



**The Dynamic of temporary jobs: Theory and
Some Evidence for Spain (The Role of Skill)**

by

Elena Casquel*

Antoni Cunyat**

DOCUMENTO DE TRABAJO 2005-19

September 2005

* Casquel@umh.es

** Cunat@uv.es

Los Documentos de trabajo se distribuyen gratuitamente a las Universidades e Instituciones de Investigación que lo solicitan. No obstante están disponibles en texto completo a través de Internet: <http://www.fedea.es/>.

These Working Documents are distributed free of charge to University Department and other Research Centres. They are also available through Internet: <http://www.fedea.es/>.

The Dynamics of Temporary Jobs: Theory and some Evidence for Spain (The Role of Skill)¹

Elena Casquel²

Universidad Miguel Hernández de Elche

Antoni Cunyat³

Universitat de València

First version: March, 2003

This version: July, 2005

¹We wish to thank Gerard van den Berg, Peter Dolton and Thomas Bauer for very useful comments. Special thanks go to Aico van Vuuren for the support for programming with the Ox codes and his advice for the model estimation. We are also grateful to seminar participants at Tinbergen Institute, 2004 Royal Economic Society Conference, ESPE 2005 conference and XIX Simposio de Análisis Económico. Part of this work was written while the first author was visiting the Tinbergen Institute in Amsterdam and the second author the Scholar research institute in the University of Amsterdam, whose hospitalities are gratefully acknowledged. Financial support of the Instituto Valenciano de Investigaciones Económicas (IVIE) is gratefully acknowledged. We also like to thank the Valencian government through project GV04B-086 for financial support.

²Departamento de Estudios Económicos y Financieros. Av/ de la Universidad. 03202 Elche (Spain). Casquel@umh.es

³Department d'Anàlisi Econòmica. Av/ dels Tarongers s/n. Campus dels Tarongers. Edifici Departamental Oriental. 46022 Valencia (Spain). Antonio.Cunyat@uv.es

Abstract

This paper analyzes the dynamics of temporary jobs in a labor market characterized by worker's skill heterogeneity and employment protection. We construct a theoretical labor market that incorporates skill differences across workers in order to identify under which conditions temporary contracts are a way for workers to access to permanent contracts (stepping stone effect) or they are dead-end jobs without any good prospect (trap effect).

We use longitudinal survey data of individuals to estimate competing risks model with multi-spells for Spain. To deal with selectivity, the model incorporates correlated unobserved determinants in the transition rates. Our results show the existence of two opposite dynamics of temporary contracts for skilled and unskilled workers: whereas for skilled workers temporary contracts serve as a stepping stone, unskilled workers seem to experiment a penalty, that is, they get "stuck". in temporary contracts. More importantly, controlling for unobserved heterogeneity is quite important in order to obtain clear estimates.

Keywords: temporary contracts, permanent contracts, duration models, unobserved heterogeneity.

JEL classification: J63, J64.

1 Introduction.

This paper analyzes the dynamics of temporary jobs in a labor market characterized by worker's skill heterogeneity and employment protection.

The motivation for this work is the following. A better understanding of where temporary contracts led when they expire can shed some light on the actual benefits and costs of labor market flexibility. In this sense, there are two contradictory hypotheses. One view considers the bridging function of temporary contracts, suggesting that they can serve as an entry route to permanency. The second one suggests that temporary contracts can become dead-end jobs without any good prospect.

In this paper, we show the existence of two opposite dynamics of temporary contracts for skilled and unskilled workers. We argue that there is not need to discriminate between these two alternatives, since both can coexist in the labor market, that is, it is possible a different use of temporary contracts for different groups of workers (skilled and unskilled workers).

In the theoretical part of the paper we construct a labor market that incorporates skill differences¹ across workers in order to identify under which conditions temporary contracts are a way for workers to access to permanent contracts (stepping stone effect) or they are dead-end jobs without any good prospect (trap effect).

