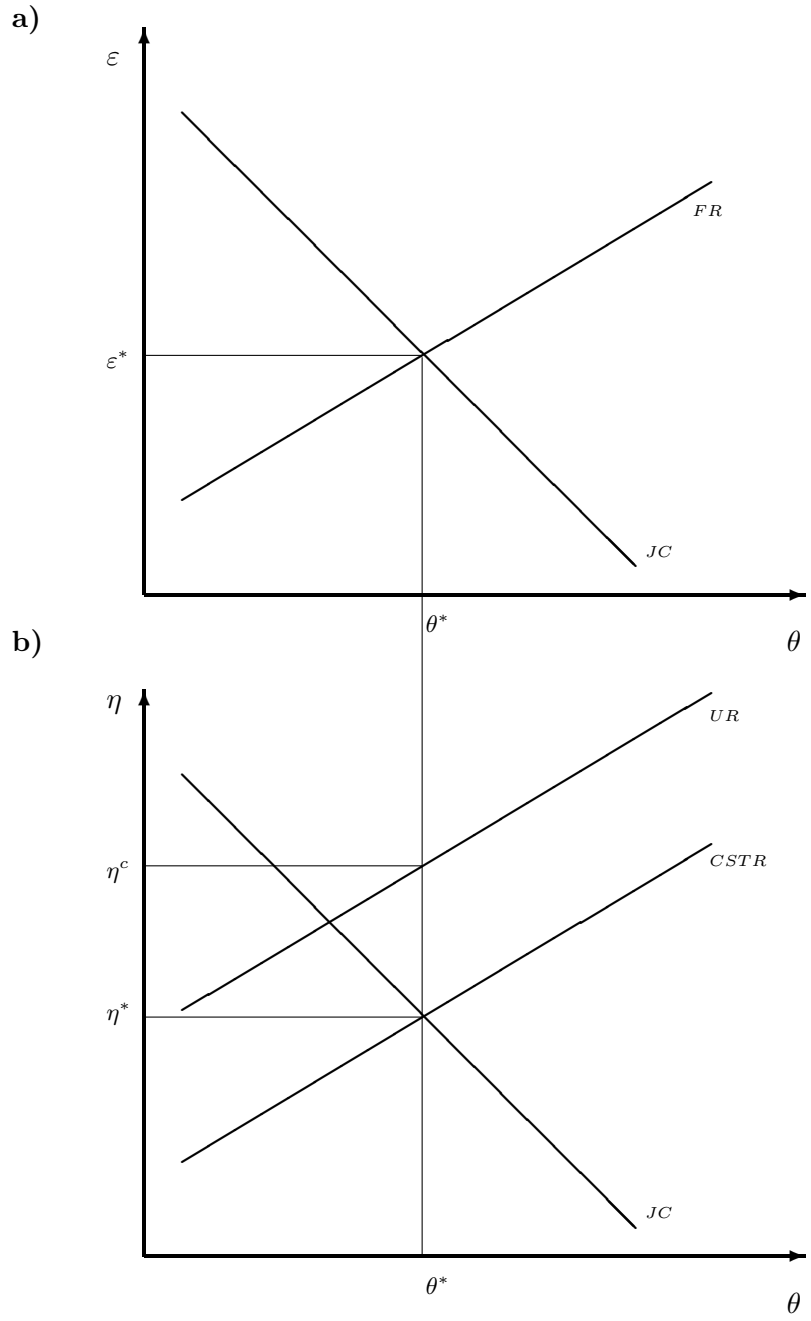
Substituting the relevant value functions into the above conditions provides the expressions of wages for each type of contract:

$$w^s = \beta b + (1-\beta)[\bar{\varepsilon} + \eta + k\theta)] \tag{2.20}$$

$$w^r = \beta b + (1-\beta)[\bar{\varepsilon} + \eta + k\theta)] \tag{2.21}$$

$$w^p = \beta b + (1-\beta)[\varepsilon + \bar{\eta} + k\theta)] + (1-\beta)f \tag{2.22}$$

Figure 2.1: *The joint determination of θ, ε and η in the skilled labor market*



The above expressions are quite standard. Although w^s and w^r look alike, they differ in the value of η. It is inferred that the wage paid by a renewed

short-term job is identified for values of η over the interval $[\eta^*, \eta^c]$, and that one paid by an entry-level job for values of $\eta < \eta^*$.[1] As well as be increasing in ε and identified for given values of η, w^p takes also into account the firing costs. Workers can use them as an additional threat in wage bargaining and, as a result, a long-term job pays a higher wage. Thus, the ranking of the wages for each type of job is $w^p > w^r > w^s$.

Unemployment

I complete the steady state analysis by deriving the equilibrium value of unemployment rate.

The total number of workers employed with an entry-level job amounts to $\theta q(\theta)[1 - F(\varepsilon^*)]u$; a fraction $p[1 - G(\eta^*][1 - F(\varepsilon^*)]$ of which is renewed with another fixed-term contract and a fraction $(1-p)[1-G(\eta^*)][1-F(\varepsilon^*)]$ is converted into a long-term job. Among entry-level short-term jobs, those with worker specific productivity less than η^* and a fraction $F(\varepsilon^*)$ (i.e., jobs with job specific productivity less than ε^*) are terminated. Analogously, among renewed short-term jobs, those with worker specific productivity less than η^c and a fraction $[1 - F(\varepsilon^*)]$ are destroyed (i.e., not transformed into long-term ones). Adding up the fraction $(1 - p)$ of entry-level short-term jobs and the number of jobs coming from renewed short-term contracts, one gets the total number of long-term jobs in the economy. A fraction $\delta F(\varepsilon^*)$ of those jobs are destroyed every period. Therefore, the evolution of unemployment is given by the following apparently cumbersome equation:

$$\dot{u} = [1 - F(\varepsilon^*)]\theta q(\theta)u + [1 - F(\varepsilon^*)][1 - G(\eta^*)]p[1 - F(\varepsilon^*)]\theta q(\theta)u$$

$$+[1 - F(\varepsilon^*)][1 - G(\eta^c)](1 - p)[1 - F(\varepsilon^*)]\theta q(\theta)u$$

[1] Equation (2.39) actually does not explain which value of η has to be considered and, recalling that firms and workers are uncertain about workers ability, it seems that η should not be really taken into account in the determination of such wage. In spite of that and as far as the model tells, I can infer that such value must be less than η^*.

$$+[1-F(\varepsilon^*)][1-G(\eta^c)][1-F(\varepsilon^*)][1-G(\eta^*)]p[1-F(\varepsilon^*)]\theta q(\theta)u$$

$$-F(\varepsilon^*)\theta q(\theta)-[1-F(\varepsilon^*)]G(\eta^*)\theta q(\theta)u-[1-F(\varepsilon^*)]G(\eta^c)[1-F(\varepsilon^*)]$$

$$[1-G(\eta^*)]p[1-F(\varepsilon^*)]\theta q(\theta)u-\delta F(\varepsilon^*)\Big\{1-u-[1-F(\varepsilon^*)]\theta q(\theta)u+$$

$$[1-F(\varepsilon^*)][1-G(\eta^*)]p[1-F(\varepsilon^*)]\theta q(\theta)u\Big\}$$

In steady state inflows into unemployment must be equal to outflows, as a result the equilibrium unemployment rate is:

$$u^* = \frac{\delta F(\varepsilon^*)/[1-F(\varepsilon^*)]}{\delta F(\varepsilon^*)/[1-F(\varepsilon^*)]+\theta^* q(\theta^*)\Big\{[1-G(\eta^*)]+[1-G(\eta^c)]-}$$

$$\frac{\ldots}{\delta F(\varepsilon^*)-\delta F(\varepsilon^*)/[1-F(\varepsilon^*)]+p\Big(1-G(\eta^*)-[1-G(\eta^c)]+}$$

$$\frac{\ldots}{[1-G(\eta^*)][1-G(\eta^c)-(1-\delta)F(\varepsilon^*)-G(\eta^c)\Big)\Big\}} \tag{2.23}$$

The above expression shows the familiar increasing relation between equilibrium unemployment rate and job specific reservation productivity ε^*; in terms of the model this means that, *ceteris paribus*, the higher the value of ε^* the higher the destruction rate of long-term jobs. Unemployment also rises whether firms are more demanding about workers ability, both for renewing a short-term contract, η^*, and for upgrading jobs into long-term ones, η^c, other things equal. Unfortuntely the interpretation of p, the policy instrument that allows contracts renewals, is not so clear-cut. As p depends on the sign of the

terms in round brackets in (2.23), which is not of immediate interpretation, it is ambiguously related to u^*. However, I can say more about it in the next section.

2.3.3 Comparative statics

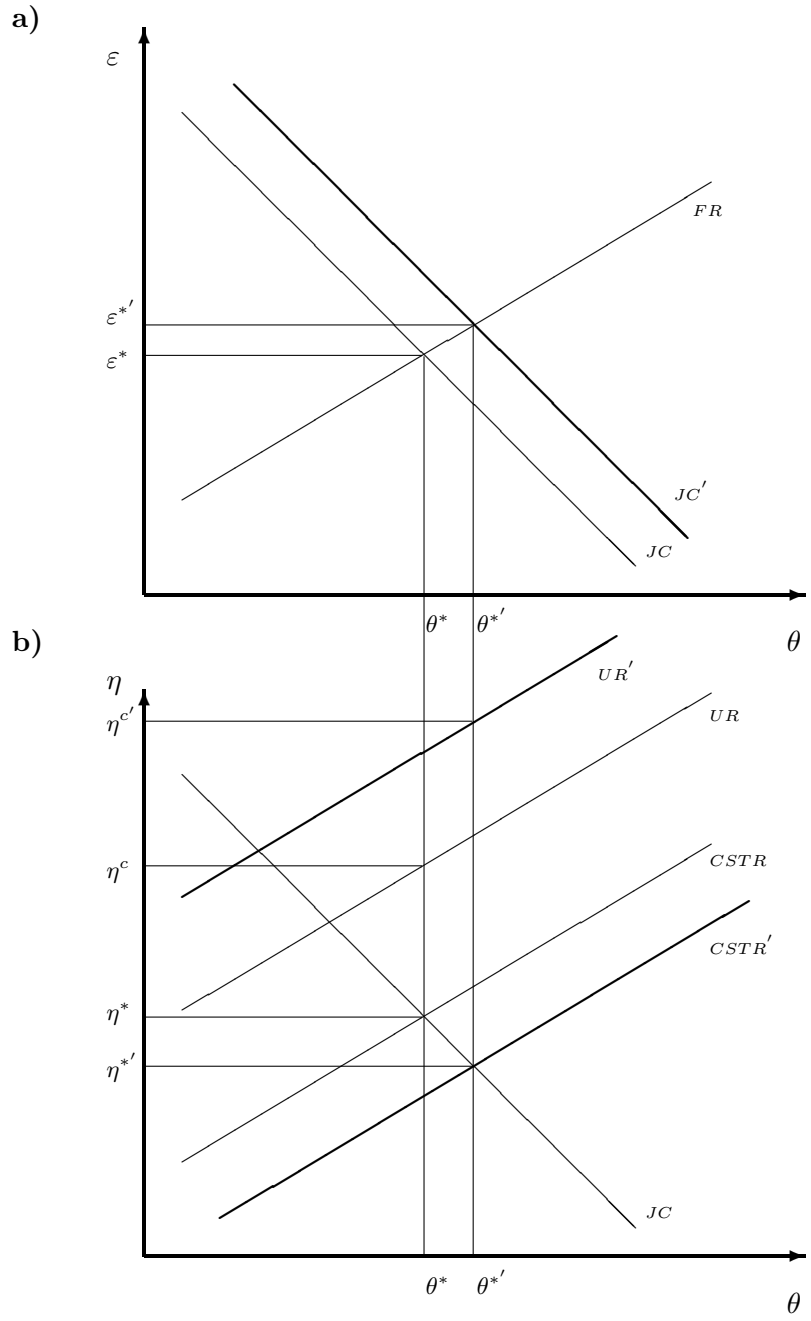
Having derived the key relationships of the economy, it is simple to examine the effect of a change in one of the parameters. What I am interested in, is the net effect of changes in the policy instruments p on the hiring and and firing behaviour of the firms. Put it differently, how do less stringent restrictions on short-term contract renewals affect the labor market equilibrium? The answer to this question can be easily obtained by doing some comparative static to the model. The effect of an increase in p on job creation and job destruction is sketched in figure (2.2).

