How Do Employment Contract Reforms Affect Welfare? Theory and Evidence*

Cristina Tealdi†

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Abstract

Short-term employment contracts have been deployed rapidly across the European Union (EU) in the past two decades. Characterized by a high degree of flexibility, they were thought to be the solution to persistent labor market rigidities and high unemployment rates. The objective of this paper is to investigate both theoretically and empirically the effects of introducing short-term employment contracts to the labor market, and to draw conclusions regarding the change in welfare for different categories of people. Data from the Italian labor market show that workers hired on a short-term basis are mostly young, female, inexperienced, less educated, and poorly qualified. Short-term contracts, which are associated with lower wages, often come in sequences. Labor force participation has increased in particular among older workers. Such changes in labor force composition and transition patterns can be explained by a search model with workers heterogeneity and differentiated contracts. In steady state, a pooling equilibrium of less and more productive workers exists, when only permanent contracts are available. In the presence of short-term contracts, a separating equilibrium allocates less and more productive workers towards different career paths. Through model calibration it is possible to quantify the change in welfare for different categories of workers. Moreover, within a multi-state duration framework, the model is estimated with the Heckman and Singer non-parametric maximum likelihood (NPMLE) estimation procedure. One of the major findings is that inexperienced workers are worse off after the reforms. However, after the accumulation of some work experience, they have the opportunity to compensate for their losses, if they are more productive. Less productive workers, even though provided with higher chances to work, are the ones paying the cost of higher turnover and lower wages.

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†Department of Economics, Northwestern University, 302 Arthur Andersen Hall, 2001 Sheridan Road, Evanston, IL 60208-2600, c-tealdi@northwestern.edu

1 Introduction

The recent economic downturn has caused a remarkable increase in unemployment rates both in North America and Europe. Throughout the recent economic history, high unemployment rates have been on the economic reform agenda of nearly all countries. In particular, young workers face considerably higher unemployment rates than prime-age workers. This has further increased the urgent need to identify solutions for boosting employment among this demographic group. The Bureau of Labor Statistics reported that "in US historically one out of every eight young workers was unemployed, a rate of unemployment more than two and a half times that of prime-age workers". In Europe the numbers are even more dramatic. Short-term employment contracts, characterized by flexible employment features, were thought to be the solution, and have been deployed rapidly in particular across the rigid EU economies. Featuring short duration, lower costs, and more straightforward hiring procedures, they are designated to be an agile instrument to increase labor market flexibility and, in turn, to reduce unemployment. In this respect, Italy represents an excellent case study because of the abrupt increase in the share of short-term contracts in the mid-nineties, followed by a sharp decrease in the unemployment rate, in particular among young workers.

The objective of this paper is to investigate both theoretically and empirically the effects of introducing short-term employment contracts to the labor market. The analysis of the changes in the labor force composition and the transition patterns is the basis for developing a search model, which captures these features and delivers conclusions regarding the income change for different typologies of workers.

In agreement with the findings of Tealdi [27], I use data from Bank of Italy and the National Social Security Institute to show that people hired short-term tend to be young, female, inexperienced, less educated, and poorly qualified. The data indicate the existence of a substantial wage premium for workers hired permanently, which is present even when differences in education level, gender, age, working sector, geographical location, and occupation are taken into account. I show that labor force participation and employment are higher for older workers after the reforms. However, lower unemployment rates among young workers come as a consequence of lower labor force participation.

Data alone are not sufficient to draw conclusions regarding the effects of introducing short-term employment contracts. They indeed draw a purely descriptive picture of the changes registered after the introduction of short-term contracts. In order to be able to provide welfare conclusions, I develop a model, which replicates the patterns found in the data. I extend a standard search model, in the spirit of Diamond [6], Mortensen [18], and Pissarides [21], allowing for workers' heterogeneity and differentiated contracts.

This model describes a pre-reforms economy, characterized solely by permanent contracts and no possibility of firing, and a post-reforms economy, featuring the availability of short-term contracts, that implies a higher degree of flexibility. In this set up, workers are heterogeneous with respect to productivity. The productivity level of the workers is not observed at the early stage of their working career, but rather at a later time, after the accumulation of some work experience. When the productivity is unobserved, the workers are *inexperienced*; once it is observed, the workers become *experienced*. In the pre-reforms

economy, the inability for firms to fire workers causes the creation of a pool of permanently employed, with both high level and low level of productivity. This pooling is reflected in the wage, which is a weighted average of the productivity of the two categories. In the post-reforms economy, given the availability of short, cheaper, and more flexible short-term contracts, young workers are hired temporarily, when they first join the labor force. At the expiration of the short-term contracts, only more productive workers will be upgraded to a permanent contract, receiving a higher wage. Less productive workers will have the chance to keep working short-term, alternating spells of unemployment and temporary work.

The model is able to replicate closely the changes regarding the Italian labor market composition. Performing the calibration of the model, I compute the income and the length of the working career among different groups of workers. All workers spend more time within the labor force. Moreover, I detect a substantial increase in wages and in income among more productive experienced workers. In contrast, inexperienced workers as well as less productive experienced workers are worse off in the post-reforms economy. In particular, less productive workers are the ones paying the cost of lower wages and higher turnover. Considering the entire working career of the individuals of both productivity levels, I find that after the reforms the present value lifetime income is lower for less productive workers, but higher for more productive workers.

There are several strands of literature related to this paper. This study is linked to papers, which empirically analyze short-term employment contracts and their impact on the labor market. In particular, the empirical literature on the topic[1] tends to focus on the way short-term contracts affect the transition patterns across contracts, the job and worker turnover, and the unemployment duration[2]. This paper complements the existing literature, providing a complete overview of the changes in the labor market since the mid-nineties, when short-term contracts were introduced. I describe in detail the characteristics of workers hired on a short-term basis and the evolution of labor force composition, transition patterns, and wages for different categories of workers.

From a theoretical point of view, this paper represents the first attempt to quantify the change in welfare due to the introduction of short-term contracts for different groups of workers. A number of papers develop models to study the effect of short-term contracts on the labor market and, in particular, on employment[3]. The model by Blanchard and Landier [16] is the one that most closely resembles the model described in this paper. The authors use a search model to investigate whether the introduction of short-term employment contracts, common mostly among young workers, reduced the welfare for workers of age 20-24 in France. I extend their set up considering the economy pre-reforms, when only permanent contracts are available, and post-reforms, when both permanent and short-term contracts are present. This allows me to illustrate the changes in workers' behavior, induced by the availability of

[1]Berton [3], Berton, Devicienti, Pacelli [5], Aguirregabiria and Alonso-Borrego [1], Giannelli, Jaenichen, Villosio [15].

[2]Other important contributions to be mentioned are Guell [8] and Guell and Petrongolo [9] for the case of Spain.

[3]Hopenhayn and Rogerson [13], Varejao and Portugal [22], Cao et al [25], Bentolila, Dolado et al. [24], Bentolila and Saint-Paul [2], Berton and Garibaldi [4], Postel-Vinay and Cahuc [23].

contracts with limited duration in the same economy. Moreover, I include the whole sample of workers (not only young), hence I am able to draw welfare conclusions across different age groups.

In terms of methodology, this paper closely follows the search and matching literature of Mortensen and Pissarides [19]. I extend the basic model to allow for heterogeneity on the side of the workers and differentiated contracts. With respect to productivity, I follow the approach used by Machin and Manning [17]. The authors introduce heterogeneity in terms of productivity across workers and jobs in a search model to explain the increased wage inequality in the US and UK. The authors show that the supply of more productive workers can lead to lower unemployment rate and higher wages among this category of workers. I use a similar framework to study how this result changes when short-term employment contracts are present. This allows me to compare the labor force composition, transition patterns, and wages before and after the reforms.

Finally, in terms of model estimation, this paper is also related to the literature on the estimation of multi-spells and multi-states duration models. As in Heckman and Walker [12] and Heckman, Hotz, and Walker [14], I estimate a multi-state model with unobserved heterogeneity, using the non parametric maximum likelihood estimator described in Heckman and Singer [10].

This paper is organized as follows: Section 2 provides an overview of the regulatory framework characterizing the Italian labor market in the last two decades. Section 3 describes the data sources and presents in detail the results of the empirical analysis of the data regarding changes in labor force composition, transitions, and wages. Section 4 describes the search model. Section 5 presents two approaches to test the model: estimation and calibration. According to the findings, I provide conclusions regarding the change in welfare for different categories of workers. The last section (Section 6) concludes the paper and discusses future research.

2 Changes in the Italian Labor Market Regulatory Framework[4]

Since 1995 many reforms have been approved in Italy with the specific intent of increasing labor market flexibility. To achieve this goal, short-term employment contracts have been introduced as a versatile instrument. Specifically, the objectives of the interventions, in accordance with the European guidelines, can be summarized in the following key points: increasing labor force participation, boosting employment, and reducing unemployment especially among young people. Indeed, in the nineties, the Italian labor market statistics regarding employment, unemployment, and labor force participation were much worse compared to other European countries. The labor force participation rate was one of the lowest in Europe, especially among women (44% compared to the average 54% among the EU

[4]See Tealdi [26] for an extensive description of these reforms.

countries[5]); young and long term unemployment rates were very high (31% and 70% respectively compared to the average 16% and 44% among the EU countries)[6]; the employment rate was quite low, particularly among women (36% compared to the average 49% among the EU countries[7]). The Italian government promptly implemented new reforms to help, in particular, the weakest groups of workers: women, young, unemployed, and low educated. Due to the nature of these contracts and due to the government subsidies, their costs were much lower compared to permanent contracts. These features would have allowed firms to manage their workforce in a more flexible way, according to specific needs, and would have reduced the cost burden pending on the employers, triggering a more competitive market.

In Italy short-term contracts were already present in the 60s, but they were underutilized until 1995, when for the first time some new forms of limited length contracts were independently regulated. Before 1995, only two types of quasi substitute short-term contracts were available: apprenticeship and CFL (Contract aiming at training workers). Together they were covering less than 10% of the total number of contracts. Their objective was dual. Not only they offered the opportunity of working, but they also included a remarkable amount of training on the job.[8] It is extremely important to clarify that for both types of contracts age was a strict requirement. Only young people qualified for this type of contract. The age threshold changed over time since their introduction, however individuals older than 34 years old could not be hired on any of the two short-term contracts.

Since 1995, gradually, many types of short-term contracts were regulated according to the specific needs of firms in different sectors and industries, in order to boost further their utilization. The key novelty was that age was not anymore listed among the eligibility criteria. The market responded positively to this set of reforms and the utilization of short-term contracts increased consistently over time. In particular the share of short-term employment raised from 7% in 1994 to over 13% in 2008[9]. The number of people hired short-term in 2003 was more than 20 times bigger than the number of people hired short-term in 1995[10]. Figure 1 shows the number of short-term contracts as a share of the total number of signed contracts.

In order to evaluate the effect of the recent changes in the Italian labor market, I focus on the overall effect of these reforms. In particular, I analyze the differences in the labor market before 1995 and after 2003. I describe the data and present the results in the following paragraphs.

[5]Average rate across 19 European countries. Year: 1990. Source: OECD.

[6]Average rate across 19 European countries. 15-24 years old cohort. Unemployment duration longer than 1 year. Year: 1990. Source: OECD.

[7]Average rate across 19 European countries. Year: 1990. Source: OECD.

[8]They differed in the length of the contract itself and in the training required. The apprenticeship contract was in general longer and demanded more training. Controls for training were much stricter for apprenticeship and were organized at both national and local levels.

[9]Source: OECD

[10]1004 individuals were hired short-term in 1995. 14505 individuals were hired short-term in 2003. Source: WHIP.

3 Descriptive Analysis

3.1 Data Sources

Our empirical analysis is based on two data sets offering complementary information.

The Survey on Household Income and Wealth (SHIW) [20] is a sample survey conducted by the Bank of Italy every two years. The data collection started in the sixties with the aim of gathering information on the incomes and savings of the Italian households. Today, SHIW is one of the most widely used sources of information on socio-demographic characteristics, labor force status, income, savings, and wealth of the Italian population. The sample used in the most recent surveys comprises about 8,000 households (24,000 individuals), distributed over approximately 300 Italian municipalities. The target population of SHIW consists of the Italian resident population.