We find that there are three possible cases which imply different conversion rates. The first one is the *no conversion equilibrium* (conversion rate is zero) in which it is not worthwhile for firms to convert temporary jobs into permanent neither if they are matched with a skilled or an unskilled worker. In this case, temporary contracts are dead-end jobs for both groups of workers (trap effect). The second one is the *full conversion equilibrium* (conversion rate is one) in which it is beneficial for firms to convert temporary jobs into permanent no matter the type of worker they are matched to. In this case, temporary contracts are a way to access to permanent contracts for both group of workers (stepping-stone effect). Finally, the *segmentation equilibrium* (conversion rate lies between zero and one) in which firms only convert temporary jobs into permanent when matched with a skilled worker. In this case, the stepping stone effect dominates for skilled workers, while the trap effect dominates for unskilled workers. The emergence of one equilibrium over the other will depend crucially on the firing costs, among other factors.

Our model could be viewed as closer to Wasmer (1999) and Blanchard and Landier (2002) in the sense that they also analyze the coexistence of temporary and permanent contracts. The former has an endogenous coexistence of both types of contracts and no transition between contracts and the latter assumes and exogenous coexistence of both types of contracts but has an endogenous transition into permanent contracts. However, the present model can generate a full range of conversion rates into permanent contracts (0, 1 or in between), given the skill heterogeneity of workers. This is an improvement over Blanchard

¹ We assume that skills are perfectly correlated with educational outcomes.

and Landier (2002), and the fact that the conversion rate is endogenous is also an improvement over Wasmer (1999). More importantly, to the best of our knowledge there is no work available which can make accurate predictions on whether the stepping stone or the trap effect dominates.

It is important to note that firms know the worker's skill they are matched to before hiring. Hence, they are not using the temporary contract as a screening device to obtain information about worker's type. On the other hand, workers of different skill levels enter the labor market in the same conditions, with a temporary contract. Therefore, we are not assuming an exogenous dual labor market, where some workers are in the core segments of the labor market and other in the peripheral segments. Segmentation in our framework can arise endogenously from the heterogeneity of workers.

The empirical analysis of the paper tests whether there are significant different conversion patterns (segmentation equilibrium) for skilled and unskilled workers or similar ones (full conversion/ no conversion equilibrium). In addition, we test for other worker's characteristics.

We do so using a competing risks model with multi-spells focusing on Spain. A study of Spain is especially compelling for many reasons. First, the Spanish labor market is a "two-tier system", in which firing costs only apply to the termination of permanent contracts. Secondly, Spain provides a fascinating case of study since the share of temporary contracts is the highest in Europe (see Table 15 and Figure 2). In this sense, whereas the average share of temporary contracts in the European Union of 15 States has remained around 12% during the nineties, in Spain has remained far beyond the 30%.

Our data are from the European Community Household Panel Survey (ECHP) for Spain that contains a rich variety of individuals, household and labor market characteristics. The longitudinal nature of the data allows us to reconstruct all the transitions for workers with a temporary contract. We use this data to estimate a competing risks model with multi-spells. We calculate the transition rate from temporary to permanency and the transition rate from temporary to "other states"². The transition rates of importance are modeled as function of observed and unobserved explanatory variables. The unobserved heterogeneity is correlated across states and it is determined internally³. In this way, we correct for selectivity bias. Otherwise, we could not interpret the estimated parameters since they can be contaminated by individual specific effects⁴.

The main advantage of our dataset is that it contains more than one spell for some individuals. In this setup, this is particularly useful since the dynamics of temporary jobs is a quite complex process which can imply in some cases a continuous sequence of temporary jobs. Moreover, multi-spell data greatly facilitates the identification and estimation of the joint distribution of the unobserved heterogeneity variables (see Honoré (1993) and van den Berg (2001)).