An increase in p shifts the CSTR downward: short-term jobs last longer on average (i.e., they are perpetuated with another short-term contract more frequently) which raises their expected present value; for a given θ, an increase in p lowers η^*. The intuition is that, as it is easier to renew a short-term contract, the learning process about her/his productivity is spread out on a longer span; firms are less exacting on the level of η required to renew the contract.

The UR shifts upward: for a given θ, an increase in p induces less frequent transformation of renewed short-term jobs into long-term jobs. As the learning process elapses longer, assessment about workers ability is now more efficient (compared to situation in which renewal were not allowed), hence, firms ask for larger value of η to upgrade workers with a long-term contract . Accordingly, firms better offset expensive termination of long-term jobs.

In order to take into account the decrease of η^*, the JC curve in panel (a) shifts to the right (recall that JC is drawn for given value of η^*, see discussion above) and a new value of labor market tightness is detected. Thus job creation increases. Moreover, note that JC in panel (b) does not move because p does affect JC only through its effect on η^*, which it is already taken into account by shifting in θ^*. The proofs of these statements follow.

Figure 2.2: *The effect of an increase in p in the skilled labor market*



Proof. Differentiating equation (2.17) with respect to η^* and p, one gets:

$$\left.\frac{\mathrm{d}\eta^*}{\mathrm{d}p}\right|_{\theta=\text{const}} = -\frac{(F(\varepsilon^*)\int_{\eta^*}^{\eta^c}[1-G(x)]\mathrm{d}x}{1+r+F(\varepsilon^*)[1-G(\eta^*)]} < 0$$

Hence η^* is decreasing in p.

Yet, differentiating equation (2.18) with respect to η^c and p, one gets:

$$\left.\frac{\mathrm{d}\eta^c}{\mathrm{d}p}\right|_{\theta=\text{const}} = -\left[\left.\frac{\mathrm{d}\eta^*}{\mathrm{d}p}\right|_{\theta=\text{const}} - \frac{(F(\varepsilon^*)p}{1+r}\int_{\eta^*}^{\eta^c}[1-G(x)]\mathrm{d}x\right] > 0$$

Hence η^c is increasing in p.

□

I can be more precise about the shift of UR. Note from the proof above that the differential $\mathrm{d}\eta^c/\mathrm{d}p$ is greater than $\mathrm{d}\eta^*/\mathrm{d}p$, thus the shift of UR is larger than the shift of CSTR: it is now harder to get a long-term job! More interesting, the shift of JC in panel (a) picks a new value of the reservation job specific productivity ε^*. The opportunity cost of long-term jobs (of every jobs actually) raises leading to more intense job turnover. It is now more likely that, throughout their career, workers are stuck longer in short-term jobs. Analogously, the increase in ε^* might reflect firms' propensity to substitute long-term jobs with short-term jobs.

As both job creation and job destruction increase in equilibrium, the effect of an increase in p on the unemployment rate looks ambiguous. However, both in terms of job specific, ε^*, and worker specific productivity, η^c, job destruction increases more compared to the increase in job creation, as a result equilibrium unemployment rate rises.

2.4 Unskilled labor market

Workers who do not hold an university degree are entitled to search in the *unskilled* submarket. In this submarket, firms are not concerned in learning about workers ability, as a result the hypothesis about the learning process is discarded (see above for the rationale behind such a premise). However, the distinction between short-term jobs and long-term jobs is still relevant. In particular, firms post vacancies only as short-term jobs. Derivation of the Bellman equations and characterization of the equilibrium follow.

In the unskilled submarket employers and workers meet following the matching function $m(u_u, v_u)$. I denote by ${J_u}^i, {W_u}^i, U_u, V_u$ the value of a filled

job, of being employed, of being unemployed and of a vacancy respectively, where index $i \in [s, p]$ indicates type of labor contract, s stands for short-term and p for long-term.

Match rents are divided between firm and worker by the generalized Nash wage rule, with continuous renegotiation, i.e.:

$$J_u^s(\varepsilon) - V_u(\varepsilon) = \beta[J_u^s(\varepsilon) - V_u(\varepsilon) + W_u^s(\varepsilon) - U_u] \tag{2.24}$$

$$J_u^p(\varepsilon) - [V_u(\varepsilon) - f] = \beta[J_u^p(\varepsilon) - V_u(\varepsilon) + f + W_u^p(\varepsilon) - U_u] \tag{2.25}$$

where $\beta \in [0, 1]$ indicates the firm bargaining power.

The difference between those equation is again represented by firing costs. They only enters the total surplus of the long-term job, because firm incurs firing costs upon destroying it.

2.4.1 Bellman equations

A new short-term job returns a flow of output equal to $\varepsilon + \bar{\eta}_u$ and pays a wage w_u^s per unit of time. Under the assumptions of the model, η_u is taken as a constant. Short-term jobs may be hit by a shock with instantaneous probability δ, which changes the value of ε. It is drawn from its c.d.f $F(\varepsilon)$. Then, a fraction $(1 - p)$ of these matches are perpetuated as long-term job. The value of a new short-term job to the firm and to the worker solves the following Bellman equations:

$$rJ_u^s(\varepsilon) = (\varepsilon + \bar{\eta}_u) - w_u^s + (1 - \delta)p[J_u^s - V_u] + (1 - p)\delta \int \{\max[J_u^p(x), V_u] - J_u^s(\varepsilon)\} \mathrm{d}F(x) \tag{2.26}$$

$$rW_u^s(\varepsilon) = w_u^s + (1 - \delta)p[W_u^s - U_u] + (1 - p)\delta \int \{\max[W_u^p(x), U_u] - W_u^s(\varepsilon)\} \mathrm{d}F(x) \tag{2.27}$$

where J_u^p and W_u^p are the values of continuing the match to the firm and

worker under the open-ended contract. These value functions solve the following functional equations:

$$rJ_u^p(\varepsilon) = (\varepsilon + \bar{\eta}_u) - w_u^p + \delta \int \{\max[J_u^p(x), V_u - f] - J_u^p(\varepsilon)\} \mathrm{d}F(x) \quad (2.28)$$

$$rW_u^p(\varepsilon) = w_u^p + \delta \int \{\max[W_u^p(x), U_u] - W_u^p(\varepsilon)\} \mathrm{d}F(x) \quad (2.29)$$

Firms freely enter the market by creating costly vacancies. A vacancy is kept open at cost k per unit of time, whereas is filled at rate $q(\theta_u)$. Every new job is a fixed-term one. When meeting a worker, a firm decides to hire a worker if the value of a filled short-term jobs is greater than the value of keeping the slot vacant. The value of a vacancy is given by the following Bellman equation:

$$rV_u = -k + q(\theta_u)[J_u^s(\varepsilon) - V_u] \quad (2.30)$$

A job seeker benefits from a flow of exogenous value of leisure or unemployment income b_u when unemployed. She/he comes in contact with a vacant short-term job at rate $\theta_u q(\theta_u)$. The value of unemployment to the worker solves the following Bellman equation:

$$rU_u = b_u + \theta_u q(\theta_u)[W_u^s(\varepsilon) - U_u] \quad (2.31)$$

2.4.2 Equilibrium

Like in the skilled labor market I first rewrite the value functions in terms of surplus, with the help of the sharing rules (2.24) and (2.25), then I derive the threshold values of productivity as functions of the labor market tightness θ_u.

Because of free entry, the value of a vacancy must always be equal to zero in equilibrium. From (2.30) and the sharing rule (2.24), I get the following equality:

$$\frac{k}{q(\theta)\beta} = S^s \tag{2.32}$$

Substituting this relation into equation (2.31), adding it up toghether with the Bellman equations (2.26) - (2.29) and making use of the sharing rule (2.24), one ends up with expressions of the total match surpluses for the short-term and long-term jobs as follows:

$$(1 + r + \delta p)S_u^s(\varepsilon) = (\varepsilon + \bar{\eta}_u) - b_u + (1 - p)\delta \int \max[S_u^p(x), 0]\mathrm{d}F(x) - \frac{1-\beta}{\beta}k\theta_u \tag{2.33}$$

$$(r + \delta)S_u^p(\varepsilon) = (\varepsilon + \bar{\eta}_u) - b_u + f + \delta \int \max[S_u^p(x), 0]\mathrm{d}F(x) - \frac{1-\beta}{\beta}k\theta_u \tag{2.34}$$

Each of the above surpluses are monotonically increasing in their current job specific productivity parameter, that means that job destruction satisfy a reservation property. There exists a threshold productivity which make surpluses equal to zero.

Thus, imposing the condition $S_u^p(\varepsilon^c) = 0$ and solving the integral term, one gets the threshold value ε^c as follows:

$$(\varepsilon^c + \bar{\eta}_u) = b_u + \frac{1-\beta}{\beta}k\theta_u - f - \frac{\delta}{r+\delta}\int_{\varepsilon^c}^{\bar{\varepsilon}}[1 - F(x)]\mathrm{d}x \tag{2.35}$$

I refer to this relation as the Firing Relation (FR). It makes the threshold productivity ε^c an increasing function of the unskilled labor market tightness parameter θ_u.

Similarly, I derive the threshold value that triggers a short-term dismissal as follows:

$$(\varepsilon^* + \bar{\eta}_u) = b_u + \frac{1-\beta}{\beta}k\theta_u - \frac{(1-p)\delta}{r+\delta}\int_{\varepsilon^c}^{\bar{\varepsilon}}[1 - F(x)]\mathrm{d}x \tag{2.36}$$

Subtracting this last equation from equation (2.35), one gets:

$$\varepsilon^* = \varepsilon^c + f + \frac{p\delta}{r+\delta}\int_{\varepsilon^c}^{\bar{\varepsilon}}[1-F(x)]\mathrm{d}x \tag{2.37}$$

I call this relation the Upgrading Relation (UR) (in line with the its "counterpart" in the skilled submarket), because it provides the reservation productivity of the match which makes firms and workers indifferent between upgrading the match with a long-term job and destroy it.

The job creation rule is obtained by substituting (2.33) into (2.32) and noting that (2.33) can be written down as $S^s(\varepsilon) - S^s(\varepsilon*) = \varepsilon - \varepsilon^*/(r+\delta)$:

$$q(\theta_u) = \frac{k}{\beta}\frac{r+\delta}{(\varepsilon-\varepsilon^*)} \tag{2.38}$$

As in the conventional Mortensen an Pissarides' model, labor market tightness is decreasing in ε^c. The lower the destruction threshold, the higher the expected return of a match: jobs last longer, thus, firms tend to post more vacancies.

The joint determination of θ_u, ε^* and ε^c in the unskilled labor market is depicted in figure 2.3. Substituting the value for ε^* defined in equation (2.37) into JC and using FR, the labor market tightness θ_u^* is uniquely determined. In turn, ε^* is characterized directly from UR.