Work Histories Italian Panel (WHIP) [7] is a database of individual work histories, based on the National Social Security Institute's administrative archives. The reference population consists of individuals, Italian and foreign, who have worked in Italy for the whole or only part of their working career. A large representative sample has been extracted from this population. Overall the sample consists of a dynamic population of about 700,000 people. For each of these individuals the main episodes of their working careers are observed. The complete list of observations includes information on working contracts, retirement spells, social benefits, and workers, jobs and firms characteristics. The data do not include information on public sector workers or freelancers (lawyers or notaries), who have an independent security fund. The period of observation spans from 1985 to 2004.

3.2 Data Description

Through the analysis of the data, I can analyze the changes in the labor market after the reforms regarding labor force composition, employment and unemployment rates, transitions across states, and wages.

In this section, I present the main patterns found in the data. I can summarize them in four categories: the investigation of the characteristics of the workers hired short-term; the analysis of the labor force composition; the evaluation of the wage difference across types of contracts; and the study of the transitions across states. Having a complete picture of the labor market changes in mind, I will be able to design a model, which is able to replicate the evidence found in the data.

3.2.1 Characteristics of the workers hired short-term

To investigate the characteristics of the workers hired short-term, I focus on age and gender of the workers, education level, and occupation. Table 1 shows that fixed term contracts are more common among young individuals. However, since 1995 the share of older people hired on a short-term basis has been consistently increasing (Figure 2). Gender is not an important feature to discriminate between short-term and permanent positions. In general,

less educated people are more likely to be hired on short-term contracts. Among other categories, surprisingly, the most likely to be hired short-term are the ones with a 3 year college degree (19%), followed by those with a post graduate degree (17%). Finally, I observe the distribution of contracts across occupation. Most of the consultants are temporary hired. Among others, blue collar workers and teachers are the categories of people more likely to be hired short-term, while white collar workers and managers are mostly hired permanently.

Controlling for these individual characteristics, I perform a probit regression. Table 2 shows the results. Female workers have approximately 6% higher chances to be hired short-term. By age groups, it appears that belonging to the 15- 24 year old age group strongly increases the likelihood of having a temporary job (+17%). Moreover, young people in their thirties[11] are more likely to be hired short-term; their chances are approximately 6% higher than older age groups. Both high level and low level of education play a significant role in explaining the probability to have a short-term job. Surprisingly having a five year bachelor degree raises the chance of being hired temporarily. In particular, the interaction effect of high education level (bachelor's degree) and young age (25-34 year old) is positive and significant. This confirms the findings of Barbieri and Scherer (2009). Managers as well as white collars and teachers have higher chances to be hired permanently compared to blue collar workers.

From this analysis I can conclude that people who are more likely to be hired short-term are females, young, and low qualified. They are in general poorly educated. However, I can also identify a group of more educated people belonging to the 25-34 year old age group who have a greater chance to be hired short-term.

3.2.2 Labor force composition

The second goal is to analyze the labor force composition and, in particular, the transitions of people between states (employment, unemployment, and out of the labor force). I perform the statistical analysis according to age groups to investigate the presence of cohort effects. The analysis is conducted over the period 1991-2006 by five age categories: 15-24 year old, 25-34 year old, 35-44 year old, 45-54 year old, and 55-64 year old. The graphs are shown in Figure 3.

The 15-24 year old age group is characterized by a gradual, but constant decrease in unemployment starting from 1997. Figure 3(a) suggests that the lower unemployment rate is explained only by the increasing flow of workers outside the labor force. The employment rate remains constant over time.[12].

The 25-34 year old and 35-44 year old age groups can be analyzed together because

[11] belonging to the 25-34 year old age group

[12] These movements can be due to the fact that over the last fifteen years education has become more and more valued and a larger number of young people attend college. This trend has been enhanced by the implementation of policies targeting the achievement of higher levels of education. One of this reforms increased the age for compulsory education to sixteen years old (previously fourteen). Another important legislation approved in 1999 introduced a new and shorter college degree, consisting of only three years of undergraduate classes (compared to the previous degree consisting of five years).

they show a similar trend. For both cohorts the employment to population ratio slightly increases. Unemployment is approximately constant and labor force participation slightly decreases, but these movements are not very pronounced[13](see Figure 3(b) and 3(c)).

Among the 45-54 year old age group, employment and labor force participation grow significantly (by more than 10%) after 1997, while unemployment is approximately constant (see Figure 3(d)). The patterns among the 55-64 year old age group appear similar but delayed[14] (Figure 3(e)). Therefore, I detect among these two cohorts a significant flow of individuals moving from out of the labor force directly into employment.

In summary, it appears that the age group showing more dynamics is the 45-54 year old age group. Even though the unemployment to population ratio does not show a negative trend, many individuals, who were previously (before 1995), either not working or looking for jobs, are employed after 1995. This investigation becomes more interesting when I identify the people who were outside the labor force before and after the reforms.

In 1995 more than two thirds of the individuals out of the labor force belonging to the 45-54 year old age group were female homemakers. This percentage is significantly lower in 2006. In order to identify any trend among females, I need to isolate it from the trend of increased female labor force participation across Europe in the last two decades. Looking at Figure 4, I can notice that an increasing trend was present since the end of the seventies, but after 1997 the fraction of females in the labor force grows clearly at a faster rate. Focusing on the labor force participation for females older than 45, I can recognize a similar and even more pronounced pattern.

3.2.3 Wages across types of contracts

The third objective of this section is to analyze how wages differ across types of contracts. Data show that workers hired short-term tend to have lower income[15]. Figure 5 shows the distribution of annual income across contracts types. Short-term contracts offer much lower income compared to permanent contracts. This result captures at the same time the fact that a short-term employee may not work for the entire year and that her income is lower compared to a permanent employee. Moreover, this evidence can be attributed to specific individual characteristics, as described in section 3.2.1. Breaking down the distribution of income across contracts by cohort (Figure 6), I can notice that across all age groups workers tend to face on average lower income if they are hired on short-term contracts compared to permanent contracts. The distribution of income is wider for older cohorts, but the short-term negative effects on income is persistent.

[13]around 5%.

[14]A pension reform in 1992 extended the pension age from 55 to 60 for women and from 60 to 65 for men. Another reform in 1995 changed the way pensions are calculated, moving from salary-based to contribution-based payments. Moreover it allowed retirement at 57 if welfare contributions have been paid for at least 35 years. Later reforms changed the retirement age for both women and men, but they became affective only in 2008.

[15]For some specific types of short-term contracts, the law requires workers to be paid as much as workers hired permanently, given the same work responsibilities. However, in general, there are no regulations regarding wages for other types of short-term contracts.

To test for the presence of a wage premium for working permanently, I perform an OLS regression. I consider as regressors some characteristics of the workers, the employers, and the jobs.

As expected, being hired on a permanent position rather than a short-term position significantly increases the earnings received by the worker. There is a premium for working permanently which is strongly significant even when controlling for individual and job characteristics. Consequently, this premium can only be explained by some unobservable factors.

3.2.4 Transitions across contracts

The objective of this section is to analyze the transitions across contracts. I focus on three states: non-employment[16], short-term employment and permanent employment. I investigate how these transitions changed over time, before and after the labor market reforms.

I consider the pool of workers hired short-term in January 1995, January 2000 and January 2003. Table 4 shows how the transitions from and to short-term contracts have significantly changed. Approximately 30% of workers hired on a short-term basis in 1995 were at their first job experience, approximately 50% were coming from a situation of non-employment and only 8% were transiting from another short-term contract. However, the patterns are very different in 2000 and 2003. The percentages of workers at their first job experience in 2000 and 2003 were respectively 4% and 3%. Approximately 7% of the workers both in 2000 and 2003 were coming from non-employment condition. However, and most importantly approximately 85% of workers in the beginning of the new century were transiting from another short-term contract.

Afterwards, at expiration of the first job experience on a short-term contract approximately 30% of the workers would move to another short-term contract in 1995, but this percentage is up to approximately 50% in 2000 and 2003. The chance for workers to experience either a non-employment condition or another short-term contract after the first experience on a short-term contract since 2000 is approximately 90% . The likelihood to transit to a permanent position is down from 25% in 1995 to approximately 10% after 2000. Among the individuals with previous working experience, the chance to move to a permanent position is unchanged. However, before the reforms 50% of the workers would move to a non-employment condition and 30% to a new short-term contract. Those percentages are reversed after the reforms: 30% of the workers would move to a non-employment condition and 50% to a new short-term contract after 2000.

In summary, from 1995 to 2003 I identify an important and significant change in the transition patterns across types of contracts. After the reforms, sequences of short-term contracts as well as cycles of short-term employment and non-employment became extremely common. This is true particularly among workers who have no or little job experience. Among more experienced workers the probability to transit to a permanent job does not

[16]In the data I do not observe whether the workers are unemployed or out of the labor force when they are not working.

change over time, but the chances to be employed (even though for a limited amount of time) are much higher.

4 The Search Model

After collecting the empirical evidence, I proceed to model workers behaviour. From the data description, I was able to infer that workers hired short-term are mostly young, poorly qualified, and poorly educated. Sequences of short-term contracts became very common and the associated wages are much lower compared to wages associated to permanent contracts. Moreover, the labor force participation rate has increased significantly among older workers, even after taking into account the increased female labor force participation trend. Having this picture in mind, the objective is to design a model which is able to explain the changes in labor force composition and transition patterns, as found in the data. The estimation of the model will help drawing conclusions regarding the change in welfare for different categories of workers and it will help inferring predictions for the future. I adapt the standard Mortensen-Pissarides search model to the environment described above, introducing workers heterogeneity and allowing for differentiated contracts. I describe the model before the reforms, when only permanent contracts are available, and after the reforms, when both permanent and short-term contracts are available. Workers are in one of the three states: out of the labor force, unemployed, or permanently employed.

4.1 The Set up

In the economy there is a population of measure 1. Every instant a measure k of individuals are born. They are *inexperienced* and they are out of the labor force. At rate m, which is the parameter of a Poisson arrival process, they join the labor force as unemployed and start looking for jobs. There are two types of workers defined by their productivity level, $h - type$, with high level of productivity, and $l - type$, with low level of productivity. The share of $h - type$ workers is equal to p. The productivity of the workers is not revealed, hence firms are not able to discriminate. For both types, the productivity level is the entry level productivity y_0. When they are hit by a productivity shock at rate $\lambda > 0$, their productivity level may change. If they are $h - type$, their productivity level jumps up to y, with $y > y_0$. If they are $l - type$, their productivity level is unchanged and equal to y_0. When the shock hits, they become *experienced*. In this instant the productivity of the worker is common knowledge. When the worker is *experienced* she may retire at a rate s and, after joining the out of the labor force state, she may die at rate d. I define b as the value of the unemployment benefits[17].

Firms hire both *inexperienced* and *experienced* workers. I assume that the waiting time until a shock hits the worker-firm match is distributed exponentially. Hence the probability that the shock is realized is just the density of the distribution and the parameter of the

[17]The eligibility criteria for unemployment benefits are quite strict and explicitly require continuos work experience.

distribution is the rate at which the shock takes place. Firms without workers post vacancies at a cost of c and they fill them with probability α, which is the parameter of a Poisson arrival process. In equilibrium, job creation is governed by profit maximization by taking into account expected revenue and cost of a new match. Negative shocks arrive to existing matches at the Poisson rate δ. When this happens the productivity of the job is reduced to zero and hence the match is dissolved.