Our work is not the first attempt to apply duration analysis to temporary contracts. Some works use models without potentially selectivity unobserved

²Including unemployment, inactivity and a new temporary contract.

³See Heckman and Singer (1984).

⁴See van den Berg et al (2002).

heterogeneity. More specifically, Guell and Petrongolo (2004) find that conversion rates increase with tenure. D'Addio and Rosholm (2004) obtain for Europe that non-employment before entering the temporary job, labor market conditions and elementary occupation tasks increase job instability⁵. Booth et al (2002) also analyze the conversion rate from temporary to other states.

By contrast, Zijl et al (2004) using a multi-state model and applying the "time of events" approach show that temporary contracts serve as stepping stone towards regular employment. Finally, van Ours (2004) investigates locking-in effects of temporary subsidized jobs using a natural experiment from the Slovak labor market.

Our results suggest that workers' skills play a key role in all the transitions and they are consistent with the existence of a segmentation equilibrium in our theoretical model, in which two opposite dynamics of temporary contracts emerge for high and low skilled workers. More specifically, for high educated workers temporary contracts serve as stepping stone. By contrast, low educated workers seem to experiment a penalty, that is, this group of workers seem to get stuck in temporary contracts. In this sense, we observe that the predicted transition rate to permanency is twice larger for higher educated workers than for low educated and in the predicted transition rate to "other states" it is 1.5 larger for low educated workers than for high educated workers. Most importantly, controlling for unobserved heterogeneity is quite important in order to obtain clear estimates.

The paper is organized as follows. In Section 2 we introduce the theoretical model. Section 3 empirically tests whether there are significant different conversion patterns for skilled and unskilled workers. Finally, Section 4 concludes and summarizes.

2 The Theoretical model

In this section we construct a labor market that incorporates skill differences across workers in order to identify under which conditions temporary contracts are a way for workers to access to permanent contracts (stepping stone effect) or they are dead-end jobs without any good prospect (trap effect).

In characterizing the labor market, we think of it as one in which firms hire workers in temporary jobs and, then, they have to decide whether they keep them in a permanent job or they fire them. This assumption was first introduced by Blanchard and Landier (1999). Contrary to these authors, a key point for our analysis is the existence of ex-ante skill differences between workers. This implies that one may have, depending on workers' type, a full range of conversion rates into permanent contracts (0, 1 or in between).

Assume an economy with a continuum of workers of size one (see Figure 1). To simplify, we suppose that there are two types of workers: high-skilled and low-skilled (H -type and L -type workers), which differ in their productivity

⁵Other studies, as Toharia (1996) and Alba-Ramirez (1998) analyse conversion rates using logit specifications.

only if the match turns out to be good. We also assume that firms know the workers's type⁶ before hiring. The mass of H-type workers is μ , and the mass of L-type workers is $1 - \mu$.

The number of firms is endogenously determined. Each firm offers one job, which costs c to set up and it is either vacant or filled. In the former case, the firm is actively engaged in hiring at a cost k . We assume that when a new firm is created, a temporary job is offered which starts with productivity y , regardless of the type of worker the firm is matched. Productivity then changes with instantaneous probability λ . The new level of productivity can take two values. With probability p , it changes to a low productivity level such that the match is destroyed and the position is vacant again, that is, this is the probability of facing a destructive shock. With probability $1 - p$, it changes to a new value y_i , $i \in \{H, L\}$, which depends on the type of worker the firm is matched to. When productivity changes from y to y_i , the firm can decide either to lay off the worker (and, hence, hire a new worker in a temporary job), or keep him in a permanent job. In the latter case, the permanent job can be destroyed with instantaneous probability⁷ $\phi < \lambda$, in which case there exist firing costs, f , which are pure waste.

The sequence of transition of productivity is such that all workers face the same probability of being hit by a destructive shock (p). This is a reasonable assumption and although it is not so intuitive as assuming that the transition rate p is skill-specific, nothing important would change in the latter case. On the other hand, with probability $1 - p$, the match has productivity y_i which depends on the type of worker. In this sense, one could interpret this change in productivity as the outcome of a learning process: skilled workers learn while unskilled do not.