Wages

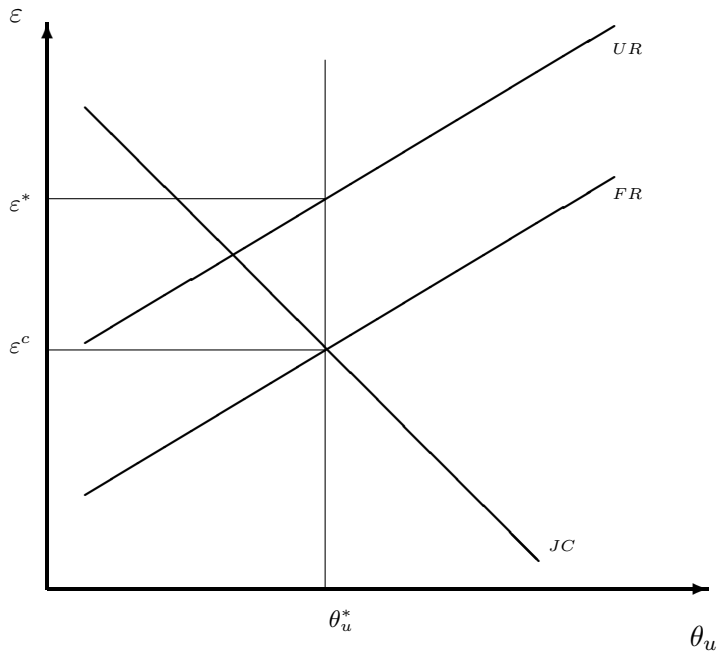
The Nash wage bargain is a contingent wage contract defined by:

$$w^s = \arg\max(J_u^s(\varepsilon) - V_u)^\beta (W_u^s(\varepsilon) - U_u)^{1-\beta}$$

$$w^p = \arg\max(J_u^p(\varepsilon) - V_u + f)^\beta (W_u^p(\varepsilon) - U_u)^{1-\beta}$$

Substituting the relevant value functions into the above conditions provides the expressions of wages for each type of contract:

Figure 2.3: *The joint determination of θ_u, ε^* and ε^c in the unskilled labor market*



$$w_u^s = \beta b_u + (1-\beta)[\varepsilon + \bar{\eta}_u + k\theta_u)] \tag{2.39}$$

$$w_u^p = \beta b_u + (1-\beta)[\varepsilon + \bar{\eta}_u + k\theta_u)] + (1-\beta)f \tag{2.40}$$

Unemployment

The final equation of the model is the steady state condition for unemployment. The total number of workers employed with a short-term contract amounts to a fraction $\theta_u q(\theta_u)$ coming from unemployment plus a fraction $p(1-\delta)$ coming form previous short-term jobs (whether they are not hit by a shock). A fraction $\delta F(\varepsilon^*)$ of those jobs are destroyed when a productivity shock makes the value of the match productivity falling below ε^*. Analogously, long-term jobs amounts to a fraction $\delta[1-F(\varepsilon^*)]$ of short-term jobs

and a portion $\delta F(\varepsilon^c)$ of those are destroyed every period. The evolution of unemployment is specified in the following equation:

$$\dot{u} = \theta_u q(\theta_u) + p(1-\delta)\theta_u q(\theta_u) - \delta F(\varepsilon^*)\theta_u q(\theta_u) - \delta F(\varepsilon^*)(1-\delta)\theta_u q(\theta_u)$$

$$+\delta[1-F(\varepsilon^*)](1-p)\theta_u q(\theta_u) - \delta F(\varepsilon^c)[1-u-\theta_u q(\theta_u) + p(1-\delta)\theta_u q(\theta_u)]$$

In steady state inflows into unemployment must be equal to outflows, as a result the equilibrium unemployment rate is:

$$u^* = \frac{\delta F(\varepsilon^c)}{\delta F(\varepsilon^c) + \theta_u^* q(\theta_u^*)\Big\{\delta[F(\varepsilon^*) - F(\varepsilon^c)] + 1 - \delta F(\varepsilon^*)(1-\delta) + p(1-\delta)[1-\delta F(\varepsilon^c)]}$$

$$\frac{\ldots}{+\delta(1-p)[1-F(\varepsilon^*)] + \delta F(\varepsilon^*)\delta\Big\}} \tag{2.41}$$

The above expression shows the established increasing relation between equilibrium unemployment rate and the reservation productivity ε^c: other things equals, the higher the value of ε^c the higher the destruction rate of long-term jobs. Unemployment also rises with ε^*, the threshold value of upgrading jobs into long-term ones. Unfortunately, even in the unskilled labor market, the effect of p, the policy instrument that allows contracts renewals, on the unemployment rate is turned out to be not so clear-cut.

2.4.3 Comparative statics

I now turn to examine the effect of an increase in p on job creation and job destruction behaviour of the firms. The comparative statics are depicted in figure (2.4).

An increase in p shifts the UR upward, as a result less short-term jobs are converted into long-term jobs. The intuition behind this statement is straightforward: for a given θ_u, it is more profitable keeping (renewing) short-term jobs than converting them into long-term jobs, since in case of an adverse shock firms must pay the firing costs. Further, to better compensate the loss in case of firing, firms are more exacting about the minimum acceptable productivity, ε, by raising the opportunity cost of long-term jobs.

Conversely, the firing relation is not affected by such a policy.

The JC curve shifts downward. The increase of ε reduces the expected profitability of fixed-term jobs by inducing firms to post less vacancies. The proofs of these statements follows.

Proof. Differentiating equation (2.37) with respect to ε^* and p, one gets:

$$\left.\frac{\mathrm{d}\varepsilon^*}{\mathrm{d}p}\right|_{\theta=\text{const}} = -\left[-\frac{(1-p)\delta}{r+\delta}\int_{\varepsilon^*}^{\bar{\varepsilon}}[1-F(x)]\mathrm{d}x\right] > 0$$

Hence ε^* is increasing in p.

The proof for JC is immediate from equation (2.38). □

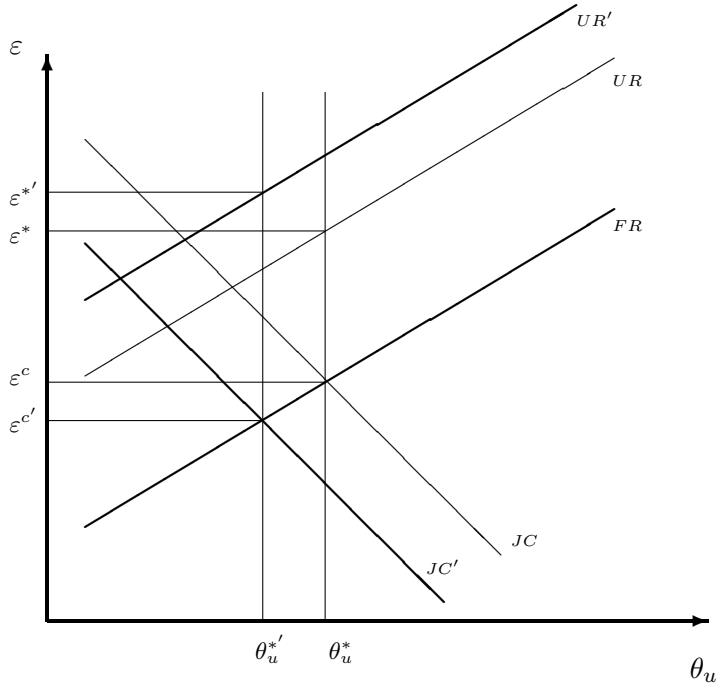
2.5 Synopsis and other implications

Given the equilibrium values of the main parameters of the model, I can draw some conclusion about the implications of a change in the policy instrument p. I summarize the previous results and outline further implications in the following.

Skilled submarket. An increase in p:

- Fosters job creation by reducing the worker specific reservation productivity, η^*. As it is easier to renew a short-term contract, the learning process about workers' productivity is spread out on a longer span; firms are less exacting on the level of $\eta*$ required to renew the contract.

Figure 2.4: *The effect of an increase in p in the unskilled labor market*



- Induces less frequent transformation of short-term jobs into long-term jobs by raising the threshold value η^c. As the learning process elapses longer, assessment about workers ability is now more efficient, firms demand larger value of η^c to upgrade workers with a long-term contract. It is now more likely that workers are stuck longer in short-term jobs.
- Gives rise to more long-term job destruction by raising the threshold value ε^*. Higher ε^* together with higher η^c reduce the number of long-term jobs but increase the number of short-term jobs in the economy.
- Conditional on that job destruction increases more compared to the increase in job creation, hence the equilibrium unemployment rate unambiguously rises.
- Increases the *within* wage inequality. Entry-level jobs pay less and renewed and long-term jobs pay more compared to the scenario in

which p is lower or null.

Unskilled submarket. An increase in p:

- Induces less frequent conversion of short-term jobs into long-term jobs by raising the threshold productivity ε^*. Firms are entitled to keep short-term jobs longer (by renewing them) and are more exacting about the minimum acceptable productivity, ε by raising the opportunity cost of long-term jobs.
- Reduces job creation. The higher the threshold value ε^*, the lower the expected present value of short-term jobs, which yields less job creation.
- Reducing both job creation and job destruction affects ambiguously unemployment. However, the decrease in equilibrium tightness θ_u^* tends to make the unemployed workers worse off by lowering their option value of search.
- Rises the *within* wage inequality. Long-term jobs pay less than short-term ones.

I can further draw some conclusions about the *between* wage inequality. Let compare top earners in the skilled labor market and the bottom earners in the unskilled labor market: after the change in the policy p, the wage ratio between these two groups turn out to be wider. To some extent, an increase in p might exacerbate workers polarization in terms of earning in the economy.

Chapter 3

Empirical analysis I

3.1 How long do I take to get a long-term job?

The goal of this chapter is to answer one of the main questions formalized in the preceding chapter, namely, how long do workers take to obtain a permanent contract in the Italian labour market? To deal with it, I focus on one country, Italy.

The purpose of this study is also to analyze the effect of fixed-term contracts on the probability of finding a permanent job. This is not the first attempt to apply event history analysis to temporary employment. Among others, using a duration model with competing risks of terminating into permanent employment versus alternative states, Guell and Petrongolo (2004) argue that the level and the timing of permanent promotions of fixed-term contracts can be suggestive of different levels of workers' outside options, and find that conversion rates from temporary to permanent jobs increase with tenure for Spain. For UK, Booth et al. (2002) study the effect of the number of temporary contracts held in the past on current wages. For Italy, Gagliarducci (2005) emphasizes the role of repeated short-term contracts on the probability of finding a permanent job. He finds that it is not temporary employment *per se*, but the intermittence associated with it that deteriorates employment prospects .

In this empirical investigation I study the determinants and the timing

Table 3.1: Raw yearly transition rates. 2000-2004.

	Same FT	**New FT**	**Long-Term**	**Unemp**	**Self-Employed**	**Other**	*total*
year 1	11.27	11.03	28.40	47.24	0.49	1.57	100
year 2	25.61	10.01	37.88	21.82	0.51	4.18	100
year 3	33.07	8.78	36.33	18.36	0.27	3.19	100
year 4	43.50	5.27	30.51	18.14	2.33	2.33	100
year 5	54.34	3.97	16.38	24.81	0.25	0.25	100

Transition rates are computed according to the distribution of individuals across labour market states in each year. Source: WHIP.

of the conversion of short-term jobs into permanent ones, focusing on the difference between skilled and unskilled workers.

The chapter is organized as follows: section 1 discusses the data and provides some preliminary evidence of the duration of fixed-term job needed to get a long-term one; section 2 introduces and shows the econometrics strategy applied; section 3 presents the results and some discussion is given in section 4.

3.2 The Data

The sample used in this paper is drawn from the WHIP dataset (Work Histories Italian Panel), which is a panel survey of individual work histories, based on INPS (Istituto Nazionale di Previdenza Sociale, Social Security Institute) administrative archives. The reference population is made up by all the people, who have worked in Italy even only for a part of their working career and it amounts to about 370,000 individuals. The workers for whom activity is not observed in WHIP are those who worked in the public sector or as freelancers (lawyers or notaries) who have an autonomous security fund.

For each of these people the main episodes of their working careers are observed. Furthermore, data concerning the firm in which the worker is em-

ployed is also available. The observed period goes from 1985 to 2004. Workers transitions can be studied by linking consecutive information on the same individuals, available for all cohorts selected since 1985. As the introduction of fixed-term contract in the Italian labour market is dated back to 1998 (196/1997 law which has introduced temporary work agencies), I do not consider individuals surveyed before 1998.[1] Owing to a change in the way data are recorded after year 2000, that make difficult to use the whole dataset, I decide to further reduce the observational period by selecting only workers between 2000 and 2004.

Although I do not have information about when the first entry in the labour market occurs, I conjecture that people not surveyed two year before 2000 are engaged in education or have never been employed earlier (while it is trivial for workers that enter the observational period after 2000). This allows me to end up with a sample of individuals that enter the labour market for the first time. I further select workers aged 15 to 35 at the beginning of the first spell and employed with a short-term contract, so that having a sample of individuals that enters the labour market for the first time and via short-term contract. Thus, there is only one initial state (FT) and this leaves me with 8316 working spells.