Firms and workers come together via a matching function $M(u, v)$ where u is the rate of unemployment and v is the vacancy rate. This function is twice differentiable and increasing in its arguments. It exhibits constant returns to scale. The flow of matches for a vacancy can be defined as $M(u, v)/v = \alpha(\theta)$ which is a differentiable decreasing function, where θ is the tightness of the labor market defined by v/u. The flow of matches for an unemployed worker can be defined as $M(u, v)/u = \mu(\theta)$, which is an increasing function[18]. All realized job matches yield a surplus. If the worker and the firm separate, each part will have to go through a costly search process in order to meet its next partner. The surplus of the match is shared between the parities. Here, I assume that the surplus is divided in fixed proportions between the firm and the worker, through an asymmetric Nash Bargaining process, where β represents the worker's share. So, workers and firms bargain the specific wage for each type of contracts and for each type of workers before the beginning of the match and this wage changes only when the conditions of the contracts are altered.

Notationally speaking, I'm going to use X_Y and X_O for any variable X referring respectively to *inexperienced* (Young) and *experienced* (Old) workers.

4.2 The Benchmark Model

In this set up, only permanent contracts are available and firing is not allowed. The mechanism works in this simple way: a firm looking for a worker posts a vacancy; when it decides to hire a worker, it offers her a permanent contract. When the firm hires an *inexperienced* worker, the firm doesn't know whether the worker is $h-type$ or $l-type$[19]. The productivity of the worker is the entry level productivity y_0. Suppose that a worker's type is revealed at rate λ. The worker becomes *experienced*. Independently on the worker's type, the firm keeps her within the workforce since firing is not allowed. In equilibrium the wage is going to be a function of the proportion of $h - type$ and $l - type$ employed workers. At rate δ the match may be destroyed and at rate s^p[20] the worker may retire. In which case, the firm opens a new vacancy.

[18] Standard Inada conditions apply.

[19] In this scenario information is perfect. Further extensions of the model could include asymmetric information and signaling.

[20] The subscript p denotes the permanent feature of the contract.

4.2.1 The Firm's Problem

There are two types of vacancies: for *experienced* and for *inexperienced* workers. When the firm posts a vacancy, the Bellmann equations for the firm are:

$$\begin{aligned} rJ_Y^V &= -c_y^p + \alpha_y^p[J_Y^E - J_Y^V] \\ rJ_O^V &= -c_o^p + \alpha_o^p[(pJ_O^{EH} + (1-p)J_O^{EL}) - J_O^V] \end{aligned}$$

In the first equation it is easy to see that whenever the firm opens a vacancy for *inexperienced*workers it has to pay a cost c_y^p. The vacancy is filled at rate α_y^p and α_o^p respectively with the permanent hiring of a *inexperienced* or an *experienced* worker. The parities bargain the current wage and the wage they will earn when they will become *experienced*.

When the vacancy is filled with *inexperienced* or *experienced*, $h-type$ and $l-type$ workers, the firm Bellman equations are respectively:

$$\begin{aligned} rJ_Y^E &= y_0 - w_y - \tau_y^p + \lambda[p(J_O^{EH} - J_Y^E) + (1-p)(J_O^{EL} - J_Y^E)] + \delta(J_Y^V - J_Y^E) \\ rJ_O^{EH} &= y - w_o - \tau_o^p + \delta(J_O^V - J_O^{EH}) + s^p(J_O^V - J_O^{EH}) \\ rJ_O^{EL} &= y_0 - w_o - \tau_o^p + \delta(J_O^V - J_O^{EL}) + s^p(J_O^V - J_O^{EL}) \end{aligned}$$

When the *inexperienced* worker is hired, her productivity is the entry level productivity y_0 and the firm pays her a wage w_y. Moreover the firm has to pay welfare contributions equal to τ_y^p if the worker in *inexperienced* and τ_o^p if the worker in *experienced*. At rate λ the firm learns whether the worker is $h-type$, with productivity level $y > y_0$, or $l-type$ with unchanged productivity level. In both cases, the firm is forced to keep the worker since firing is not allowed. At rate δ the match is destroyed and the firm opens a new vacancy. When the worker is *experienced* she may retire at rate s^p and the firm opens a new vacancy.

4.2.2 The Worker's Problem

I can define the value of being unemployed for *inexperienced* and *experienced* workers as

$$\begin{aligned} rW_Y^{UH} &= \mu_y[W_Y^{EH} - W_Y^{UH}] \\ rW_Y^{UL} &= \mu_y[W_Y^{EL} - W_Y^{UL}] \\ rW_O^{UH} &= b + \mu_o[W_O^{EH} - W_O^{UH}] \\ rW_O^{UL} &= b + \mu_o[W_O^{EL} - W_O^{UL}] \end{aligned}$$

Experienced workers of different productivity levels are eligible for unemployment benefits b and they have the chance to be rehired after their match is dissolved. Indeed firms do not know their productivity level and they are not able to tell them apart by looking at

their working histories. The rate at which a worker finds a job is respectively μ_y and μ_o, for *inexperienced* and *experienced* workers.

The value of being employed for *inexperienced* and *experienced* workers of both types is

$$\begin{aligned} rW_Y^{EH} &= w_y + \lambda[W_O^{EH} - W_Y^{EH}] + \delta[\max\{W_Y^{UH}, W_Y^{OLF}\} - W_Y^{EH}] \\ rW_Y^{EL} &= w_y + \lambda[W_O^{EL} - W_Y^{EL}] + \delta[\max\{W_Y^{UL}, W_Y^{OLF}\} - W_Y^{EL}] \\ rW_O^{EH} &= w_o + \delta[\max\{W_O^{UH}, W_O^{OLF}\} - W_O^{EH}] + s^p[W_O^{OLF} - W_O^{EH}] \\ rW_O^{EL} &= w_o + \delta[\max\{W_O^{UL}, W_O^{OLF}\} - W_O^{EL}] + s^p[W_O^{OLF} - W_O^{EL}] \end{aligned}$$

where

$$\begin{aligned} rW_Y^{OLF} &= 0 \\ (r+d)W_O^{OLF} &= \pi \end{aligned}$$

Inexperienced workers get a salary equal to w_y. Their productivity is revealed to the firm at rate λ: with probability p the workers are $h - type$ and with probability $(1-p)$ the workers are $l - type$. At rate δ the match is destroyed: the worker can decide whether to exit the labor force or to join the unemployment pool. Since being *inexperienced* and unemployed gives her some chances to find a job, while the utility of being out of the labor force is zero, she chooses the latter. There are two ways an *experienced* employed worker can lose her job: if the match is destroyed at rate δ or if she retires at rate s^p. After retiring, the worker joins the out labor force pool where she may die at rate d. While out of the labor force she is eligible for a pension π. If the match gets destroyed when the worker is *experienced*, the worker can decide whether to join the unemployment pool, from which she can exit, filling a vacancy for *experienced* workers, at rate μ_o, or whether to retire. The former gives a positive utility b and the chance to be hired again, hence it is optimal for her to join the unemployment pool.

4.2.3 Wage Determination and Equilibrium Conditions

Solving the problem above from the point of view of the firms and the workers, I obtain the equilibrium equations[21]. I can use these expressions to compute the values for wages received by *inexperienced* and *experienced* workers. I assume that the wages are determined using a Nash Bilateral Bargaining mechanism and I define β as the fraction of surplus enjoyed by the workers.

In this economy there are two wage levels: one for *inexperienced* workers and one for *experienced* workers. Workers and firms decide upon the current and future wage levels when they first meet and the permanent contract is signed. Firms are willing to pay to the

[21] See Appendix for details.

workers, once they get *experienced*, the weighted average of the productivity of $h-type$ and $l-type$ workers. The weights are given by the proportion of workers belonging to each type. Indeed, when the firms sign the contract, they do not observe the workers' productivity and they are aware that firing is not allowed.

The sharing rules for the determination of the wage per each workers' category are described by the following equations:

$$\begin{aligned} \beta[J_Y^E - J_Y^V] &= (1-\beta)[p(W_Y^{EH} - W_Y^{UH}) + (1-p)(W_Y^{EL} - W_Y^{UL})] \\ \beta[p(J_O^{EH} - J_O^V) &+ (1-p)(J_O^{EL} - J_O^V)] \\ &= (1-\beta)[p(W_O^{EH} - W_O^{UH}) + (1-p)(W_O^{EL} - W_O^{UL})] \end{aligned}$$

The free entry conditions imply that on both markets (for *experienced* and *inexperienced* workers) the values of the vacancies are equal to zero. Maximizing the total surplus, I compute the wage setting condition for *experienced* workers and *inexperienced* workers. Rearranging and plugging in the expressions for each value function, I can write the wages as functions of the parameters of the model. I define θ as the tightness of the market per each segment[22].

$$\begin{aligned} w_o &= \beta[py + (1-p)y_0 - \tau_o^p] + \left(\frac{r+s^p}{r}\right)((1-\beta)b + \beta c_o^p \theta_o^p) \\ &+ (1-\beta)[s^p]\left(\frac{u}{r+d}\right) \\ w_y &= \beta[y_0 - \tau_y^p] + \frac{(r+\lambda)}{r}\beta c_y^p \theta_y^p - \frac{\lambda}{r}((1-\beta)b + \beta c_o^p \theta_o^p) \end{aligned}$$

In steady state, the measure of newborns is equal to the measure of people who die. Moreover, the share of *inexperienced* and *experienced* people is constant over time.

4.3 The Model with Short-term Contracts

The model with short-term contracts differs from the benchmark model in the opportunity for firms to hire workers either short-term or permanently. The main feature of the new contracts is the establishment of the duration when the contract is stipulated. When the firms open a vacancy for *inexperienced* workers, they can decide whether to offer a permanent or a short-term contract. Short-term contracts are characterized by a more flexible structure: they allow the firms to pay no firing costs at expiration, they are cheaper in terms of social security and welfare fees, and they are associated with a more straightforward bureaucratic process. However, in general, sequences of short-term contracts are not allowed. Whenever

[22] $\theta_o^p = \frac{\mu_o}{\alpha_o^p}$ and $\theta_y^p = \frac{\mu_y}{\alpha_y^p}$.

the short-term contract expires, at rate t, firms have to decide whether to hire the workers permanently or whether to keep them short-term and re-bargain their wage. Permanent contracts are always offered to *experienced* workers, who turn out to be more more productive $(h - type)$.

4.3.1 The Firm's Problem

Keeping the same definitions of the parameters as described in section 4.1, I compute the Bellmann equations for the firm.

In case the firms have a vacancy:

$$\begin{aligned} rJ_Y^V &= \max\{-c_{2y}^s + \alpha_{2y}^s[J_Y^{ES} - J_Y^V], -c_{2y}^p + \alpha_{2y}^p[J_Y^{EP} - J_Y^V]\} \\ rJ_O^{VH} &= \max\{-c_{2o}^s + \alpha_{2o}^s[J_Y^{ESH} - J_O^{VH}], -c_{2o}^p + \alpha_{2o}^p[J_O^{EPH} - J_O^{VH}] \\ rJ_O^{VL} &= \max\{-c_{2o}^s + \alpha_{2o}^s[J_O^{ESL} - J_O^{VL}], -c_{2o}^p + \alpha_{2o}^p[J_O^{EPL} - J_O^{VL}]\} \end{aligned}$$

Firms decide whether to offer a short-term or a permanent contract when they open a vacancy for *inexperienced* workers or less productive workers. In case they have a vacancy for more productive workers, they offer a permanent position. In the first equation it is easy to see that whenever a firm opens a vacancy it has to pay a cost. If the opening position offers a contract to an *inexperienced* worker the cost is c_{2y}^s[23], if the contract is short-term, or c_{2y}^p[24] if the contract is permanent. If the vacancy offers a contract to an *experienced* worker the cost is c_{2o}^p[25], if the contract is short-term, or c_{2o}^p if the contract is permanent. In both situations, $c_{2y}^s > c_{2y}^s$ and $c_{2o}^p > c_{2o}^s$[26]. The vacancies offering a short-term contract to *inexperienced* and *experienced* workers are filled respectively at rate α_{2y}^s and at rate α_{2o}^s. The rates at which vacancies offering permanent contracts are filled are α_{2y}^p and α_{2o}^p respectively for *inexperienced* and *experienced* workers.