Unemployed workers and vacancies are assumed to meet each other randomly according to a conventional function $m(v, u)$ with constant returns to scale, where v and u denote, respectively, the masses of job vacancies and of unemployed workers. We denote the arrival rate for workers as $h(\theta)$, where $\theta = \frac{v}{u}$ is the labor market tightness. We assume that $h'(\theta) > 0$ and that $\lim_{\theta \rightarrow 0} h(\theta) = 0$. We suppose that H and L-type workers meet vacancies at the same rate. Similarly, vacancies meet unemployed workers at the rate $l(\theta)$. We assume that $l'(\theta) < 0$ and that $\lim_{\theta \rightarrow 0} l(\theta) = \infty$. Let η denote the fraction of the unemployed workers who are L-type, then the arrival rate for vacancies of L-type workers is $\eta l(\theta)$. The link between μ and η will depend on the conversion rates of the economy, which will be determined below.

In Appendix 2 we explore the alternative hypothesis that firms segment the market given that they observe the skills of workers. Our conclusion is that the same results hold.

⁶ In this sense, we are ruling out the existence of private information about the worker's productivity. Hence, worker's types are not defined as usual in models with private information. Here, the type of a worker is just whether the worker is skilled or unskilled.

⁷ This assumption was introduced by Wasmer (1999). The interpretation is that temporary contracts are terminated either by destruction or due to reaching the maximum duration, which is proxied as another Poisson process, that is, $\lambda = \phi + s_{\text{maximum duration}}$.

When a match is formed, the firm and worker divide the surplus of the match according to the asymmetric Nash bargaining solution. The worker's share of the surplus is exogenous and denoted by $\beta \in (0, 1)$.

In deriving the asset value equations we use the following notation. Let U_i be the value of an unemployed worker of type $i \in \{H, L\}$, and V the value of a vacancy. J_{ij} the value of a type of contract $j \in \{T, P\}$ filled with a worker of type i . Similarly, let W_{ij} denote the value of employment for a worker of type i in a contract of type j . The surplus of a match between worker of type i and a job with contract of type j , will then be given by

$$S_{iT} = W_{iT} + J_{iT} - U_i - V \quad (1)$$

$$S_{iP} = W_{iP} + J_{iP} - U_i - V + f \quad (2)$$

Hence, the wage w_{ij} is given by the Nash Bargaining solution of

$$\beta (J_{iT} - V) = (1 - \beta) (W_{iT} - U_i) \quad (3)$$

$$\beta (J_{iP} - V + f) = (1 - \beta) (W_{iP} - U_i) \quad (4)$$

Finally, we assume that the common discount rate of workers and firms is r . Moreover, the unemployed workers earn a flow income $z < y$. We now develop expressions for the asset value equations.

First, the value to a firm of employment of a worker of type i on a job with temporary contract is given by:

$$rJ_{iT} = y - w_{iT} + \lambda [p(V - J_{iT}) + (1 - p)(\max(V, J_{iP}) - J_{iT})] \quad (5)$$

and for a permanent contract:

$$rJ_{iP} = y_i - w_{iP} + \phi(V - J_{iP} - f) \quad (6)$$

Next, the value to a worker of type i of employment on a job with temporary contract is:

$$rW_{iT} = w_{iT} + \lambda [p(U_i - W_{iT}) + (1 - p)\{\max(U_i, W_{iP}) - W_{iT}\}] \quad (7)$$

and for a permanent contract:

$$rW_{iP} = w_{iP} + \phi(U_i - W_{iP}) \quad (8)$$

The value of unemployment for a worker of type i is:

$$rU_i = z + h(\theta)(W_{iT} - U_i) \quad (9)$$

Finally, the value of a vacancy is given by:

$$rV = -k + \eta l(\theta)(J_{HT} - V) + (1 - \eta) l(\theta)(J_{LT} - V) \quad (10)$$