Destination states are derived by grouping labour contracts into three broad category, namely FT, if worker change for another FT contract, SE, if worker turns to be self-employed and LT, if he gets a long-term contract. The latter is considered as the absorptive state. FT state is comprised by the following fixed-term contracts: i) CFL (Contratto di Formazione e Lavoro), which provides the worker with on-the-job-training; ii) Agency contract, the provider (agency) hires the workers and supply his work to the firms; iii) Apprenticeship, similar to CFL; iv) Collaborator (*co.co.co (pro)*, Collaborazione Coordinata e Continuativa (a Progetto)), although they are ranked as self-employed from a fiscal viewpoint, it is not unrealistic to consider them as para-subordinate employed; indeed, it has been shown that most of fixed-term

[1] Before 1998, fixed-term employment is allowed only for jobs that were temporary in their nature, as seasonal activities and for particular project, and thus all the preceding years are not of my concern.

Table 3.2: Long-term conversion rates by duration and type of contract and median durations by type of contract, 2000-2004. Source: WHIP.

Duration (months)	**CFL**	**Temporary**	**Apprenticeship**	**Parasubordinate**	**Others***
<6	7.46	48.01	19.90	24.63	0.0
7-12	11.92	26.15	36.73	24.81	0.38
13-18	19.66	19.90	35.01	23.98	1.44
19-24	47.03	9.53	28.60	13.56	1.27
25-30	20.38	12.83	47.92	15.47	3.40
31-36	8.19	10.32	54.80	13.52	13.17
37-42	11.35	9.93	63.12	10.64	4.96
>42	6.90	10.34	70.11	10.34	2.30
All durations	18.75	20.66	39.07	18.86	2.65
Median durations	24	17	47	41	25

* Others includes self-employed and re-employment contracts.

contracts is of this type, in particular for young workers and women, and that tasks and duties involved are not so different from the ones of subordinates (see Berton *et al.*, 2005); v) Others, which consists of re-employment contract, designed to long-term unemployed workers, and unranked contracts.

In order to give a flavor of labor market transitions in our sample, Table (3.1) shows raw yearly transition rates into five labor market states. It is worth pointing out that as WHIP does not allow to keep track of the firm where the workers is employed in, I am not able to distinguish whether there has been a contractual renewal in the same firm. As a result, "New FT" state picks out workers who switch to a different type of fixed-term contract or experience a period of unemployment before switching. Analogously, "Same FT" state identifies workers who do not go through a period of unemployment before switching and, hence, they are still employed with the same contract or their contract has likely been renewed without interruption in between.

As expected, 11.27% of fixed-term workers is still employed with the same fixed-term contract after the first year. This figure increases as time goes

by. Although it highlights strong state dependence into fixed-term job, the magnitude of these percentages can be misleading, mainly, because of the aggregation operated in computation: years refer to months in which workers are observed to switch, so that same workers can appear more than once within each figures (e.g., year 1 means anything between 1 and 12 months, year 2 means anything between 13 and 24 months and so forth.). Exit to unemployment records the highest values in the first year, meaning that (fixed-term) employment is extremely volatile at the onset of the working career. Roughly 28% and 38% of fixed-term workers obtains a permanent job after the first and the second year respectively; then, transition to long-term state turns to be decreasing, suggesting that being employed for a long span with a fixed-term contract has a detrimental effect on the chance of getting a permanent job. Lastly, transitions to self-employment state are negligible.

To give a better understanding of how the type of fixed-term contract affects transitions, table (3.2) depicts raw transition rates by duration and type of contract for the period 2000-2004. CFL shows a clear spike at 19-24 months, whereas temporary (or agency) contract experiences the highest conversion rate in the first months and then is decreasing. The increasing trend of the apprenticeship contract is explained by his legal duration: it shows spikes at 37-42 months and over, corresponding to his legal duration of 4 or 5 years. Further, be employed as a parasubordinate for long span seems to lower probability of getting a permanent job.

Covariates included in the regressions showed further on are mainly individual characteristics such as gender, age; job characteristics such as part-time, sector and type of fixed-term contract. Demographic characteristics (area of residence of the firm in which individual is employed) are also considered; they should grasp the effect of local labor market, if any, on the conversion of contracts. Unfortunately, WHIP does not provide educational level attained by individuals so I am not able to control for that. As my interest also focus on the conversion pattern by skilled and unskilled groups, I attempt to overcome this issue recovering a skill measure from the type of job filled by workers, instead of education (the two measures *de facto* mirror each other). As a result,

skilled workers are those which hold a managerial occupation. Average values of these covariates at the entry time into the panel are reported in Table (4.1).

3.3 Econometric strategy

The model used in this empirical investigation is a continuos time duration model. More precisely, I make use of a Cox proportional hazard model (Cox 1972, 1975). The main advantage of the Cox model is that the relationship between covariates and the hazard rate can be estimates without having to make any assumptions whatsoever about the nature and shape of the baseline hazard rate: it comes out from the data. Furthermore, as fixed-term contract can terminate in several states not only in long-term employment, I consider a competing risks model which distinguish exits to the following states: long-term, new fixed-term, self employment or unemployment. A common applied approach to the competing risks problem is the latent survivor approach. It assumes that there are K specific outcomes and that there is assumed to exits a latent failure time associated with each outcome. Only the shortest duration time is actually observed, while the others are censored (treated as censored). I will make use of this approach.

As my concern is about conversion into long-term employment I only consider LT state as the terminal state, treating durations finishing for other reasons as censored at time of exit. In doing so, one assumption must hold, namely, the K risks must be conditionally independent (see Box-Steffensmeier and Jones, 2004; and Narendranathan and Stewart, 1993). Hence, the model is a Cox proportional hazard-latent survivor time approach and the unit of time is one month.

The hazard rate of the transition out of fixed-term job for the ith individual is:

$$h_{ik}(t) = h_{0k}(t) \exp(\beta_k' \mathbf{x}) \tag{3.1}$$

where $h_{0k}(t)$ is the baseline hazard function associated with the kth risk, $\mathbf{x}$ is a vector of time-invariant explanatory variables and β_k is a vector of un-

Table 3.3: Mean and standard deviation of sample covariates.

	Mean	**(Std. Dev.)**	**No. of spells**
Age	22.68	(5.45)	8316
Female	0.45	(0.50)	8316
Part-time	0.09	(0.28)	8316
More jobs	0.03	(0.16)	8316
Skilled Worker	0.18	(0.38)	8316
Unskilled Worker	0.82	(0.38)	8316
FT exp.	14.11	(12.95)	8316
CFL	0.10	(0.30)	8316
Temporary	0.16	(0.37)	8316
Parasubordinate	0.24	(0.42)	8316
Apprenticeship	0.48	(0.50)	8316
Construction	0.09	(0.30)	8316
Manufacturing	0.21	(0.41)	8316
Services	0.41	(0.49)	8316
North-West	0.30	(0.46)	8316
North-East	0.25	(0.44)	8316
Centre	0.22	(0.42)	8316
South	0.21	(0.41)	8316
Cohort '65-'72	0.15	(0.35)	8316
Cohort '73-'80	0.37	(0.48)	8316
Cohort '81-'89	0.47	(0.50)	8316

All variables refer to the beginning of the spell (no time-varying covariates). *More jobs* indicates whether individuals have occupied in more than one job. *Skilled workers* are those who fill a managerial occupation. *Ft exp* refers to cumulative months spent before switching. *CFL*: training contract. *Temporary*: agency contract. *North-West*, *North-East*, *Centre* and *South* denote area in which worker is employed.

known coefficients. The subscript k of β means that different set of coefficients for each type of failure are allowed.[2] The likelihood contribution of a spell of length t_i is

$$L_i = \prod_{i=1}^{N} f_k(t_i|X_{ik}, \beta_k) \prod_{k=1}^{r} S_k(t_i|X_{ik}, \beta_k) \tag{3.2}$$

where $S_k(.)$ is the survivor function. Since only one failure among k possible outcomes is taken into account per unit, the overal likelihood can be partitioned in terms of the number of units failing by each of the k outcomes:

$$L_i = \prod_{k=1}^{r} \prod_{i=1}^{N_k} f_k(t_i|X_{ik}, \beta_k)^{\delta_{ik}} S_k(t_i|X_{ik}, \beta_j)^{1-\delta_{ik}} \tag{3.3}$$

where δ_{ik} is a censoring indicator such that it equals 1 if i failed due to k (long-term job) and 0 otherwise. The baseline hazard can be estimated semi-parametrically by maximizing the log of (3.3) with respect to the vector β. The vector of controls X_i includes individual and job-related covariates, which are treated as time invariant, as well as a step function of the working experience in the previous fixed-term job.

3.4 Empirical Results

I now turn to show the estimates of the econometric model outlined in the previous section. The results are reported in table (3.4). The effect of the individual characteristics on the conversion rates are quite standard and in line with the corresponding literature (see Gagliarducci, 2005 for Italy and Guell *et al.*, 2007 for Spain). Table (3.4) depicts that the hazard is increasing with age at early stage and decreasing afterwards. Gender has the expected effect on the probability of obtaining a long-term job: it shows the conventional statistical discrimination of females. Being employed as a part-timer and holding more

[2] By providing a different set of coefficients for each type of failure, the latent survivor time approach captures heterogeneity across different types of events in terms of the covariates.

Table 3.4: Maximum likelihood estimates of the transition from fixed-term to long-term employment: 2000-2004.

Variables	**Coefficients**	(**Std. Err.**)†
Age	0.246***	(0.052)
Age^2	-0.003***	(0.001)
Female	-0.170***	(0.051)
Part-time	-0.150**	(0.079)
More Jobs	-1.636***	(0.274)
Skilled	0.924***	(0.120)
FT exp × Skilled	-0.201***	(0.014)
FT exp(6) × Skilled	0.065***	(0.014)
FT exp(12) × Skilled	0.100***	(0.007)
FT exp(18) × Skilled	0.170***	(0.013)
FT exp(24) × Skilled	0.162***	(0.013)
Female × Skilled	0.280***	(0.104)
CFL	1.137***	(0.066)
Temporary	1.011***	(0.077)
Parasubordinate	0.732***	(0.160)
Construction	0.437***	(0.161)
Manufacturing	0.530***	(0.150)
Services	0.701***	(0.150)
North-west	0.382***	(0.057)
North-east	0.355***	(0.061)
Centre	0.235***	(0.062)
Cohort '73-'80	0.272**	(0.116)
Cohort '81-'89	0.401***	(0.145)
No of subjects	7886	
No of failures	2659	
log-pseudolikelihood	-20552.516	

† Standard errors are clustered on 7886 subjects.

***Significant at 1%, **Significant at 5%, *Significant at 10%.

than one job reduces the hazard of getting a long-term job. The hazard is also increasing irrespective of the fixed-term contract previously held, the highest figure is represented by the CFLs (training contracts). Industry dummies show that services exhibit the highest conversion rates and construction the lowest, and anyway positive. Besides these expected results, what is interesting to highlight is the effect of working experience on the conversion rate: although skilled workers exhibit an overall higher probability with respect to unskilled workers, table (3.4) reveals a mixed trend when one takes into account FT working experience at fixed durations, that is, at earliest months (between 1 and 6) this probability turns out to be decreasing and increasing afterwards (constant after 24 months), suggesting a screening process of the firms about workers, consistently with prediction of chapter 3.