In case the firms have filled positions:

$$\begin{aligned} rJ_Y^{EP} &= y_0 - w_y - \tau_y^p + \lambda[p(J_O^{EPH} - J_Y^{EP}) + (1-p)(J_O^{EPL} - J_Y^{EP})] \\ &+ \delta[J_Y^V - J_Y^{EP}] \\ rJ_Y^{ES} &= y_0 - w_y - \tau_y^s + \lambda[p(\max\{J_O^{EPH}, J_O^{ESH}\} - J_Y^{ES}) \\ &+ (1-p)(\max\{J_O^{EPL}, J_O^{ESL}\} - J_Y^{ES})] + \delta[J_Y^V - J_Y^{ES}] \\ &+ t[J_Y^V - J_Y^{ES}] \\ rJ_O^{EPH} &= y - w_o^h - \tau_o^p + (\delta + s^p)[J_O^{VH} - J_O^{EH}] \\ rJ_O^{EPL} &= y_0 - w_o^l - \tau_o^p + (\delta + s^p)[J_O^{VL} - J_O^{EL}] \\ rJ_O^{ESL} &= y_0 - w_o^l - \tau_o^s + (\delta + t + s^s)[J_O^{VL} - J_O^{EL}] \end{aligned}$$

[23]The superscript s refers to short term contracts, while the subscript y refers to *inexperienced*(young).

[24]The superscript p refers to permanent contracts.

[25]The subscript o refers to *experienced*(old).

[26]The cost of opening a vacancy is always higher for permanent positions compared to short-term positions.

Inexperienced workers have a productivity level equal to y_0 and they get paid w_y. Moreover the firm has to pay social security fees τ_y^p, if the worker is hired permanently, or τ_y^s, if the worker is hired short-term. If a disruptive shock δ hits the match, the firm opens a new vacancy. At rate λ the worker's productivity is observed and she becomes *experienced*. If the worker is hired short-term and she turns out to be less productive, the firm decides whether to hire her permanently or on a short-term basis.

Experienced workers have a productivity level equal to y. The firms pay them a salary equal to w_o and cover the social security and welfare cost τ_o. Whenever the workers retire or the match is hit by a disruptive shock or the short-term contract terminates, the firms open a new vacancy.

In equilibrium it is more profitable for the firms to offer short-term contracts to *inexperienced* workers because of the lower associated costs and the possibility of firing at no cost at expiration of the contract. Moreover it is more profitable to offer short-term contracts to less productive workers when their productivity is observed.

4.3.2 The Worker's problem

I can define the value of being unemployed for *inexperienced* and *experienced* workers as

$$\begin{aligned} rW_Y^{UH} &= \mu_{2y}(W_Y^{EH} - W_Y^{UH}) \\ rW_Y^{UL} &= \mu_{2y}(W_Y^{EL} - W_Y^{UL}) \\ rW_O^{UH} &= b_h + \mu_{2o}^h(W_O^{EH} - W_O^{UH}) \\ rW_O^{UL} &= b_l + \mu_{2o}^l(W_O^{EL} - W_O^{UL}) \end{aligned}$$

Whenever an *inexperienced* worker is unemployed, she is not eligible for unemployment benefits and she finds a job at rate μ_{2y}. *Experienced* $h-$*type* workers have higher opportunity costs since they are eligible for unemployment benefits b_h and their chance to find a job is μ_{2o}^h. *Experienced* $l-$*type* workers are eligible for lower unemployment benefits b_l since they do not have a continuous working history ($b_h > b_l$). For simplicity, I normalize b_l=0. However, less productive workers are not exiting the labor force if hit by a disruptive shock. At rate μ_{2o}^l they can find a new short-term job. Hence, they spend their life going through cycles of unemployment and short-term employment until they exit the labor force (discouraged) at rate s[27].

The values of being employed for *inexperienced* and *experienced* workers are

$$\begin{aligned} rW_Y^{EH} &= w_y + \lambda[W_O^{EH} - W_Y^{EH}] + t[W_Y^{UH} - W_Y^{EH}] + \delta[W_Y^{UH} - W_Y^{EH}] \\ rW_Y^{EL} &= w_y + \lambda[W_O^{EL} - W_Y^{EL}] + t[W_Y^{UL} - W_Y^{EL}] + \delta[W_Y^{UL} - W_Y^{EL}] \\ rW_O^{EH} &= w_o^h + \delta[W_O^{UH} - W_O^{EH}] + s^p[W_O^{OLF} - W_O^{EH}] \\ rW_O^{EL} &= w_o^l + \delta[W_O^{UL} - W_O^{EL}] + t[W_O^{UL} - W_O^{EL}] + s^s[W_O^{OLF} - W_O^{EL}] \end{aligned}$$

[27] s refers to short-term contract.

where

$$\begin{aligned} rW_Y^{OLF} &= 0 \\ (r+d)W_O^{OLF} &= u \end{aligned}$$

Inexperienced workers are always offered short-term contracts, since it is more profitable for the firms. When an *inexperienced* worker is hired, her productivity is the entry level productivity y_0 and the firm pays her a wage w_y. At rate λ the firm gets to know the worker's type. When the productivity of the worker is revealed she becomes *experienced*. If she turns out to be $h-type$, at expiration the firm offers her a permanent contract and the two parities re-bargain the wage. If at expiration she turns out to be $l-type$, the firm decides whether to offer a permanent or a short-term contract. When $l-type$ workers lose their jobs, they are not out of the labor force as in the previous set up. Indeed, they have the chance to be hired again at rate μ_o^l on short-term contracts. If the short-term contract expires before the productivity of the worker is revealed, the firm can not keep the worker and opens a new vacancy for *inexperienced* workers. At rate δ matches are destroyed and firms open new vacancies. When workers of both types are *experienced*, they may exit the labor force at rate s^p and s^s if they are hired permanently or short-term respectively[28] and the firms open new vacancies. Once workers exit the labor force, they may die at rate d.

In this framework, there is no more pooling between $h-type$ and $l-type$ workers and they do not compete for the same types of contracts. Each of the two categories, when *experienced*, targets a specific segment of the market and each type bargains independently its own wage.

4.3.3 Wage Determination and Equilibrium Conditions

Solving the problem above for workers and firms, I get the equilibrium system of equations[29]. I can solve for the wage levels received by *inexperienced* and *experienced* workers. I assume that the wage is determined using a Nash Bilateral Bargaining mechanism and I define β to be the fraction of the surplus enjoyed by the workers.

In this economy there are three wage levels, one for each type of worker: *inexperienced* and *experienced*, $h-type$ and $l-type$.

The following sharing rules apply to the specific categories:

$$\begin{aligned} \beta[J_O^{EPH} - J_O^{VH}] &= (1-\beta)[W_O^{EH} - W_O^{UH}] \\ \beta[J_O^{ESL} - J_O^{VL}] &= (1-\beta)[W_O^{EL} - W_O^{UL}] \\ \beta[J_Y^{ES} - J_Y^{V}] &= (1-\beta)[p(W_Y^{EH} - W_Y^{UH}) + (1-p)(W_Y^{EL} - W_Y^{UL})] \end{aligned}$$

[28] I expect that $s^s > s^p$ since workers hired short-term can exit the labor force either because they want to retire or because they are discouraged.

[29] See Appendix for details.

The free entry conditions imply that the value of the vacancies for each segment of the market is equal to zero. Solving for the equilibrium wages, I get the wage setting condition for each type of worker. Rearranging and plugging in the corresponding expressions per each value function, I obtain the wage levels for the three categories of workers as functions of the parameters of the model. I define θ as the tightness of the market per each specific segment[30].

$$\begin{aligned}
w_o^h &= \beta[y-\tau_o^p] + \frac{(r+s^p)}{r}((1-\beta)b_h + \beta c_{2o}^p \theta_{2o}^p) - (1-\beta)s^p\left(\frac{u}{r+d}\right) \\
w_o^l &= \beta[y_0-\tau_o^s] + \frac{(r+s^s)}{r}(\beta c_{2o}^s \theta_{2o}^s) - (1-\beta)s^s\left(\frac{u}{r+d}\right) \\
w_y &= \beta[y_0-\tau_y^s] + \beta\frac{(r+\lambda)}{r}c_{2y}^s\theta_{2y}^s - \frac{\lambda}{r}\Big[p((1-\beta)b_h + \beta c_{2o}^p\theta_{2o}^p) \\
&+ (1-\beta)(1-p)(c_{2o}^s\theta_{2o}^s)\Big]
\end{aligned}$$

5 Model Testing

Solving the two models described in sections 4.2 and 4.3, I can compute the equilibrium employment, unemployment, and labor force participation rates for *inexperienced* and *experienced* workers as functions of the parameters of the models. Using these expressions, I can assign values to the parameters in order to match the rates found in the data. The objective is to compute the average lifetime income for an individual from the beginning of her working career until her retirement, before and after the reforms. There are two approaches I can follow to reach this goal. I can estimate the parameters of the model or I can calibrate them. In the following section I will illustrate advantages and disadvantages of both approaches. Some welfare conclusions will be inferred based on the findings.

5.1 Estimation

5.1.1 The statistical model

Models with survival data characterized by multiple types of failures or events are referred as *competing risk models*. Since this paper deals with more general event history data, inferred by observing individuals over time and containing information on the times of occurrence of certain events and the types of events that occur, I consider a further extension of the competing risk model, the multi-state model. In the latter, the various events are considered as transitions from one state to another and a state structure specifies the diverse states (absorbing or transient) and defines the possible future transitions. Each individual may experience a certain number of events over time, i.e. go through the possibly recurrent states, with transition times being arbitrary and measured on a continuous timescale.

[30] $\theta_{2o}^p = \frac{\mu_{2o}^h}{\alpha_{2o}^p}$, $\theta_{2o}^s = \frac{\mu_{2o}^l}{\alpha_{2o}^s}$, $\theta_{2y}^s = \frac{\mu_{2y}}{\alpha_{2y}^s}$

The main features I am interested in are:

- Flexible modelling of baseline transition intensities,
- Inclusion time-varying covariate effects,
- Inclusion of frailty terms (i.e. subject specific random effects) to account for unobserved heterogeneity.

In particular, the latter represents a key point in the estimation for two reasons. First, not accounting for unobserved heterogeneity can cause the estimates to be biased, and, second, I do not observe in the data any variables describing the productivity of the workers. This is a key element in the model, and consequently I need to account for it in the estimation introducing an unobserved heterogeneity component. Specifically, I estimate this model following an approach based on the nonparametric maximum likelihood (NPMLE) estimation procedure described in Heckman and Singer [10]. This procedure approximates any distribution function of unobservable with a finite mixture distribution. The approximation is constructed to maximize sample likelihood. Using the notation of Heckman and Singer [11], I assume that an individual working history evolves in the following way. The process starts at calendar time $t = 0$. I define a finite state continuous time process $\{Y(t), T > 0\}, Y(t) \in \bar{N}$, where the set of possible states is finite ($\bar{N} = 0, 1, ..., C; C < \infty$). Let $R = k$, $k \in \bar{N}$, denote the value assumed by $Y(t)$ at the kth transition time. Transitions occur at or after $t = 0$. In this notation, $Y(t)$ records the individual's state at time t. An individual begins her working career at time zero, $Y(t) = R = 0$, and waits there a random length of time. The multi state hazard rate for the transition from state i to state j takes the form

$$h_{ij}(t_{ij} \mid \mathbf{x}'\boldsymbol{\beta}_{\mathbf{ij}}, c_{ij}\theta)$$

where i denotes the origin state and j denotes the destination state, t_{ij} is the duration in state i which exits in state j, $\mathbf{x}$ is a vector of observed variables (possibly time varying), $\boldsymbol{\beta}_{\mathbf{ij}}$ is a vector of associated coefficients, θ is a scalar unobservable, and c_{ij} is a transition specific factor loading. Specifying the functional form for the hazard, it is possible to estimate the parameters of the hazard as well as the population distribution of the unobservables.