2.1 Equilibrium

The nature of equilibrium will depend on the parameters of the model. There are three possible cases which imply different conversion rates. The first one is the *no conversion equilibrium* (conversion rate is zero) in which it is not worthwhile for firms to convert temporary jobs into permanent neither if they are matched with a skilled or an unskilled worker. In this case, temporary contracts are dead-end jobs for both groups of workers (trap effect). The second one is the *full conversion equilibrium* (conversion rate is one) in which it is beneficial for firms to convert temporary jobs into permanent no matter the type of worker they are matched to. In this case, temporary contracts are a way to access to permanent contracts for both group of workers (stepping-stone effect). Finally, the *segmentation equilibrium* (conversion rate lies between zero and one) in which firms only convert temporary jobs into permanent when matched with a skilled worker. In this case, the stepping stone effect dominates for skilled workers, while the trap effect dominates for unskilled workers.

As a previous step, we obtain the surplus of the different job-worker matchings.

From (1), (2), (5), (6), (7) (8), and (9), the surplus of a job in a permanent and temporary contract occupied by a worker of type $i \in \{H, L\}$ is given, respectively, by:

$$S_{iP} = \frac{y_i - z + r(f - c)}{r + \phi} - \frac{\beta h(\theta)}{r + \phi} S_{iT} \quad (11)$$

$$S_{iT} = \frac{y - z - rc - \lambda(1 - p)f}{r + \lambda + \beta h(\theta)} + \frac{\lambda(1 - p)}{r + \lambda + \beta h(\theta)} (\max\{f, S_{iP}\}) \quad (12)$$

The surplus of a permanent job (11) with a i -worker is equal to the discounted flows obtained in the matching net of the i -worker's discounted value of continued search. This latter value is the surplus of a temporary job with a i -worker weighted by the bargaining power of the worker and the probability of finding a temporary job. Therefore, the surplus of a permanent job decreases with the value of a temporary job.

On the other hand, the surplus of a temporary job (12) with a i -worker is equal to the discounted flows obtained in the matching. These flows have two components. The first one is the flows obtained inside the temporary relationship. The second one is the maximum value between the firing costs and the surplus of a permanent job with a i -worker. The latter component can be interpreted as a consequence of the decision of the firm whether to convert the temporary job into permanent or not once there is a good change in productivity.

From (12), it follows a crucial condition which determines the conversion of temporary jobs into permanent. It is stated in the following corollary.

Corollary 1 *A match between a firm and a i -worker is only profitable under a permanent contract when:*

$$S_{iP} \geq f$$

Corollary 1 states that after a good change in productivity the firm decides to keep i -worker in a permanent job only if the surplus generated under a permanent job is greater or equal to the firing costs. The intuition behind this result is simple: to convert a temporary job into permanent cannot be profitable if the firing costs the employer has to pay once the worker has been hired under a permanent contract exceeds the value of this conversion, S_{iP} . Otherwise, the firm is better off laying off the worker after a good change in productivity.

The condition of conversion stated in Corollary 1 can be rearranged to express it in terms of the productivity of the match, which depends on the type of worker.

Lemma 2 *There exists a threshold productivity value,*

$$\bar{y} = z + \frac{\beta h(\theta)}{r + \lambda + \beta h(\theta)} (y - z) + \left(1 - \frac{\beta h(\theta)}{r + \lambda + \beta h(\theta)}\right) rc + \phi f$$

such that if $y_i \geq \bar{y}$, where $i \in \{H, L\}$, a temporary job with a i -worker will be converted into permanent. By contrast, if $y_i < \bar{y}$, a temporary job with a i -worker is not converted into permanent.