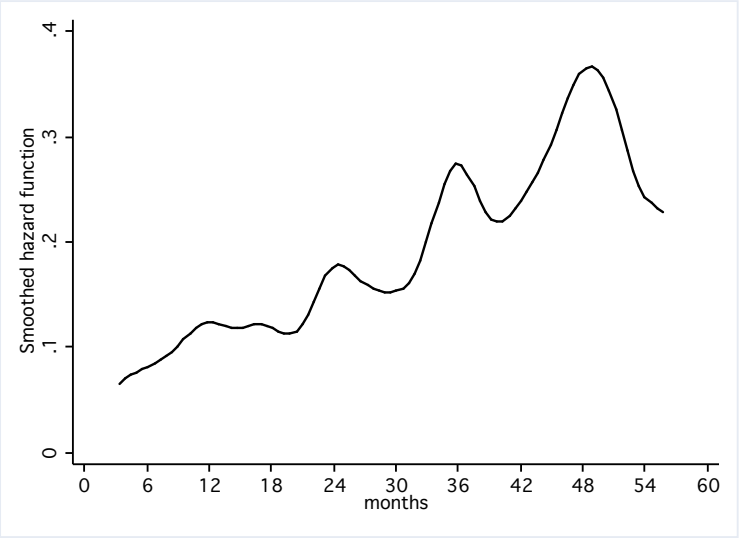


Figure 3.1: *Predicted monthly hazard rate for the transition from FT to LT employment, 2000-2004. Reference category: male, aged 25, belonging to cohort '73-'80, full-time employed with a parasubordinate contract in the services sector, and firm located in North-West. Smoothed hazard function using gaussian kernel and bandwidth equals 2.*

The predicted monthly hazard corresponding to the above regression is plotted in figure (3.1) for a representative fixed-term worker (male, aged 25, belonging to cohort '73-'80, full-time employed with a parasubordinate con-

tract in the services sector, and employer located in North-West). It is evident that hazard rate is fairly increasing over the whole period and it exhibits spikes at durations around 25, 36 and 48 months. The presence of these spikes denote significant heterogeneity in the time pattern of conversion rates and it can be associated with both difference in the screening behaviour of the firms, if one considers different evaluation practices, and dissimilar reservation values of worker specific productivity operating in the economy. Overall, the hazard function suggests that on average individuals have to undergo a period, varying between 24 and 48 months, of fixed-term employment in order to obtain a permanent contract.

It is interesting to note that, at a later time, the hazard rate starts to decline, indicating that longer span of fixed-term employment might have a harmful effect on the probability of getting a permanent job: longer time spent in a short-term job may turn into a trap.

In order to investigate whether different population groups have different duration pattern, I carry out separate regressions for skilled and unskilled workers. In doing so, I split the sample along the type of occupation such that skilled workers are those which hold a managerial occupation. The rationale behind this choice is simple: WHIP does not provide the educational level attained by individuals. However, this drawback does not represent a concern for the analysis, if one consider that educational level and type of occupation mirror each other. The results for skilled and unskilled workers are showed in table (3.5).

All the coefficients broadly have the same effect on the transition rates to long-term job. However, some differences can be highlighted: while unskilled women have lower conversion rates than unskilled men, no significant gender differences can be detected in the skilled group; the type of fixed-term contract overall lessens the hazard of switching to a skilled long-term job, whereas the opposite occurs for unskilled workers. It is noteworthy to look at the effect of the lagged durations: although the corresponding coefficients have the same sign, the magnitude seems to be larger for the unskilled group. This finding is consistent with the prediction of chapter 2, namely, unskilled workers

Table 3.5: Maximum likelihood estimates of the transition from fixed-term to long-term employment: skilled and unskilled, 2000-2004.

	Skilled[††]		**Unskilled**	
	Coefficients	(*Std. Err.*)[†]	*Coefficients*	(*Std. Err.*)[†]
Age	0.181	(0.137)	0.410***	(0.061)
Age^2	-0.002	(0.002)	-0.006***	(0.001)
Female	0.063	(0.085)	-0.132**	(0.055)
Part-time	-0.437***	(0.140)	-0.158	(0.100)
More Jobs	-1.727***	(0.411)	-1.373***	(0.347)
FT exp	-0.340**	(0.023)	-0.363***	(0.019)
FT exp(6)	0.157***	(0.024)	0.180***	(0.020)
FT exp(12)	0.210***	(0.024)	0.256***	(0.019)
FT exp(18)	0.290***	(0.024)	0.280***	(0.019)
FT exp(24)	0.321***	(0.024)	0.330***	(0.019)
CFL	-0.054	(0.187)	0.773***	(0.107)
Temporary	-0.870***	(0.225)	0.136	(0.096)
Parasubordinate	-1.780***	(0.295)	0.003	(0.190)
Construction	0.029	(0.336)	0.440**	(0.190)
Manufacturing	0.071	(0.261)	0.630***	(0.176)
Services	0.020	(0.270)	0.630***	(0.175)
North-west	0.695***	(0.124)	0.471***	(0.071)
North-east	0.430***	(0.144)	0.335***	(0.074)
Centre	0.524***	(0.142)	0.242***	(0.073)
Cohort '73-'80	0.220	(0.162)	0.163	(0.160)
Cohort '81-'89	0.514*	(0.275)	0.231	(0.193)
No of subjects	1409		6566	
No of failures	636		2023	
log-pseudolikelihood	-3593.19		-14525.3	

[†] Standard errors are clustered on 1409 and 6566 subjects in column 1 and 2 respectively.

[††] Skilled workers are those which hold a managerial occupation.

***Significant at 1%, **Significant at 5%, *Significant at 10%.

should experience relatively shorter spell to obtain a long-term job and, as a result, they should own a higher hazard; moreover, it is in line with the results provided in Gagliarducci (2005) for Italy.[3]

The predicted monthly hazard rates corresponding to the above regressions are plotted in figure (3.2) and (3.3) for a representative fixed-term worker, singled out as earlier. First, by comparing the two plots, it is easily established that unskilled workers have an overall larger conversion rates than skilled ones. This result endorses one of the assumptions of the model, namely, that unskilled workers obtain a long-term job earlier than skilled ones, because they do not have to go through a period of screening. The hazard rates of skilled employees are increasing up to duration 12 months, then roughly constant and increasing after duration 30 months. Even in this case spikes (at 12 and 24 months) denote the presence of some heterogeneity of the conversion pattern. Conversely, transition rates of unskilled workers are approximately more regular: they are almost flat up to duration 30 months then increasing and again decreasing after duration 48 months.

3.5 Final remarks

The main purpose of this empirical investigation has been to shed light on the duration pattern of fixed-term contract and in particular on the determinants of their conversion into permanent contracts. To conduct the empirical analysis I have selected a sample of individuals who enter the labour market via fixed-term employment over the period 2000-2004, and followed until they obtained a permanent contract. I have found three main results:

i) the probability of getting a long-term job is lower at the onset of the working career, then, it increases with the duration of the fixed-term working experience;

[3]More precisely, Gagliarducci shows that filling a managerial occupation increases the chances of persistence in temporary employment and reduces the probability of moving to a permanent position.

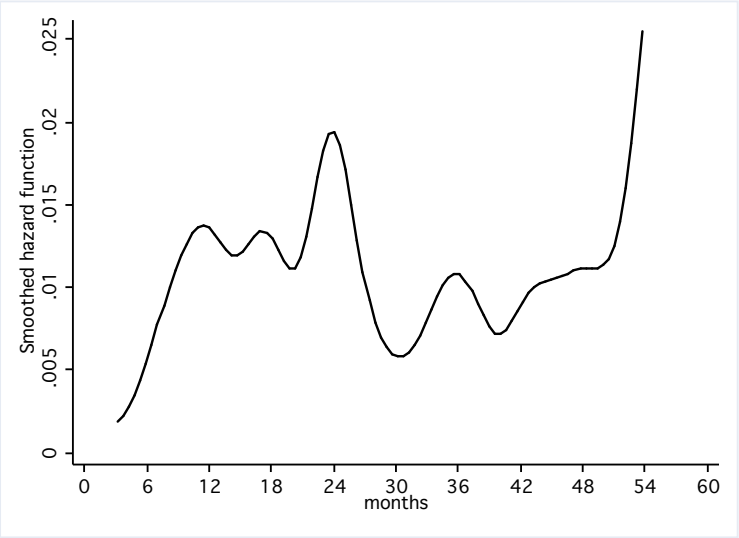


Figure 3.2: *Predicted monthly hazard rate for the transition from FT to LT employment, 2000-2004:* ***Skilled workers****. Reference category: male, aged 25, belonging to cohort '73-'80, full-time employed with a parasubordinate contract in the services sector, and firm located in North-West. Smoothed hazard function using gaussian kernel and bandwidth equals 2.*

ii) unskilled workers generally exhibit higher conversion rates than skilled ones;

iii) longer span of fixed-term employment than about 48 months seems to affect negatively the transition rates.

These findings seems to support some of the predictions of chapter 2. Screening about workers innate ability involves a more or less long period of fixed-term employment before obtaining a regular, stable job. The length of this period depends both on the type of occupation and on the firm's capability of assessing it. The less regular shape of the predicted hazard of skilled workers is suggestive of some heterogeneity in the duration pattern: while the increasing initial hazard rates likely capture the ones of the ablest workers (which see converted relatively quick their contract), the flat hazard between durations 12 to 24 months seems to indicate the period in which the workers are under evaluation by firms.

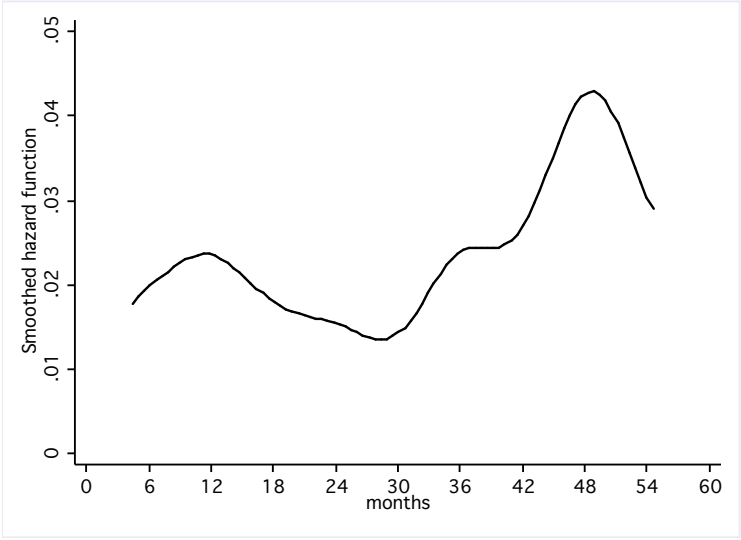


Figure 3.3: *Predicted monthly hazard rate for the transition from FT to LT employment, 2000-2004:* ***Unskilled workers****. Reference category: male, aged 25, belonging to cohort '73-'80, full-time employed with a parasubordinate contract in the services sector, and firm located in North-West. Smoothed hazard function using gaussian kernel and bandwidth equals 3.*

What one can learn by these estimates is that, irrespective of the population group considered, the highest transition rates are shown at very long durations, suggesting that on average workers have to go through a long period of fixed-term employment (perhaps with interruptions in between) in order to obtain a permanent job. Had they not, they likely might even experience lower transition rates.

Chapter 4

Empirical analysis II

4.1 Evaluating the impact of *30/2003* law on wage differentials

In this chapter I evaluate the effect of the 30/2003 law on wage differentials between workers employed with a short-term contract and workers with a long-term contract by skills category. The aim is to assess how the differential has been moving on after the introduction of the aforementioned reform.[1]

The chapter is organized as follows: section 1 discusses the data and shows summary statistics of the main variables; section 2 introduces and motivates the econometrics strategy applied; section 3 presents the results and some discussion is given in section 4.

4.2 The Data

The analysis in this paper is based primarily on a repeated cross-section formed from the 2002 and 2006 Survey of Household Income and Wealth (SHIW) of the Bank of Italy. The SHIW is based on a random sample of 8,012 households, 20,581 individuals per year. It contains information on both households and individuals. The leading purpose of the survey is to collect individual financial information, but it also contains a lot of individual char-

[1] See the introductory chapter for a description of such law.

acteristics such as the highest completed school degree, gender, age, years of working experience, weekly hours worked, gross yearly wages, region of residence, etc. Likewise, it includes information on parental education, sector and job position. I draw a subsample of 2083 and 2625 individuals employed for year 2002 and 2006 respectively. I do not consider self-employed individuals since it is unreasonable to classify them in terms of fixed (long)-term contracts. Conversely, I keep workers employed with a *co.co.co* contract, that although they are ranked as self-employed in the SHIW (and they actually are from a fiscal viewpoint), it is not unrealistic to consider them as (para) subordinate employed.[2] I further delimit the analysis to individuals aged 18 to 40, because, on one hand, coherently with the theoretical model, this group is more likely to be subject to short-term contracts, and, on the other hand, I can avoid potentially biased estimates induced by higher wages of older workers (the latter are assumed to be employed with a long-term contract).