A general multi state computer program, CTM, applicable to multi state competing risks models is used to estimate the model. The program specifies the conditional hazard function for the transition from state i to state j in the following way:

$$h_{ij}(t_{ij} \mid \mathbf{x}'\boldsymbol{\beta}_{\mathbf{ij}}, c_{ij}\theta) = \exp\left(\gamma_{0ij} + \sum_{k=1}^{K} \gamma_{kij}(t_{ij}^{\lambda_{ijk}} - 1)/\lambda_{kij} + \mathbf{x}'\boldsymbol{\beta}_{\mathbf{ij}} + c_{ij}\theta\right)$$

Two features of this program are particularly suitable for the type of estimation I want to perform. First, it accommodates general forms of duration dependence as special cases of the previous equation. In particular, setting $\beta_{ij} = 0$, $c_{ij} = 0$, $\lambda_{1ij} = 0$ and $\gamma_{2ij} = 0$ specializes to

a conventional Weibull hazard, to a Gompertz hazard if $\lambda_{1ij} = 1$ and $\gamma_{2ij} = 0$, to a quadratic hazard if $\lambda_{1ij} = 1$ and $\lambda_{2ij} = 2$, and to an exponential hazard if $\gamma_{1ij} = \gamma_{2ij} = 0$. Allowing $\beta_{ij} \neq 0$ and $c_{ij} \neq 0$ generalizes classical duration models to accommodate for general time varying regressors and unobservables. Moreover, the mixing distribution of the unobserved heterogeneity component θ can be estimated as a normal, log-normal, log-gamma or by any extensions of the Heckman and Singer [10] non parametric maximum likelihood estimator.

5.1.2 Identification

To estimate the model I use the WHIP database. This data set provides an excellent source of information. Indeed, the entire working history of a relevant sample of the population is observed.

In the model, workers are not homogenous: there are more productive ($h - type$) less productive ($l - type$), *inexperienced*, and *experienced* workers, who have different chances to be hired and fired. In order to estimate the parameters, which are specific to each type, I need to be able to differentiate these four groups of workers. Unfortunately, the data do not provide enough information to characterize each productive category.

To identify whether the workers are *experienced* or *inexperienced*, I can use both age and experience of the workers. In particular, I observe the entire working history of each individual and as such I can compute the total accumulated working experience up to date. However, I can not identify the productivity level of the workers. To solve this issue, I am going to control for unobserved heterogeneity using the Heckman and Singer non parametric maximum likelihood estimator. In particular, accounting for unobserved heterogeneity per each specific transition, I will capture how heterogeneity with respect to productivity affects the hazard rates across states.

In terms of individual characteristics, the data set I am using provides me with information regarding the gender and the age of the individuals.

In the pre-reforms economy only permanent contracts are available. In the data a small percentage of workers is hired on a short-term basis before 1995 due to the pre-existence of two types of short-term contracts. I exclude those individuals from the data set. In the post- reforms economy, it is more profitable for firms to hire *inexperienced* workers on a short-term basis, and hence I do not consider observations where workers are hired directly on a permanent basis when they first join the labor force.

A disadvantage of the data set is that I do not observe the status of the workers when they are not employed. They may be either unemployed or out of the labor force, but I can not tell these two categories apart. Hence, the parameters I estimate will include the rate at which different types of workers enter and exit the employment state. The future availability of a more complete data set[31] will enrich and improve the estimation.

[31] Such as *Veneto Worker Histories*, which includes employer employee matched data regarding the region of Veneto in Italy and which will be provided by Giuseppe Tattara.

5.1.3 The empirical results

I account for five types of transitions across four states. In particular, I consider unemployment and employment, each of them for *experienced* and *inexperienced* workers. I analyze the transitions back and forth from unemployment to employment for both types of workers and an extra transition from employment while *inexperienced* to employment while *experienced*. In the first estimation, I consider an exponential hazard model accounting for non-parametric transition-specific heterogeneity.

In Table 5 and Table 6, Panel A reports empirical estimates of the transition parameters before the reforms; panel B reports the estimates in the post-reforms. All the numbers defining the transitions rates are significant. Table 5 reports estimates when no individual characteristics are taken into account; Table 6 accounts for age and gender of the workers. The most important finding is that after the reforms the worker turnover is much higher. Among all transitions (unemployment to employment and employment to unemployment) and across both specification, the estimations show a significant increase in the transition rates in the post-reforms economy. Only the hazard rate regarding the transition from *inexperienced* employment to *experienced* employment does not change as a consequence of the reforms. Age and gender do not show a clear pattern. It seems that males were more unlikely to move to non-employment in the pre-reforms economy, while after the reforms the turnover of *experienced* workers is higher for the female group. The role played by age is similar before and after the reforms.

5.2 Calibration

In order to capture the main changes caused by the transition from a system of solely permanent contracts to a system where permanent and short-term contracts coexist, I perform a calibration exercise. The comparison of macro aggregates, such as employment, unemployment, and labor force participation rates, as well as wages, before and after the reforms, will provide me with some hints regarding the changes in welfare for different categories of people, as identified in the model. Two are the main criteria used to select the parameters: the first is the coherence with the previous literature and the second one is the matching with the labor force statistics extracted from the data (SHIW and WHIP). In particular, our objective is to match the rates of unemployment, employment, and labor force participation, as well as the average wages for different categories of workers in 1995 (before the reforms) and in 2006 (after the reforms).

Following Blanchard and Landier [16], I consider the length of a month as the unit time period and I choose the parameters of the calibration as described in Table 7.

Using these values, I can reconstruct the percentages of employment, unemployment, and labor force participation for productive ($h-type$), unproductive ($l-type$), *experienced*, and *inexperienced* workers, before and after the reforms. I am able to match approximately the values computed using the SHIW data set for the year 1995 and 2006. The results are shown in Table 8 and Table 9, respectively for *experienced* and *inexperienced* workers. Regarding *inexperienced* workers, I can reproduce an approximately unchanged labor force

composition. Indeed, in the data and in the model, the employment rate registers an increase of few percentage points which corresponds to the same decrease of the unemployment rate; the labor force participation rate is constant. The main change to be highlighted is the type of contract on which *inexperienced* workers are hired: before the reforms they were permanently hired, after the reforms they are hired short-term. Regarding *experienced* workers, through the calibration exercise, I can recreate the sharp increase in labor force participation rate present in the data, almost completely absorbed by the increase in the employment rate.

In terms of wages, *inexperienced* workers face a slight increase in the received salary. Regarding *experienced* workers, I observe contrasting trends. The salary of productive $h - type$ workers is much higher after the reforms; the salary of unproductive $l - type$ workers is lower. The formers are the only ones hired permanently and as such they are able to enjoy a wage premium. Indeed, the pooling with unproductive workers, present in the pre-reforms economy, is no longer part of the system. Unproductive workers, who were hired permanently before, are now hired short-term and, as such, they enjoy lower wages.

Using the parameter values described above, I compute the present value average lifetime income for productive ($h - type$) and unproductive ($l - type$) workers as well as the present value average income for *inexperienced* and *experienced* workers. The findings are shown in Table 10.

Inexperienced workers are worse off after the reforms. Even though their wage level is similar to the wage level in the pre-reforms economy, due to the nature of the short-term contracts on which they are hired, it takes longer for their productivity to be revealed. Hence they alternate spells of unemployment and short-term employment and their overall income is lower.

Among *experienced* workers, more productive workers fare better. Even though they are in the labor force for a longer span of time, they are the only ones hired permanently. In the pre-reforms economy, they were penalized by the pooling of more and less productive workers within the same contract type and, consequently, they were facing a much lower wage. In the post-reforms, they enjoy a much higher salary, which is a function solely of their own productivity level.

Less productive *experienced* workers are worse off after the reforms. They have higher chances to work in the post-reforms, but they have no chance to be hired permanently. They alternate spells of short-term employment and unemployment and they face a lower salary. Hence, they spend more time in the labor force, but their average monthly income is much lower compared to their income in the pre-reforms economy.

Considering the present value lifetime income for all types of workers, from the instant they join the labor force until they retire, I can identify a decrease of the overall average income for less productive workers as well as increase in income for more productive workers (see Table 11). This result is not surprising. Less productive workers, indeed, are worse off both when *inexperienced* and when they turn *experienced*. However, more productive workers, who enjoy much higher wages when *experienced*, are able to compensate for their losses occurred when *inexperienced*.

6 Conclusion and Discussion

In this paper I study both theoretically and empirically the effect of the introduction of short-term employment contracts on the labor market. The objective is to draw both qualitative and quantitative conclusions regarding the change in welfare for different categories of people. I analyze the data to find patterns, which can be explained by a search model. Data from the Italian labor market show that people hired short term are mostly young, female, inexperienced, less educated, and poorly qualified. Short-term contracts, which are associated with lower wages, often come in sequences. Labor force participation has increased in particular among older workers. To explain these patterns, I develop a standard Mortensen and Pissarides search model allowing for workers heterogeneity with respect to productivity and differentiated contracts. I analyze the career path of individuals before the reforms, when only permanent contracts are available, and after the reforms, when permanent and short-term contracts coexist.

I estimate the model according to the Heckman and Singer [10] non parametric maximum likelihood estimation procedure accounting for transition specific unobserved heterogeneity. I find that turnover is higher across all transitions from employment to unemployment and vice versa for different categories of workers. Limitations in the estimation come from the nature of the data, which do not provide sufficient information regarding worker's personal characteristics and firm's features. Using italian panel data, I perform the calibration of the model in order to quantify the change in welfare for different categories of workers. I find that inexperienced workers are worse off after the reforms. *Experienced* workers, if more productive, enjoy higher wages and the benefits of permanent contracts. Less productive *experienced* workers do not have the opportunity to be hired on a permanent basis in the post-reforms economy. Hence, they fall into cycles of unemployment and short-term employment, facing lower salaries and reduced benefits. Accounting for the lifetime income, I can additionally identify, in the post reforms era, a decrease in income for less productive individuals as well as an increase in income for more productive workers.

Future research includes the estimation of the model using matched employer-employee data[32]. This will allow me to provide a complete overview of the effect of short-term contracts on both workers and firms. Indeed, I will be able to compute firm profits before and after the reforms and to draw conclusions regarding the state of the economy. The availability of these data will also open the door to extensions of the model with additional worker and firm dynamics. The model I have developed in this paper can be considered a baseline model, which is suitable for many extensions in different directions. Thus far, I have considered only one type of job that can be performed under different types of contracts (permanent or short-term). It would be interesting to explore the allocation problem of workers among different job types, low-skilled and high-skilled, and types of contracts. The allocation issue is particularly interesting because intuitively one could think that low-skilled jobs are associated with short-term contracts and high-skilled jobs with permanent ones. However, a

[32]The data set *Veneto Worker Histories* provided by Giuseppe Tattara regarding the region of Veneto in Italy will be used.

non-intuitive cross-equilibrium might exist. In addition, I plan to perform simulation studies, where parameters, which in my search-model define features of short-term employment contracts, are perturbed to target lower unemployment rates and to minimize the loss of lifetime income. I intend to investigate whether the increased European labor market flexibility, achieved through the introduction of short-term contracts, is comparable to the American labor market flexibility. I can readily simulate this scenario by incorporating in the model the assumption that there are no firing costs associated with permanent contracts (such as in the USA). This would allow me to quantify and compare the welfare for different categories of people under different labor market regulations and different degrees of flexibility.