Table 4.1 shows summary statistics of the main variables. Overall, the two subsamples look roughly alike in terms of mean and standard deviation of the variable taken into account. Apart from married people that increase by 4%, social characteristics are stable over sample period; educational covariates show modest differences, in particular the share of individuals holding an university degree and a scientific degree increases by 3% and 2% respectively.[3] The share of fixed-term contracts raise by 6% over time, whilst part-time workers quota remains roughly unchanged. Further, sectoral and firm size covariates and demographic characteristics only exhibit modest changes.

[2]It has been assessed that most of fixed-term contracts is of this type, in particular for young workers and women, and that tasks and duties involved are not so different from the ones of subordinates. The only difference is from a fiscal viewpoint: a *co.co.co* contract is less onerous than a fixed-term subordinate contract, see amongst others Berton *et al.* (2005)

[3]Scientific degree covariate records individuals who have attained an university degree in the following subjects: Mathematics, Physics, Chemistry, Biology, Veterinary and Medicine, Engineering, Architecture, Economics and Statistics.

Table 4.1: Summary statistics 2002-2006.

	2002			2006		
Variable	**Mean**	**(Std. Dev.)**	**obs.**	**Mean**	**(Std. Dev.)**	**obs.**
Log of monthly wage	6.888	(0.462)	2083	7.018	(0.414)	2621
Age	30.924	(5.816)	2083	31.516	(5.852)	2625
Female	0.436	(0.496)	2083	0.421	(0.494)	2625
Married	0.382	(0.486)	2083	0.424	(0.494)	2625
Spouse	0.175	(0.38)	2083	0.195	(0.397)	2625
Tertiary education	0.12	(0.326)	2083	0.152	(0.359)	2625
Secondary education	0.4	(0.49)	2083	0.421	(0.494)	2625
Vocational diploma	0.301	(0.459)	2083	0.311	(0.463)	2625
Degree score	0.468	(0.365)	2083	0.505	(0.366)	2625
Scientific degree	0.059	(0.236)	2083	0.077	(0.267)	2625
Skilled worker[†]	0.046	(0.21)	2083	0.064	(0.244)	2625
Unskilled worker	0.954	(0.21)	2083	0.936	(0.244)	2625
Fixed-term	0.129	(0.335)	2083	0.189	(0.392)	2625
Long-term	0.871	(0.335)	2083	0.811	(0.392)	2625
Part-time	0.095	(0.293)	2083	0.104	(0.305)	2625
Small-firm	0.4	(0.49)	2083	0.447	(0.497)	2625
Medium-firm	0.258	(0.438)	2083	0.244	(0.43)	2625
Large-firm	0.177	(0.382)	2083	0.158	(0.365)	2625
Industry	0.399	(0.49)	2083	0.403	(0.491)	2625
Services	0.357	(0.479)	2083	0.366	(0.482)	2625
Public_sector	0.203	(0.402)	2083	0.197	(0.398)	2625
North-West	0.3	(0.458)	2083	0.246	(0.431)	2625
North-East	0.243	(0.429)	2083	0.29	(0.454)	2625
Center	0.2	(0.4)	2083	0.2	(0.4)	2625
South and Islands	0.258	(0.438)	2083	0.265	(0.441)	2625

[†] Skilled workers are those which hold a managerial occupation.

4.3 Econometric strategy

The approach taken in this paper is to compare the change in monthly wage of workers employed with a fixed-term contract between 2002 and 2006 in Italy to the change in monthly wage of workers employed with a long-term contract over the same period. Since the *30/2003* reform was effective starting in September 2003, I use the 2002 survey for the before period and the 2006 survey for the after period.

In order to get such an estimate the natural candidate is the Difference-in-differences estimator (DnD). Define by Y_{it}^1 the outcome for individual i in period t whether is exposed to the policy (treatment). The outcome for the same individual if not exposed to the policy is Y_{it}^0. Consequently the impact for the i-th individual of the policy is $Y_{it}^1 - Y_{it}^0$. The average impact for those going through the policy is $E[Y_{it}^1 - Y_{it}^0|D = 1]$, where $D = 1$ denotes individuals under treatment and $t = [b, a]$ indicates the period before and after the implementation of the policy respectively. This parameter retrieves the so-called *average treatment effect on the treated* and will be of our concern.

Clearly, the evaluation problem here can be regarded as a missing-data problem since, at a moment in time, each person is either in the programme under consideration or not, but not both. Thus constructing the counterfactual, $E[Y_{it}^0|D = 1]$, is the central issue of interest.

The conventional DnD estimator is often derived using a linear parametric model; I accomplish this by regressing the following specification:

$$Y_{it}^1 = \beta_{0t} + \beta_{1t}(\mathrm{D}_{it} \times \mathrm{AFTER}) + \beta_{2t}\mathrm{D}_{it} + \beta_{3t}\mathrm{AFTER} + \beta_4 X_{it} + \varepsilon_{it} \quad (4.1)$$

The dependent variable is the log of monthly wage. D is a dummy variable which equals 1 if individual is employed with a fixed-term contract and 0 if he is employed with a long-term contract. AFTER is a dummy variable equal to 1 if individual is observed in 2006 and 0 if surveyed in 2002. The parameter of interest is β_{1t}, regressand of the interaction terms D×AFTER: it measures the impact of the policy on average wage of fixed-term employees. X is a matrix of covariates to correct for differences in observable characteristics between

treated and control group.

As reviewed in Abadie (2005), the effect of the treatment β_{1t} is not identified without further restrictions. Decompose the error term as follows:

$$\varepsilon_{it} = \phi_i + \theta_t + \mu_{it} \tag{4.2}$$

where ϕ_i is an individual-specific effect, constant over time, θ_t is a common macroeconomic effect, the same for all agents, and μ_{it} is a temporary individual-specific effect. To get unbiased estimates a sufficient condition is that selection for treatment does not depend on the temporary individual-specific effect, i.e. $E[\varepsilon_{it}|D_{it}] = E[\phi_i|D_{it}] + \theta_t$ holds.

As the policy does not affect a specific group, but *de facto* potentially covers the labor market at whole, it does not seem that the "Ashenfelter's dip" hypothesis might affect the selection process into the treatment (see Heckman and Smith (1994)). As a result, temporary individual-specific effect issue is not of my concern.

Rather a substitution effect may arise. Employer might be induced by the policy to substitute long-term jobs with fixed-term ones, since the latter are less onerous than the former, and in particular are not subject to firing restrictions. To the extent that this reduction in labor cost just covers that gap in productivity as well as the firing costs to dismiss a long-term worker, one will not expect any substitution. Whereas, if a "gain" in terms of labor costs exists for the employers, the treatment effect on treated will be the sum of the "pure" effect and this "side-effect" of the programme. However, this may occur if workers with a fixed-term contract are perfectly substituted for existing workers employed with a long-term contract. Relying on the theoretical model in chapter 2, this is not the case, because a long-term contract is only offered to high skilled employees, had they gone over a period of screening.

Assumptions about common macroeconomic shock and constant individual specific effect also require some discussion. In order to be cancelled out on subtraction, these assumptions must hold. As I use repeated cross-section data, the composition of the treated and control group might change over time. Along with this, ϕ_i might differ across groups and $E[\phi_i|D_{it}]$ before and

after the change in policy might vary, leading to an over-estimated impact of the policy. In the linear parametric model, this is not a worry whether means of the covariates are not dissimilar in the period before and after the reform. I check for this in table 4.2.

There are some pre-treatment differences between the treated and control group. In particular, substantial differences are found in the level of education attained: treated group exhibits a higher level of better educated people and with a scientific degree than the controls; whereas older people and employed in the Industry sector and in larger firms belong mostly to the control group.

The last column of table 4.2 inspects whether differences between the two groups are stable over time. With the exception of the Married and Part-time dummies, it is evident that the two groups have been moving on similar trends over the sample period. This finding permits the assumptions of constant individual-specific effect to be valid, as the two group have not been changing over time.

The last bit of discussion is about assumption of common macroeconomic shock, θ_t. If the macro effect has a dissimilar impact across the treatment and comparison groups, that is, when the groups have some unknown characteristics that distinguish them and make them react differently to common macro shocks, the DnD estimator will return upward-baised estimate (Blundell *et al.*, 2000). To cope with this issue, Bell *et al.* (1999) propose the differential-trend-adjusted difference-in-differences estimator. Estimating a DnD for another time interval over which a similar macro trend has occurred and subtract it from the DnD of the time period of interest I am able to recover unbiased estimate. For the choice of the time interval Bell *et al.* (1999) suggest that the most recent cycle is the most appropriate. Following this procedure I examine whether in the period just before the 2002 (i.e., 2000-2002) treatment and control group follows the same tend. A null and/or not significant DnD in the 2000-2002 time interval allays concerns that macroeconomic shocks might have impacted dissimilarly the two groups. Results are reported in the appendix 1.

Although the aforementioned identifying assumptions hold, the linear parametric model can be quite restrictive in a number of ways. First, it does not

Table 4.2: Comparison of before and after covariates.

	2002		2006		Difference
	Treated	*Controls*	*Treated*	*Controls*	in differences[†]
Age	28.887	31.226	29.167	32.063	-0.546
	(6.041)	(5.722)	(6.276)	(5.611)	(0.497)
Female	0.481	0.43	0.492	0.405	0.035
	(0.501)	(0.495)	(0.5)	(0.491)	(0.041)
Married	0.299	0.394	0.284	0.456	-0.076**
	(0.458)	(0.489)	(0.452)	(0.498)	(0.037)
Spouse	0.172	0.175	0.167	0.202	-0.031
	(0.378)	(0.38)	(0.374)	(0.402)	(0.031)
Tertiary education	0.16	0.115	0.212	0.138	0.028
	(0.368)	(0.319)	(0.409)	(0.345)	(0.031)
Secondary education	0.332	0.41	0.393	0.427	0.044
	(0.472)	(0.492)	(0.489)	(0.495)	(0.039)
Vocational diploma	0.246	0.31	0.266	0.322	0.007
	(0.432)	(0.462)	(0.442)	(0.467)	(0.036)
Scientific degree	0.071	0.057	0.101	0.071	0.015
	(0.257)	(0.232)	(0.301)	(0.258)	(0.022)
Part-time	0.254	0.071	0.188	0.085	-0.079**
	(0.436)	(0.257)	(0.391)	(0.278)	(0.032)
Large-firm	0.131	0.184	0.127	0.166	0.014
	(0.338)	(0.388)	(0.333)	(0.372)	(0.028)
Industry	0.317	0.411	0.294	0.428	-0.040
	(0.466)	(0.492)	(0.456)	(0.495)	(0.038)
Services	0.396	0.352	0.444	0.349	0.051
	(0.49)	(0.478)	(0.497)	(0.477)	(0.04)
North-West	0.224	0.311	0.163	0.265	-0.014
	(0.418)	(0.463)	(0.37)	(0.441)	(0.033)
North-East	0.198	0.25	0.268	0.295	0.025
	(0.399)	(0.433)	(0.443)	(0.456)	(0.034)
Center	0.175	0.203	0.21	0.198	0.039
	(0.381)	(0.403)	(0.407)	(0.398)	(0.032)
Observations	268	1815	496	2129	

[†]Standard errors are in parentheses in the difference-in-differences column. Standard errors come from regressing the covariates on year, a dummy variable indicating whether the worker is employed with a fixed-term contract or not and an interaction term, and are adjusted for heteroskedasticity.

** Significant at 5%.

allow for β_{1t} to depend on covariates X. And second, it does not impose common support on the distribution of the Xs across all four cells, namely: $[D = 1, t = a]$, $[D = 1, t = b]$, $[D = 0, t = a]$, $[D = 0, t = b]$. This yields biased estimates as reported in Heckman *et al.* (1998).

Following Blundell *et al.* (2004), I attempt to address this point using a DnD estimator combined with propensity score matching. In my case, there are two non-random assignments, one is to the treated people and the other one is to the relevant time period. This involves matching on two propensity scores, which balances the distribution of X covariates in the treatment and comparison groups, before and after the policy reform. The assumption required to justify this approach is the following:

$$E(Y_{it}^0|D = 1, t = b, \hat{p}_d(X), \hat{p}_t(X)) - E(Y_{it}^0|D = 1, t = a, \hat{p}_d(X), \hat{p}_t(X)) =$$

$$E(Y_{it}^0|D = 0, t = b, \hat{p}_d(X), \hat{p}_t(X)) - E(Y_{it}^0|D = 0, t = a, \hat{p}_d(X), \hat{p}_t(X)) \tag{4.3}$$

where $\hat{p}_d(X)$, is the propensity score for being treated and $\hat{p}_t(X)$ for being observed in time period $t = a$. Covariates I use for the two selection rules have been showed in table 4.2. The matching method will be the nearest neighbor.