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7 Appendix

7.1 Equilibrium conditions

7.1.1 The benchmark model

The firm problem

$$\begin{aligned} J_O^{EH} &= \frac{y - w_o - \tau_o^p}{(r + \delta + s^p)} \\ J_O^{EL} &= \frac{y_0 - w_o - \tau_o^p}{(r + \delta + s^p)} \\ J_Y^E &= \frac{y_0 - w_y - \tau_y^p}{(r + \lambda + \delta)} + \frac{\lambda p}{(r + \lambda + \delta)} J_O^{EH} + \frac{\lambda(1-p)}{(r + \lambda + \delta)} J_O^{EL} \end{aligned}$$

The worker problem

$$\begin{aligned} W_Y^{EH} &= \frac{w_y}{(r + \lambda + \delta)} + \frac{\lambda}{(r + \lambda + \delta)} W_O^{EH} + \frac{\delta}{(r + \lambda + \delta)} \frac{\mu_y}{(\mu_y + r)} W_Y^{EH} \\ W_Y^{EL} &= \frac{w_y}{(r + \lambda + \delta)} + \frac{\lambda}{(r + \lambda + \delta)} W_O^{EL} + \frac{\delta}{(r + \lambda + \delta)} \frac{\mu_y}{(\mu_y + r)} W_Y^{EL} \\ W_O^{EH} &= \frac{w_o}{(r + \delta + s^p)} + \frac{\delta}{(r + \delta + s^p)} W_O^{UH} + \frac{s^p}{(r + \delta + s^p)} W_O^{OLF} \\ W_O^{EL} &= \frac{w_o}{(r + \delta + s^p)} + \frac{\delta}{(r + \delta + s^p)} W_O^{UL} + \frac{s^p}{(r + \delta + s^p)} W_O^{OLF} \end{aligned}$$

The equilibrium wage for *experienced* workers:

$$\begin{aligned} w_o &= \beta[py + (1-p)y_0 - \tau_o^p] + (1-\beta)(r + s^p)(pW_O^{UH} + (1-p)W_O^{UL}) \\ &+ (1-\beta)[s^p]W_O^{OLF} \end{aligned}$$

The equilibrium wage for *inexperienced* workers:

$$\begin{aligned} w_y &= \beta[y_0 - \tau_y^p] + (1-\beta)(r + \lambda)[pW_Y^{UH} + (1-p)W_Y^{UL}] \\ &- (1-\beta)\lambda[pW_O^{UH} + (1-p)W_O^{UL}] \end{aligned}$$

7.1.2 The model with short-term contracts

The Firm problem

$$\begin{aligned} J_O^{EPH} &= \frac{y - w_o^h - \tau_o^p}{(r+\delta+s^p)} \\ J_O^{ESL} &= \frac{y_0 - w_o^l - \tau_o^s}{(r+\delta+t+s^s)} \\ J_Y^{ES} &= \frac{y_0 - w_y - \tau_y^s}{(r+t+\delta+\lambda)} + \frac{\lambda}{(r+t+\delta+\lambda)}(pJ_O^{EPH} + (1-p)J_O^{ESL}) \end{aligned}$$

In equilibrium it is more profitable for the firms to offer short-term contracts to *inexperienced* workers. Indeed the cost is lower and it is less risky, since the firms do not know the productivity of the workers and permanently hired workers can not be fired.
The Worker problem

$$\begin{aligned} W_O^{EH} &= \frac{w_o^h}{(r+\delta+s^p)} + \frac{\delta}{(r+\delta+s^p)}W_O^{UH} + \frac{s^p}{(r+\delta+s^p)}W_O^{OLF} \\ W_O^{EL} &= \frac{w_o^l}{(r+\delta+t+s^s)} + \frac{(\delta+t)}{(r+\delta+t+s^s)}W_O^{UL} + \frac{s^s}{(r+\delta+t+s^s)}W_O^{OLF} \\ W_Y^{EH} &= \frac{w_y}{(r+\delta+\lambda+t)} + \frac{\lambda}{(r+\delta+\lambda+t)}W_O^{EH} + \frac{(\delta+t)}{(r+\delta+\lambda+t)}W_Y^{UH} \\ W_Y^{EL} &= \frac{w_y}{(r+\delta+\lambda+t)} + \frac{\lambda}{(r+\delta+\lambda+t)}W_O^{EL} + \frac{(\delta+t)}{(r+\delta+\lambda+t)}W_Y^{UL} \end{aligned}$$

The equilibrium wage for $h-type$ *experienced* workers:

$$w_o^h = \beta[y - \tau_o^p] + (1-\beta)(r+s^p)W_O^{UH} - (1-\beta)s^pW_O^{OLF}$$

The wage setting condition for $l-type$ experienced workers:

$$w_o^l = \beta[y_0 - \tau_o^s] + (1-\beta)(r+s^s)W_O^{UL} - (1-\beta)s^sW_O^{OLF}$$

Finally, the wage setting condition for *inexperienced* workers:

$$\begin{aligned} w_y &= \beta[y_0 - \tau_y^s] + (1-\beta)(r+\lambda)[pW_Y^{UH} + (1-p)W_Y^{UL}] \\ &- (1-\beta)\lambda[pW_O^{UH} + (1-p)W_O^{UL}] \end{aligned}$$

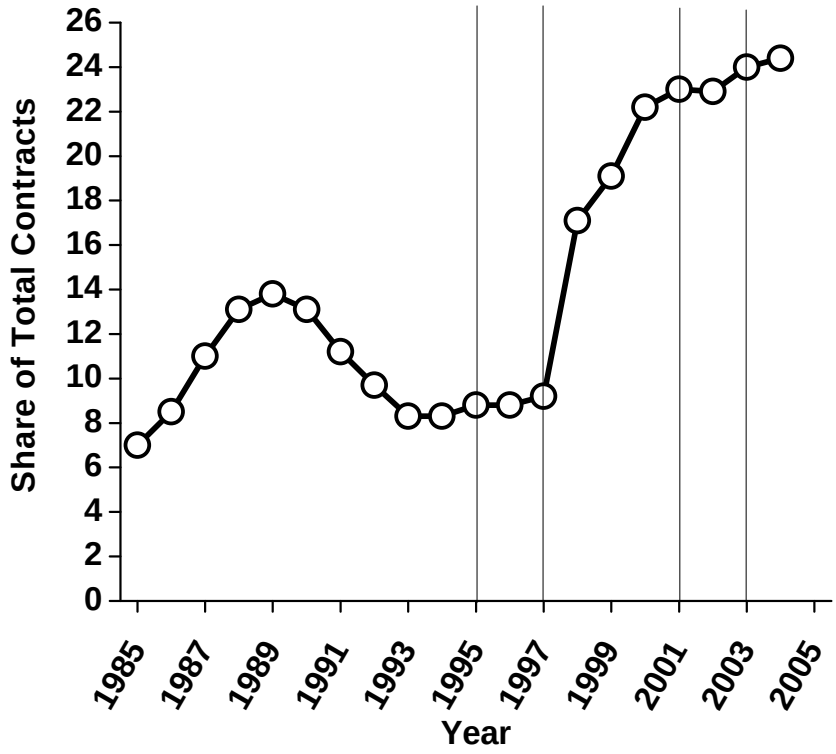

Figure 1: Percentage of short-term contracts (as a share of total contracts). Vertical lines correspond to years of introduction of new reforms. Source: *Work Histories Italian Panel (WHIP).*

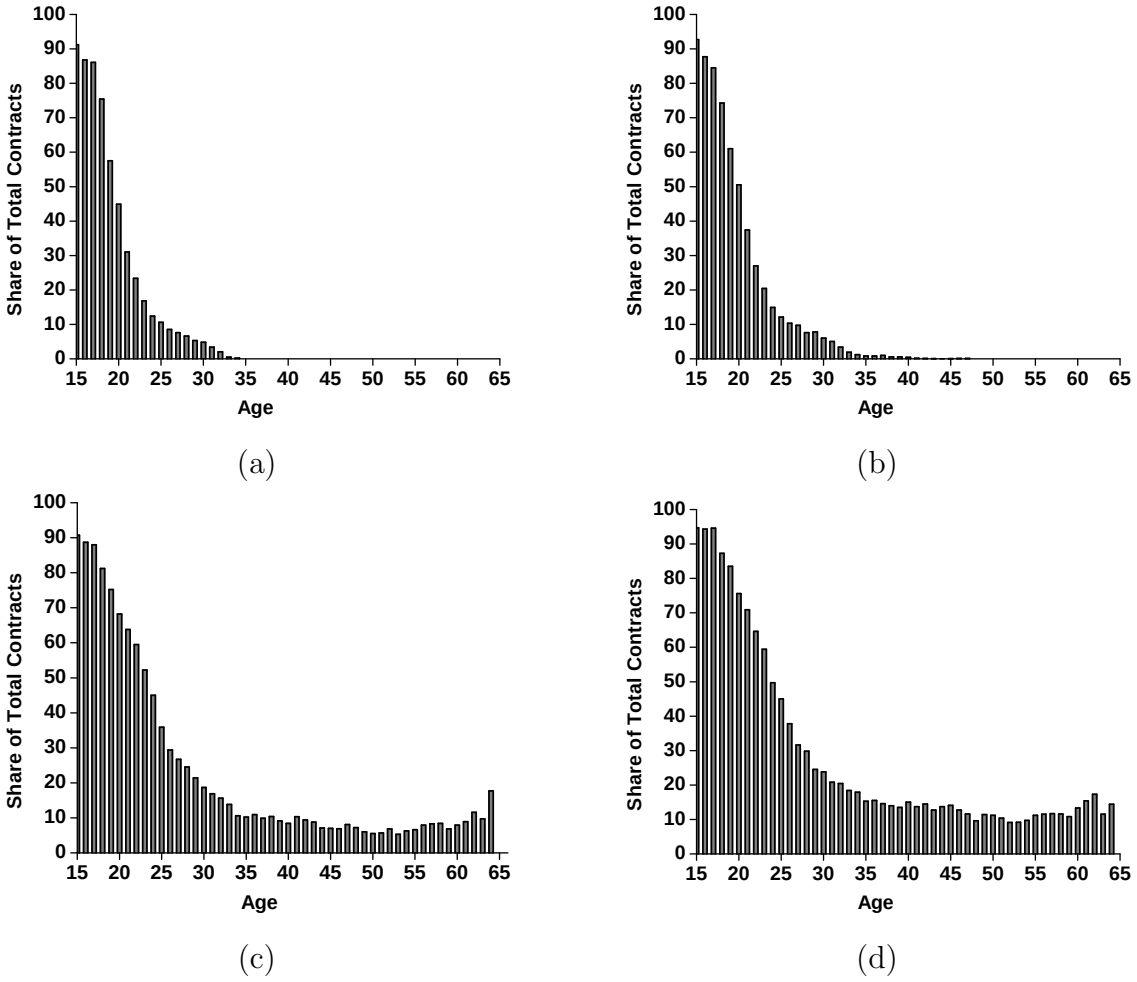

Figure 2: Short-term contracts age distribution in years (a) 1995, (b) 1997, (c) 2000, and (d) 2004. Source: *Work Histories Italian Panel (WHIP).*