This procedure allows for both observed (matching) and unobserved determinant of participation (DnD) as long as the latter can be represented by equation (4.2) for both treatment and comparison group.

4.4 Results

This section presents estimates of the impact of *30/2003* law on the log of monthly wage. Table 4.3 reports estimate of OLS regression (4.1) and DnD with propensity score matching, for the full sample. First column gives basic OLS estimate (basic DnD), i.e. using only dummies for time, treatment and interaction term. To control for differences in observable characteristics between treated and control group, I include a set of covariates in the basic

regression. This comprises a quadratic form for age, dummies for sex, marital status, macro-areas, educational level, type of degree and mark attained, part-time workers, firm size and firm sector. The quadratic form of age is also expected to capture any wage-tenure effect. Second column shows that estimate with covariates.

The same set has been used to estimate the propensity score for time and eligibility, on which I construct the counterfactuals of interest. Third column, then, reports estimate of such DnD combined with propensity score matching.[4] Although SHIW provides information about previous working experiences, I prefer to use age instead of tenure as a covariate in the estimation, and the reason is twofold. First, to have a better selection of the treatment groups. As I need to satisfy the criterion of selection into the treatment "filling a fixed-term job", the use of working experiences might create bias in such selection, detecting mostly older workers in the treatment group that stay employed with a fixed-term contract of their own accord. Second, to make as comparable as possible the DnD PSM estimates with the OLS full specification ones. Although, in the latter the use of tenure covariate is preferable because it is the wage to be modeled, such choice might make difficult any comparison between those estimates.

As expected, the estimated magnitude of the effect of the reform is sensitive to the addition of covariates: depending on the specification of the OLS regression, the fixed-term contracts reform is associated with a 4.4-8.8% drop in average wage by fixed-term workers. Basic OLS estimates are not significant, whereas, full specification and Dnd PSM do. The difference in magnitude between the first two columns suggests that part of the wage differential is explained by differences in people characteristics, namely, basic OLS is upward-biased. Although in table 4.2 I showed that most of the covariates evolves in the same way, it is likely that some unknown rule is working underneath, leading to such dissimilar estimates. This gives rise to propensity score matching technique being a valid alternative. Allowing the two participation rule to distinguish between treatment and control group in 2002 and 2006 according

[4]Matching estimates are performed using nnmatch Stata module (Abadie *et al.*, 2001).

Table 4.3: The impact of *30/2003* reform on log of monthly wage for fixed-term workers.

	Basic OLS*	OLS full specification*	DnD PSM bias-adjusted†
ATT	-0.044	-0.084**	-0.022*
(s.e.)	(0.041)	(0.037)	(0.012)
R^2	0.088	0.38	-
Observations	4704	4704	4704

†ATT estimation follows Abadie *et al.* (2001) procedure. Standard errors are boostrapped (300 replications).

* Standard errors are adjusted for heteroskedasticity. ** Significant at 5% * Significant at 10%.

to some probabilistic rule, I enable to create comparison groups comprised by individuals with the same mean characteristics of the treated group, and by means of that recover the "true" effect of the reform on wages of fixed-term employees. Furthermore, discrepancy in matching (i.e. when matching is not exact) is adjusted following Abadie *et al.* (2002).[5]

Last column of table 4.3 reports such an estimate: the policy is associated with a 2.2% drop in wage by fixed-term workers. Magnitude and direction of the OLS bias are in line with the programme evaluation literature (see chapter 26 on Cameron and Trivedi, 2005; and chapter 4 on Lee, 2005), thus I rely on this last estimation and technique to draw conclusion in the following.

I cannot limit the analysis to only that estimates because full sample put together individuals with likely varying characteristics. In order to cope with this heterogeneity and to allow for some labor market segregation effects I

[5]I perform both "simple" matching and bias-corrected matching to inspect the size of such a bias. Differences are negligible, suggesting that balance in covariates is already achieved without correcting. Moreover, matching estimates are obtained using nearest neighbor weights and four matches for each treated individual.

carry out the analysis separately for different sub-samples. In particular, I investigate whether the reform effect differs when one considers skilled and unskilled workers. In doing so, I split the sample along the type of occupation such that skilled workers are those which hold a managerial occupation. Splitting the sample by using this information instead of the educational level is preferred because wages are better commensurate with workers' qualification, when there exists overeducation in the labour market. This seems to be the case for Italy (Cutillo and Di Pietro, 2006). Thus, this skill measure might reduce the bias coming from the probable presence of overeducated workers in the sample.

Table 4.4 reports distinct estimates for skilled and unskilled workers. Even in this case OLS estimates are sensitive to specification used, suggesting that heterogeneity among individuals has not been quite removed and covariates are likely not well balanced across groups.

A non-negligible difference in the magnitude of the ATTs is showed between skill categories. In particular, skilled workers employed with a fixed-term contract earn on average 22-36% less than their colleagues employed with a long-term contracts.The differential is reduced with respect to unskilled workers, that is, short-term contracts pay 2.8%-7.4% less in terms of monthly wage.

These findings are in line with predictions of the theoretical model presented in chapter 2, on which I pointed up how the policy might affect differently skilled and unskilled labor market. On one hand, wage differential between these two groups is overall widened (considering the labor market as a whole), on the other, reform seems to impact to a greater extent skilled workers wages than unskilled ones.

4.5 Final remarks

In this section I have attempted to recover an estimate of the effect of the *30/2003* fixed-term contracts reform on wages. Using three different econometric procedure, namely basic DnD, OLS and DnD PSM, I have found a negative impact of the reform upon fixed-term workers wages. In particular,

Table 4.4: The impact of *30/2003* reform on log of monthly wage for skilled and unskilled fixed-term workers.

	Basic OLS*	OLS full specification*	DnD PSM bias-adjusted†
Skilled Workers††			
ATT	-0.22	-0.36**	-0.24**
(s.e.)	(0.24)	(0.17)	(0.115)
R^2	0.09	0.36	-
Observations	263	263	263
Unskilled Workers			
ATT	-0.038	-0.074**	-0.028 **
(s.e.)	(0.041)	(0.036)	(0.013)
R^2	0.088	0.38	-
Observations	4441	4441	4441

†† Skilled workers are those which hold a managerial occupation.

†ATT estimation follows Abadie *et al.* (2001) procedure. Standard errors are boostrapped (300 replications).

* Standard errors are adjusted for heteroskedasticity. ** Significant at 5% * Significant at 10%.

the overall wage differential is increasing by an amount ranging 2.2% to 8.4%. When I look within skill category, i.e. skilled and unskilled workers, I validate the implications of the theoretical model. Skilled workers employed with short-term contract earn on average 22% to 36% less than skilled workers employed with long-term contract. The differential is shrinking when I consider unskilled workers.

This difference in magnitude might be explained by the contrasting firms behaviour as showed in chapter 2. In the skilled submarket firms are concerned with workers ability. Thanks to fixed-term contracts they are able to assess flawlessly the level of workers ability, without incurring in firing costs when someone has to be dismissed because of an unsatisfactory level of ability (in terms of the theoretical model, ability is below some critical value). As a result, long-term jobs can be seen as a 'reward' to more productive workers and thus they have to pay more than short-term contracts. Furthermore, the same does not occur (or it does but to a smaller extent) regarding unskilled workers. As unskilled jobs entail routine tasks and, thus, do not demand substantial individual ability, firms are not concerned to discern workers with respect to ability. This is corroborated by the not sizable effect of the reform on unskilled wages, as depicted in table 4.4.

Results appear to be sensitive to the technique applied. This can be the result of several facts. First of all, heterogeneity among individuals belonging to treatment and comparison groups. I have attempted not to rely on basic DnD estimate, allowing, first, for covariates and then for selection into 'programme', making use of propensity score matching technique. The latter should be preferred as it is not relying on strong parametric assumptions and, most importantly, is able to construct counterfactuals not only on the basis of non-treated status. This enables to clear out most of the heterogeneity implied by the non-experimental data. Moreover, conditional independence assumptions required for identification of the estimator have been showed to be held and then this further supports the reliability of PSM estimates.

Second, sample size might not be sufficient to draw conclusion on the population. In particular, more compact age group should be more suitable to

evaluate the impact of the reform. Unfortunately, data in my possess does not permit such an analysis. However, even in this case DnD PSM estimates should be preferred, because they make feasible to compare individuals, matched on the basis of nearest propensity scores, i.e. with the same characteristics as showed by Rosembaum and Rubin (1983).

Although such drawbacks, it is evident from above that all the estimates point to the same conclusion: *30/2003* reform has magnified wage differential between long and short-term job.

Appendix 3.1

Testing for identifying assumptions: Common macroeconomic shock

One of the identifying assumptions of the DnD is that the two groups are affected in the same way by a macroeconomic shock. If the macro effect has a differential impact across the treatment and comparison groups the DnD estimator will return upward-baised estimate (Blundell *et al.*, 2000). A way to test such hypothesis is to look at the most recent cycle and inspect whether treated and control groups have followed the same trend.

Following Blundell *et al.* (2000), I inspect how in the preceding cycle, namely 2000-2002, fixed-term and long-term workers have been moving on. I repeat the analysis considering 2000 as the before period and 2002 as the after period. Results are depicted in table 4.5. The small and non-signicant estimated treatment effect indicates that wages for fixed-term workers have been following the same trend as long-term employees in period 2000-2002. Even tough ATTs for skilled and unskilled workers look less clear-cut (due probably to small sample size), they are always non-significant and, as a result, common trend assumptions seems to hold even by skill category.

Table 4.5: Assessment of common macroeconomic shock assumption.

	Basic OLS*	OLS full specification*	DnD PSM bias-adjusted†
Full Sample			
ATT	.030	0.004	0.024
(s.e.)	(0.49)	(0.044)	(0.083)
R^2	0.041	0.357	-
Observations	4828	4828	4824
Skilled Workers††			
ATT	0.32	0.036	-
(s.e.)	(0.25)	(0.24)	(-)
R^2	0.09	0.48	-
Observations	305	305	-
Unskilled Workers			
ATT	0.015	-0.005	0.035
(s.e.)	(0.049)	(0.045)	(0.077)
R^2	0.038	0.33	-
Observations	4523	4523	4523

†† Skilled workers are those which hold a managerial occupation.

†ATT estimation follows Abadie *et al.* (2001) procedure. Standard errors are boostrapped (300 replications). ATT is not estimated for skilled worker owing to lack of sufficient observations for treatment group.

* Standard errors are adjusted for heteroskedasticity.

Chapter 5

Conclusions

The aim of my dissertation has been to explore, both theoretically and empirically the effect of introduction of fixed-term contracts on labour market equilibrium; in particular, the goal has been to shed light on the duration pattern of fixed-term contracts and the determinants of their conversion into permanent ones, and on the effect of temporary contracts upon wage dynamic of skilled and unskilled workers.

In doing this, I have focused on one country, Italy, mostly because recent introduction of such contracts and their intense use by firms has raised concerns about the effectiveness of short-term contracts to reduce unemployment and, in particular, to represent a springboard into permanent jobs. Indeed, in the last decade, young workers have been going through many spells of unemployment and low productivity short-term jobs before obtaining a regular (permanent) job, and this succession turns out to be a trap for some of them.

The theoretical framework, developed in chapter 2, was aimed at unraveling how changes in the institutional pattern affect the hiring and firing behaviour of the firms, emphasizing the impact on fixed-term jobs. Furthermore, it constitutes the formal basis on which to build the empirical analysis in chapter 3 and 4.

The novelty has been the introduction of a process of learning (screening) about workers innate ability, for only skilled positions, in the conventional matching and searching model. It has been conjectured that knowledge about

ability is achieved through successive observations of workers' performance. I have treated such process as a decision theoretic optimal stopping problem *á la* Mortensen and Pisarrides (1999b), wherein idiosyncratic shocks to the workers specific productivity (ability) modify the value of the match and, in turn, affect the hiring and firing behaviour of the firms.