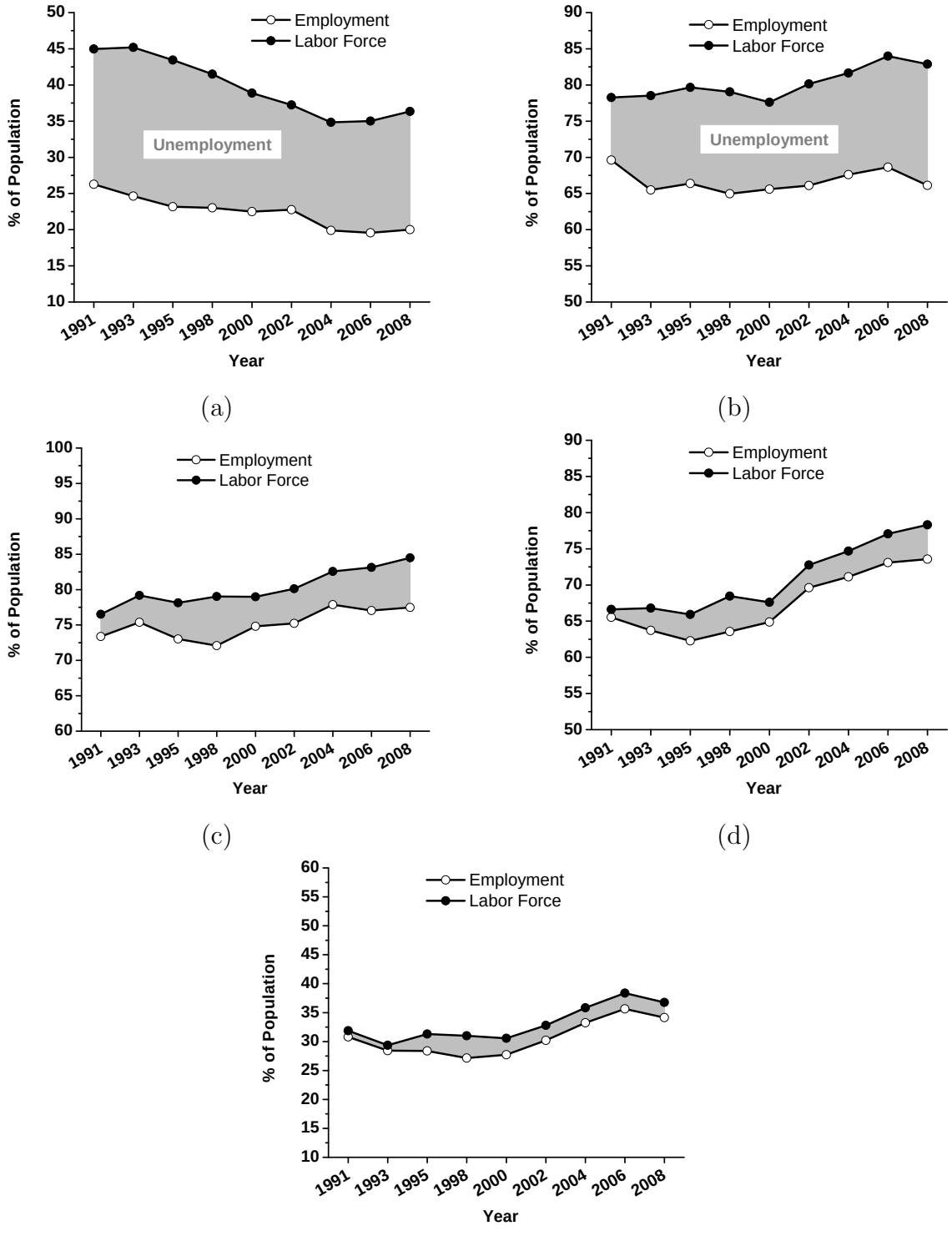

Figure 3: Labor market statistics (employment, labor force, unemployment) across age groups (a) 15-24, (b) 25-34, (c) 35-44, (d) 45-54, and (e) 55-64. Source: *Survey on Household Income and Wealth (SHIW).*

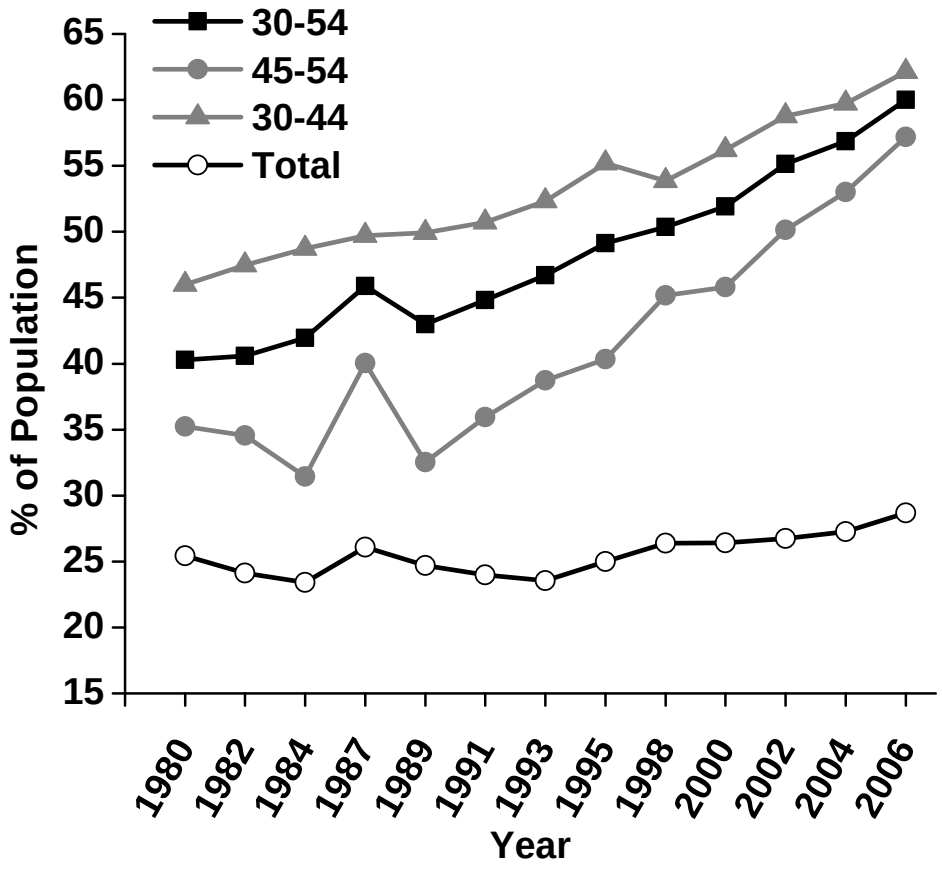

Figure 4: Female employment rate as a % of age group population. Source: *Survey on Household Income and Wealth (SHIW).*

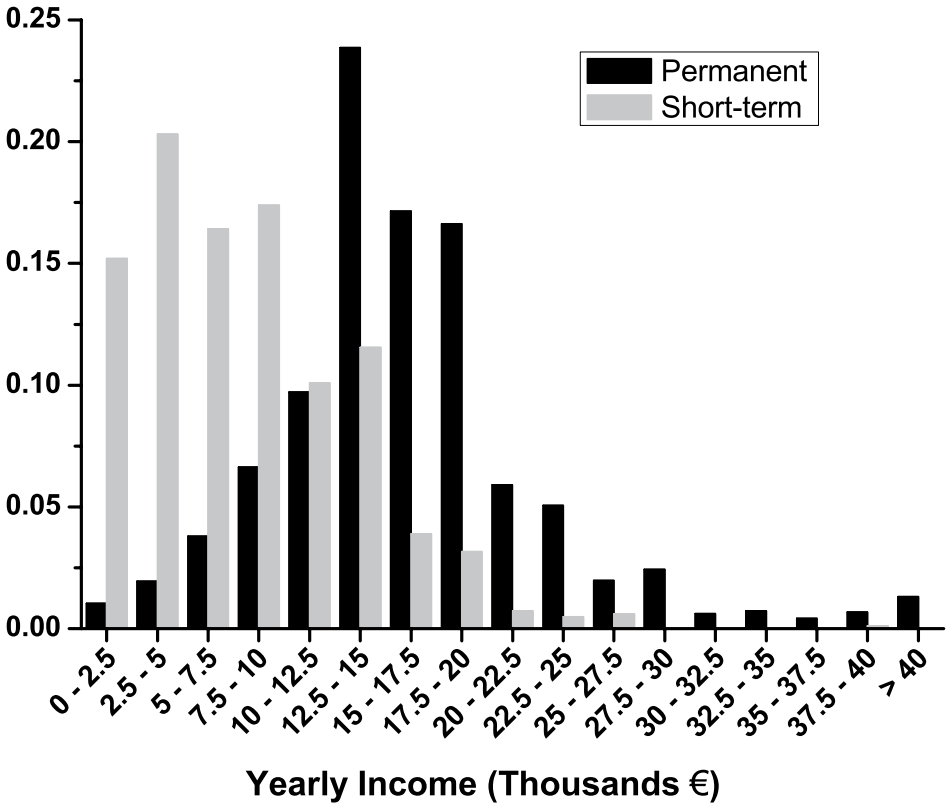

Figure 5: Distribution of yearly net income in Euro for workers in permanent and short-term contracts. Source: *Survey on Household Income and Wealth (SHIW).*

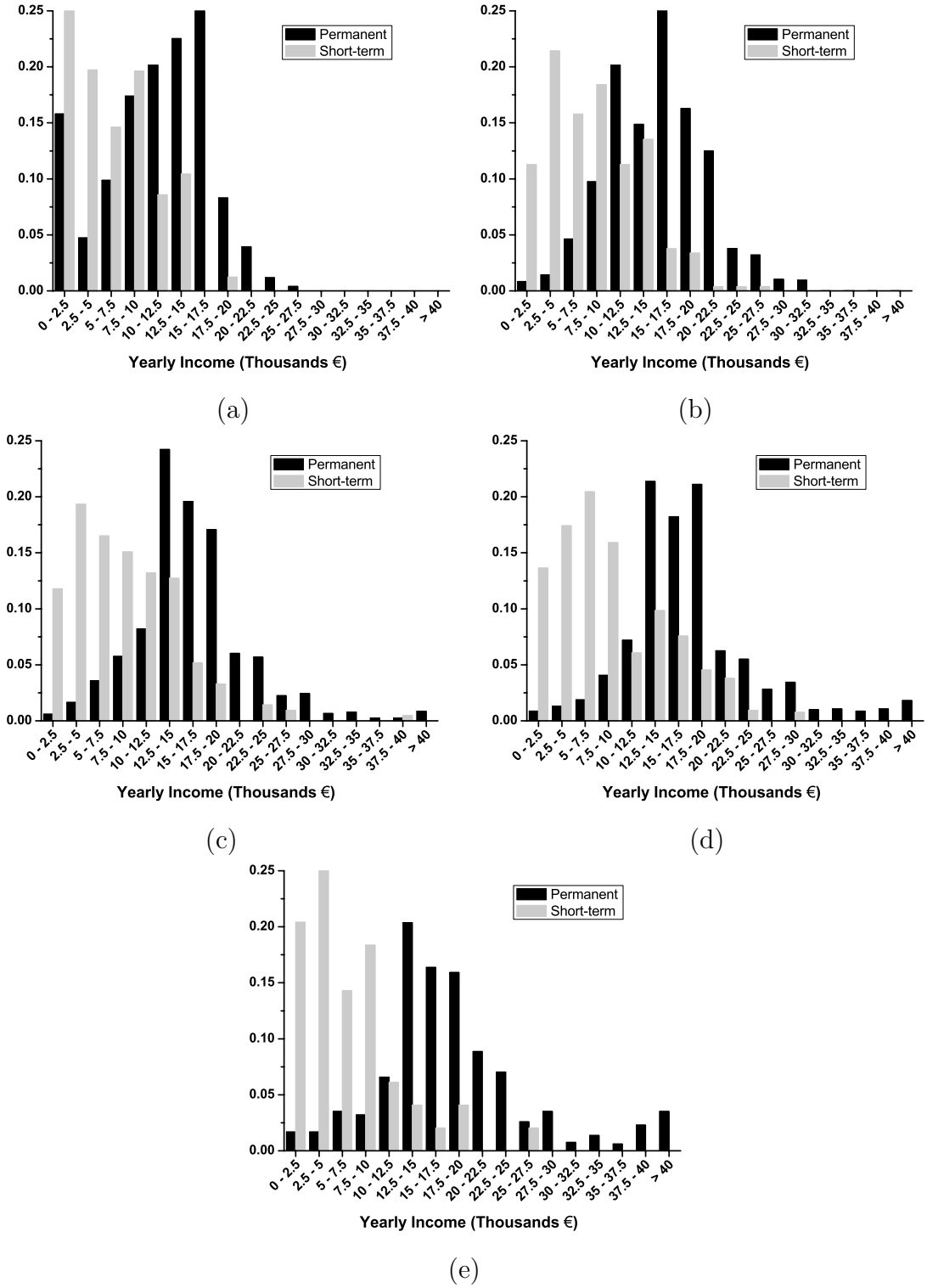

Figure 6: Distribution of yearly net income in Euro for workers in permanent and short-term contracts by age groups (a) 15-24, (b) 25-34, (c) 35-44, (d) 45-54, and (e) 55-64. Source: *Survey on Household Income and Wealth (SHIW).*

Table 1: Distribution of contracts (2006)

	Share of population (%)	Long term (%)	Short term (%)
Qualification			
Blue collar	49.06	82.34	15.05
White collar	35.59	92.05	7.95
Teacher	6.77	80.58	19.42
Junior manager	6.09	92.62	7.38
Senior manager	2.49	98.49	1.51
Age			
15 - 24	6.27	58.55	41.45
25 - 34	23.49	80.14	19.86
35 - 44	34.85	88.02	11.98
45 - 54	25.66	92.12	7.88
55 - 64	9.73	92.05	7.95
Gender			
Male	57.53	86.59	13.41
Female	42.47	84.65	15.35
Education			
No education	0.23	38.82	61.18
Primary	5.07	77.35	22.65
Junior high	33.39	84.26	15.74
Vocational	10.03	87.27	12.73
High school	37.80	87.57	12.43
3 year Bachelor's	1.73	84.97	15.03
5 year Bachelor's	11.45	87.62	12.38
Postgraduate	0.30	86.40	13.60
Geographical location			
North	53.90	88.98	11.02
Center	19.09	89.93	10.17
South	27.01	76.47	23.53

Source: *Survey on Household Income and Wealth* (SHIW).

Table 2: Probit regression (2006)

	Short-term	Short-term	Short-term	Short-term	Short-term
Female	0.045***	0.047***	0.056***	0.061***	0.061***
	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)
South	0.122***	0.121***	0.115***	0.109***	0.110***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Bachelor's	0.013	0.016			
	(0.011)	(0.012)			
Manager	-0.051***	-0.057***	-0.046***	-0.072***	-0.071***
	(0.009)	(0.009)	(0.011)	(0.006)	(0.006)
White Collar				-0.066**	-0.068***
				(0.007)	(0.007)
Teacher				-0.055***	-0.049***
				(0.008)	(0.009)
Age	-0.004***				
	(0.000)				
Age Group 15 - 24		0.191***	0.202***	0.184***	0.175***
		(0.022)	(0.023)	(0.022)	(0.022)
Age Group 25 - 34		0.068***	0.076***	0.070***	0.055***
		(0.010)	(0.070)	(0.010)	(0.010)
Master's			0.043	0.059	0.058
			(0.133)	(0.125)	(0.131)
5 Year Bachelor's			0.056***	0.072***	0.023
			(0.016)	(0.018)	(0.019)
3 Year Bachelor's			0.033	0.046	0.043
			(0.038)	(0.040)	(0.039)
Primary/Junior High			0.052***		0.011
			(0.008)		(0.009)
Primary				0.048***	0.042***
				(0.015)	(0.015)
No Education			0.260***	0.144***	0.136***
			(0.065)	(0.053)	(0.052)
Bachelor's 25-34					0.121***
					(0.041)
Number of observations	6193	6055	6055	6055	6055

NOTES: "Short-term" takes value 1 if the contract is short-term and value 0 otherwise. Bachelor's 25 - 34 is an interaction variable, which captures the category of people with a Bachelor's or higher degree belonging to the 25 - 34 age group.
Standard errors in parenthesis.
** and *** denote significance at the 5% and 1% level respectively.
Source: *Survey on Household Income and Wealth (SHIW).*

Table 3: Log wage regression (2006)

	Log wage	Log wage	Log wage	Log wage	Log wage
Permanent	0.223***	0.194***	0.194***	0.205***	0.205***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Male	0.271***	0.261***	0.253***	0.249***	0.249***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.101)
South	-0.122***	-0.113***	-0.100***	-0.094***	-0.094***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Bachelor's	0.235***	0.175***	0.176***	0.173***	
	(0.014)	(0.014)	(0.014)	(0.014)	
Manager		0.238***	0.232***	0.237***	0.235***
		(0.027)	(0.018)	(0.018)	(0.018)
Age	0.228***	0.893***	0.856***		
	(0.000)	(0.003)	(0.003)		
Age^2		-0.688***	-0.655***		
		(0.000)	(0.000)		
Size			0.084***	0.087***	0.087***
			(0.011)	(0.011)	(0.011)
Age Group 15 - 24				-0.167***	-0.167***
				(0.020)	(0.020)
Age Group 25 - 34				-0.141***	-0.140***
				(0.012)	(0.012)
Master's					0.050***
					(0.093)
5 Year Bachelor's					0.163***
					(0.015)
3 Year Bachelor's					0.052***
					(0.041)
Constant	6.314***	5.818***	5.830***	6.742***	6.742***
	(0.023)	(0.066)	(0.066)	(0.017)	(0.017)
Number of observations	5795	5696	5694	5694	5694
R^2	0.254	0.315	0.322	0.314	0.314

NOTES: *** denotes significance at the 1% level.
Source: *Survey on Household Income and Wealth (SHIW).*

Table 4: Workers transiting from/to short-term contracts (as a % of workers hired on a short-term basis)

			1995	2000	2003
First job			0.3137	0.0391	0.0307
Panel A: Transitions to the short-term contract					
Non-employment			0.4702	0.0686	0.0754
Short-term	⇒	Short-term	0.0777	0.8384	0.8549
Long-term			0.1384	0.0539	0.0390
Panel B: Transitions from the short-term contract					
Short-term (first job)	⇒	Non-employment	0.4730	0.4037	0.4596
		Short-term	0.2952	0.4754	0.4350
		Long-term	0.2317	0.1209	0.1054
Short-term (not first job)	⇒	Non-employment	0.4804	0.2787	0.2977
		Short-term	0.2917	0.4635	0.4717
		Long-term	0.2279	0.2579	0.2307
Number of observations			1004	12467	14505

Source: *Work Histories Italian Panel (WHIP).*

Table 5: Estimation results for transition hazard rates

	Constant	H-Factor
Panel A: Before the reforms		
Non-employment(y) → Employment(y)	**1.05**	-0.07
	(0.01)	(0.02)
Employment(y) → Non-employment(y)	**-1.78**	4.58
	(0.03)	(0.03)
Employment(y) → Employment(o)	**1.18**	-1.10
	(0.00)	(0.04)
Non-employment(o) → Employment(o)	**0.53**	1.14
	(0.01)	(0.01)
Employment(o) → Non-employment(o)	**-1.66**	3.31
	(0.00)	(0.01)
Panel B: After the reforms		
Non-employment(y) → Employment(y)	**2.23**	-1.96
	(0.00)	(0.01)
Employment(y) → Non-employment(y)	**1.50**	-1.00
	(0.00)	(0.03)
Employment(y) → Employment(o)	**1.28**	-0.06
	(0.01)	(0.04)
Non-employment(o) → Employment(o)	**1.60**	1.44
	(0.00)	(0.00)
Employment(o) → Non-employment(o)	**-1.17**	2.81
	(0.01)	(0.01)

NOTES: y(young): inexperienced, o(old): experienced.
H factor allows for transition specific heterogeneity.
Standard errors in parenthesis.
Panel A includes estimates regarding transitions pre-reforms.
Panel B shows estimates post-reforms.

Table 6: Estimation results for transition hazard rates

	Constant	Male	Age	H-Factor
Panel A: Before the reforms				
Non-employment(y) → Employment(y)	**1.04**	-0.13	0.01	-0.05
	(0.02)	(1.42)	(0.06)	(0.02)
Employment(y) → Non-employment(y)	**-0.75**	-20.41	-2.26	4.37
	(0.03)	(1.64)	(0.07)	(0.03)
Employment(y) → Employment(o)	**1.57**	5.72	-1.15	-1.06
	(0.02)	(1.26)	(0.04)	(0.04)
Non-employment(o) → Employment(o)	**1.15**	15.49	-2.06	1.27
	(0.02)	(1.30)	(0.05)	(0.01)
Employment(o) → Non-employment(o)	**-2.15**	-22.60	2.29	3.44
	(0.02)	(1.44)	(0.06)	(0.01)
Panel B: After the Reforms				
Non-employment(y) → Employment(y)	**1.84**	4.98	-3.46	1.64
	(0.02)	(1.35)	(0.06)	(0.01)
Employment(y) → Non-employment(y)	**0.40**	-1.04	-1.21	2.13
	(0.03)	(1.70)	(0.09)	(0.02)
Employment(y) → Employment(o)	**1.39**	12.11	-0.26	-0.37
	(0.05)	(3.01)	(0.16)	(0.03)
Non-employment(o) → Employment(o)	**2.25**	-23.51	-1.40	1.45
	(0.01)	(0.66)	(0.03)	(0.00)
Employment(o) → Non-employment(o)	**-0.27**	-31.91	-1.26	2.85
	(0.02)	(0.93)	(0.04)	(0.01)

NOTES: y(young): inexperienced, o(old): experienced.
H factor allows for transition specific heterogeneity.
Standard errors in parenthesis.
Panel A includes estimates regarding transitions pre-reforms.
Panel B shows estimates post-reforms.

Table 7: Calibration parameter values

Parameter	Pre-reforms	Post-reforms
r	0.01	0.01
β	0.4	0.4
p	0.85	0.85
k	500	500
y_0	1500	1500
y	2500	2500
b	500	500
c_o^p	1500	1500
c_y^s	—	1000
c_o^s	—	750
m	0.046	0.044
u	100	100
d	0.009	0.009
s^p	0.0035	0.0032
s^s	—	0.005
δ	0.015	0.015
t	—	0.1
λ	0.05	0.05
μ_y	0.14	0.22
μ_o^h	0.14	0.14
μ_o^l	—	0.18
α_y^p	0.10	—
α_y^s	—	0.10
α_o^p	0.45	0.14
α_o^s	—	0.08
τ_o^p	500	500
τ_y^p	300	—
τ_o^s	—	200
τ_y^s	—	100

Table 8: Labor market statistics for *experienced* workers: data versus model

	Data		Model	
	Pre-reforms	Post-reforms	Pre-reforms	Post-reforms
Total employment rate	58.2%	65.0%	58.3%	65.6%
Permanent employment rate				
$h-type$	—	—	53.9%	43.8%
$l-type$	—	—	4.4%	—
Short-term employment rate				
$l-type$	—	—	—	21.9%
Total unemployment rate	4.8%	5.4%	4.8%	5.2%
$h-type$	—	—	4.8%	5.0%
$l-type$	—	—	—	0.2%
Total out of labor force rate	37.0%	29.6%	37.0%	29.2%
Average wage (in €)				
$h-type$	1570	2040	1520	2000
$l-type$	1570	1370	1520	1406

Source: *Survey on Household Income and Wealth (SHIW)* and *Work History Italian Panel (WHIP)*

Table 9: Labor market statistics for *inexperienced* workers: data versus model

	Data		Model	
	Pre-reforms	Post-reforms	Pre-reforms	Post-reforms
Total employment rate	39.4%	39.0%	39.0%	39.1%
Permanent employment rate				
$h-type$	—	—	19.5%	—
$l-type$	—	—	19.5%	—
Short-term employment rate				
$h-type$	—	—	—	19.6%
$l-type$	—	—	—	19.6%
Total unemployment rate	18.5%	16.5%	18.5%	16.3%
$h-type$	—	—	9.3%	8.2%
$l-type$	—	—	9.3%	8.2%
Total out of labor force rate	42.3%	44.5%	42.5%	44.5%
Average wage (in €)	1050	1120	1010	1100

Source: *Survey on Household Income and Wealth (SHIW)* and *Work History Italian Panel (WHIP)*

Table 10: Welfare changes by worker's types

	Pre-reforms	Post-reforms
Average working income while in the labor force (1000 €)		
Inexperienced	20.6	20.9
Experienced $h-$ *type*	448.0	658.0
Experienced $l-$ *type*	448.0	269.2
Average time in the labor force (in months)		
Inexperienced	22	26
Experienced $h-$ *type*	309	339
Experienced $l-$ *type*	309	262
Present value of total income while in the labor force (1000 €)		
Inexperienced	16.5	15.9
Experienced $h-$ *type*	20.3	22.3
Experienced $l-$ *type*	20.3	19.6

Table 11: Lifetime income changes by worker's types

	Pre-reforms	Post-reforms
Average working income while in the labor force (1000 €)		
$h-type$	365.7	375.5
$l-type$	365.7	155.5
Average time in the labor force (in months)		
$h-type$	267	291
$l-type$	267	212
Present value of total income while in the labor force (1000 €)		
$h-type$	40.4	50.0
$l-type$	40.4	30.3