Following this approach, in order to obtain a fixed-term contract renewal the present value of a worker's future ability must be higher than the current one, namely, the new value of ability must be higher than the reservation value that gives rise to a non-renewal. Analogously, in order to see converted a short-term into a long-term job, the realization of ability must be higher than the reservation value that triggers a non-conversion, which, in turn, is also higher than the reservation value of a renewal.

This approach has enabled me to unambiguously identify both the determinants of job creation and destruction in terms of job specific (technology) and worker specific productivity (ability).

I have also introduced an exogenous policy parameter, p, in the model which is intended to easing restrictions on the use of temporary employment contracts (e.g. renewals of fixed-term contract). Shifts in such parameter allow me to draw interesting conclusions about the key relations of the model, in particular, with respect to job creation and job destruction, equilibrium unemployment rate and wages of skilled and unskilled workers.

It has be shown that easing restrictions on the use of temporary contracts affects heterogeneously the two submarkets. In particular, in the skilled submarket, it fosters job creation, induces less frequent transformation of short-term jobs into long-term jobs and increase the *within* wage inequality, i.e., long-term wages push up whereas short-term wages lower for entry-level jobs and rise for the succeeding ones. One of the key effect of such a policy change is that the learning process elapses longer: assessment about workers ability becomes more efficient, firms demand larger value of ability to upgrade workers with a long-term contract. As a result, it is more likely that workers are stuck longer in short-term jobs.

Conversely, in the unskilled submarket, firms are entitled to keep short-

term jobs longer (by renewing their contracts) and are more exacting about the minimum acceptable productivity, by raising the opportunity cost of long-term jobs. In addition job creation falls and wage differential between fixed-term and long-term workers decreases. By comparing top earners in the skilled labor market and the bottom earners in the unskilled labor market, I have showed that, after the policy change, the wage ratio between these two groups turn out to be wider. To some extent, an increase in p might exacerbate workers polarization in terms of earning in the economy.

The duration analysis of chapter 3 has focused on the determinants and the timing of the conversion of fixed-term into permanent contracts. To deal with it, I selected a sample of individuals who entered the labour market via fixed-term employment over the period 2000-2004, and followed them until they obtained a permanent contract. The sample used has been drawn from the WHIP dataset (Work Histories Italian Panel), which is a panel survey of individual work histories, based on INPS (Istituto Nazionale di Previdenza Sociale, Social Security Institute) administrative archives. The model used in this empirical investigation is a continuos time duration model (Cox proportional hazard).

The main findings can be summarized as follows: i) the probability of getting a long-term job is lower at the onset of the working career, then, it increases with the duration of the fixed-term working experience; ii) unskilled workers generally exhibit higher conversion rates than skilled ones; iii) longer span of fixed-term employment than about 48 months seems to affect negatively the transition rates.

These findings seems to support the predictions of chapter 2. Screening about workers innate ability involves a more or less long period of fixed-term employment before obtaining a regular, stable job. The length of this period depends both on the type of occupation and on the firm's capability of assessing it. The less regular shape of the predicted hazard of skilled workers is suggestive of some heterogeneity in the duration pattern: while the increasing initial hazard rates likely capture the ones of the ablest workers (which see converted relatively quick their contract), the flat hazard between durations

12 to 24 months seems to indicate the period in which the workers are under evaluation by firms.

Furthermore, irrespective of the population group considered, the highest transition rates are shown at very long durations, suggesting that on average workers have to go through a long period of fixed-term employment (perhaps with interruptions in between) in order to obtain a permanent job. Had they not, they likely might even experience lower transition rates.

The goal of the second empirical investigation was to evaluate the effect of the *30/2003* law (fixed-term contract reform) on wage differentials between workers employed with a short-term contract and workers with a long-term contract by skills category. I was concerned with assessing how the differential has been moving on after the introduction of the aforementioned reform. I compared the change in monthly wage of workers employed with a fixed-term contract between 2002 and 2006 in Italy to the change in monthly wage of workers employed with a long-term contract over the same period. Since the *30/2003* reform was effective starting in September 2003, I used the 2002 survey of SHIW (Survey of household income and wealth, Bank of Italy) for the before period and the 2006 survey of SHIW for the after period.

To conduct the empirical analysis I made use of three different econometric procedure, namely basic Differences-in-differences, OLS and Difference-in-differences combined with propensity score matching.

Results suggests a negative impact of the reform upon fixed-term workers wages. In particular, the overall wage differential is increasing by an amount ranging 2.2% to 8.4%. When I look within skill category, i.e. skilled and unskilled workers, I validate the implications of the theoretical model. Skilled workers employed with short-term contract earn on average 22% to 36% less than skilled workers employed with long-term contract. The differential is shrinking when I consider unskilled workers.

This difference in magnitude validates the contrasting firms' behaviour as implied by the theoretical model: in the skilled labor market, long-term jobs can be seen as a 'reward' to the ablest workers and thus they have to pay more than short-term contracts. Conversely, the same does not occur (or it

does but to a smaller extent) in the unskilled labor market. As unskilled jobs entail routine tasks and, thus, do not demand substantial individual ability, firms are not concerned to discern workers with respect to ability. This is corroborated by the not sizable effect of the reform on unskilled wages.

Policy implications are fairly evident: while temporary contracts surely have fostered job creation (at least soon after their introduction, Boeri and Garibaldi, 2007), giving to the firms the opportunity of getting away somehow from the rigid legislation applied to the permanent contracts, they also have contributed to create a dualism in the Italian labour market, lessening the position of fixed-term employees both in term of wages and future chances of obtaining a stable job.

Considering the past experience of other European countries, which have introduced largely before such contracts (e.g. Spain), policy makers should be aware of these side-effects that, in turn, might lead to a non-negligible polarization in the Italian economy.

Bibliography

[1] Abadie, A., Drukker, D., Leber Herr, J., Imbens, W., Guido (2001), "Implementing Matching Estimators for Average Treatment Effects in Stata", *The Stata Journal*, 1(1): 1-18.

[2] Abadie, A., (2005), "Semiparametric Difference-in-Differences Estimators", *Review of Economic Studies*, 72: 1-19.

[3] Bell, B., Blundell, R., Van Reenen, J., (1999), "Getting the unemployed back to work: an evaluation of the new deal proposals", *International Tax and Public Finance*, 6: 339-360.

[4] Berton, F., Pacelli, L., Segre, G., (2005), "I Lavoratori parasubordinati in Italia: tra autonomia del lavoratore e precarieta' del lavoro" *Rivista Italiana degli Economisti*,10(1): 57-99

[5] Berton, F. and Garibaldi, P. (2006). "Workers and firm sorting into temporary jobs", *Labor Working Paper*, (51):30.

[6] Blanchard, O. and Landier, A. (2002). "The perverse effects of partial labour market reform: Fixed-term contracts in France",

The Economic Journal, 112(June):F214–F244.

[7] Blundell, R., Costa Dias, M., (2000), "Evaluation methods for non-experimental data", *Fiscal Studies*, 21(4): 427-468.

[8] Blundell, R., Costa Dias, M., Meghir, C., and Van Reenen, J., (2004). "Evaluating the Employment Impact of a Mandatory Job Search Program", *Journal of the European Economic Association*, 2(4): 569-606.

[9] Boeri, T. and Garibaldi, P. (2007). "Two tier reforms of employment protection: a honeymoon effect?", *The Economic Journal*, 117(June):F357–F385.

[10] Booth, A. L., Francesconi, M., and Frank, J. (2002). "Temporary jobs: Stepping stones or dead ends?",be *The Economic Journal*, 112(June):F189–F213.

[11] Box-Steffenmeier, J., and Jones, B., (2004), Event history modeling. Cambridge University Press.

[12] Cahuc, P. and Postel-Vinay, F. (2002). "Temporary jobs, employment protection and labor market performance" *Labour Economics*, 9:63–91.

[13] Cahuc, P. and Zylberberg, A., (2004), Labor Economics, Cambridge University Press.

[14] Cameron, A., and Trivedi, P., (2005), Microeconometrics: Methods and Applications, Cambridge University Press.

[15] Cutillo, A., and Di Pietro, G. (2006). "The effects of overeducation on wages in Italy: a bivariate selectivity approach", *International Journal of Manpower*, 27(2):143–168.

[16] Dolado, J., Garcìa-Serrano, C., and Jimeno, J. (2002). "Drawing lessons from the boom of temporary jobs in Spain", *The Economic Journal*, 112(June):F270–F295.

[17] European Commission (2005), "Employment in Europe".

[18] Gagliarducci, S., (2005), "The dynamics of repeated temporary jobs" *Labour Economics*, 12: 429-448

[19] Guell, M., and Petrongolo, B., (2007), "How binding are legal limits? Transitions from temporary to permanent work in Spain" *Labour Economics*, 14: 153-183

[20] Heckman, J., and Smith, J., (1994), "Ashenfelter's dip and the determinants of program participation", University of Chicago, mimeo.

[21] Heckman, J., Ichimura, H., Smith, J., Todd, P., (1998), "Characterizing selection bias using experimental data", *Econometrica*, 66(5): 1017-1098.

[22] Kugler, A. D. and Saint-Paul, G. (2004), "How do firing costs affect worker flows in a world with adverse selection?", *Journal of Labor Economics*, 22(3):0.

[23] Lee, M-J., (2005), Micro-Econometrics for Policy, Program, and Treatment Effects, Advanced Text in Econometrics, Oxford University Press.

[24] Manning, A., (2003) Monopsony in motion, Princeton University Press

[25] Ministero del Lavoro, della Salute e delle Politiche sociali, (2008), "Rapporto di monitoraggio delle politiche occupazionali e del lavoro",

[26] Mortensen, D., (2003) Wage dispersion. Why are similar workers paid differently? Princeton University Press, Zeuthen lectrure book series, MIT Press.

[27] Mortensen, D. and Pissarides, C. (1994), "Job creation and job destruction in the theory of unemployment", *The Review of Economics Studies*, 61(3):397–415.

[28] Mortensen, D. and Pissarides, C. (1999a), "Unemployment responses to 'skill-biased' technology shocks: The role of labour market policy", *The Economic Journal*, 109(455):242–265.

[29] Mortensen, D. and Pissarides, C. (1999b), "New developments in models of search in the labor market", in Ashenfelter, O. and Card, D. (ed.), Handbook of Labor Economics, edition 1, volume 3, chapter 39, pages 2567-2627 Elsevier.

[30] Rosenbaum, P. R. and Rubin, D. B. (1983), The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1):41–55.

Appendix 1

The institutional background

This appendix is aimed at showing the main features of three reforms, the 196/1997, which has introduced the agency contracts in 1998, the 368/2001, which recognizes the legal nature of fixed-term contract, and the 30/2003 which has reformed all the previous fixed-term contracts and introduced new contractual forms.

The first act toward liberalization of non-standard contracts has been the so-called "Treu law" (law 196/1997), which legalized and regulated the supply of temporary workers by authorized agencies. Temporary Work Agencies are entitled to "hire" workers on a temporary basis and to supply their work to firms. This sort of employment is only banned in the following cases: i) replacement of workers on strike, ii) firms that experienced collective dismissals in the previous 12 months, and iii) jobs that require medical vigilance. The law lets the provision of further regulation to collective bargaining. In particular, collective bargaining have set that temporary workers cannot exceed 8-15% of standard employees and that firms cannot extend a contract more than four time for a maximum of 24 months.

The 368/2001 law, for the first time in Italy, recognizes the legal nature of fixed-term contracts, reversing the previous institutional setting based on the proscription of putting any definite duration on labour contract, except for some cases explicitly scheduled by law (e.g., seasonal jobs). Employer is entitled to use fixed-term contract for technical and productive reasons and for substituting absent workers. In fact, the law does not provide any restriction about their use.

Although these two reforms introduce some flexibility in the Italian labour market, they only represent a timid step toward a complete change. By contrast, the 30/2003 represents the biggest reform in terms of impact on the labour market. It improves earlier short-term contracts and introduces new contractual forms to better meet the requirements of a changing labour market. After the reform, any worker can be hired on a temporary basis without the requirement of a specific cause. This implies that for any job, employers can *de facto* freely choose between a long-term or a short-term contract.