Proof. It follows immediately from (11), (12) and Corollary 1. ■

The threshold productivity $\bar{y}$ is the sum of four elements. The first two are the worker's outside option, which is the sum of the value of being unemployed and the value of being hired under a temporary job in another firm. The third one is the set up costs of the employer and the fourth one is the firing costs. Therefore, a temporary job is converted into permanent only if the worker's productivity exceeds the worker's outside option, the set up costs and the firing costs. In other terms, the higher any of these elements the more difficult for a worker to access a permanent job.

Now, we are ready to characterize the equilibrium of this model. The type of equilibrium will depend on whether the productivity of a skilled and unskilled worker exceeds the threshold productivity $\bar{y}$.

Proposition 3

- i) If $y_L < y_H < \bar{y}$, there exists a unique **no conversion equilibrium**, where temporary jobs with skilled and unskilled workers are never converted into permanent.*
- ii) If $\bar{y} \leq y_L < y_H$, there exists a unique **full conversion equilibrium**, where temporary jobs with skilled and unskilled workers are always converted into permanent.*
- iii) If $y_L < \bar{y} \leq y_H$, there exists a unique **segmentation equilibrium**, where only temporary jobs with skilled workers are converted into permanent.*

Proof. See Appendix 1. ■

Depending on the parameters of the model, three possible equilibria may arise. The first one is the no conversion equilibrium in which neither type of worker can access to permanent jobs. The new value of productivity of either a skilled and an unskilled worker is too low and the firm prefers to lay-off the worker and hire another one under a temporary contract rather than convert the current temporary contract into permanent. In this case, temporary contracts are dead-end jobs for skilled and unskilled workers (trap effect).

The second one is the full conversion equilibrium in which both types of workers can access to permanent jobs. The new value of productivity for any type of worker is high enough and the firm prefers to convert the current temporary contract into permanent. In this case, temporary contracts are a way to access to permanent contracts for both group of workers (stepping-stone effect).

The third one is the segmentation equilibrium in which only the skilled workers can access to permanent jobs. The new value of productivity is only high enough to convert the current temporary contract into permanent with a skilled worker. In this case, the stepping stone effect dominates for skilled workers, while the trap effect dominates for unskilled workers.

What determines whether the stepping stone effect or the trap effect dominates for skilled and unskilled workers is the value of productivity exceeding or not the threshold productivity value. The latter depends, in turn, on the worker's outside option, the firm's set up costs and the firing costs.

The question we want to answer in the empirical part of the paper is whether there are significant different conversion patterns for skilled and unskilled workers (segmentation equilibrium) or similar ones (full conversion and no conversion equilibrium). In other words, whether the stepping stone effect dominates for skilled workers and the trap effect for unskilled workers or not.

As a previous step, let us move on to briefly discuss through some simulations the effects of a change in some of the model's parameters.

2.2 Comparative statics

In this section we run some simulations in order to illustrate quantitatively the comparative statics of the model. In the baseline case, we use the matching function $m(\theta) = 2\sqrt{\theta}$ and we assume that $y = 1$, $y_H = 1.2$, $y_L = 0.8$, $\mu = 0.25$, $f = 0.2$, $\beta = 0.5$, $\lambda = 0.3$, $\phi = 0.1$, $p = 0.5$, $r = 0.03$, $z = 0.2$, $k = 0.01$ and $c = 0.3$.

The benchmark simulation is presented in Table 1. This parameter configuration is such that there is a segmentation equilibrium. We do this because this type of equilibrium is confirmed by the empirical part of the paper. This case generates an unemployment rate of about 11% percent. An equilibrium value of $\theta = 1.01$, which implies that the average duration of unemployment is 5.94 months and the average duration of a vacancy is 6.05.

In Tables 2 to 5, we show the comparative statics of a change in unemployment insurance, firing costs, destruction rate of temporary contracts (λ) and destruction rate of permanent contracts (ϕ).

We find that when the unemployment insurance increases, the worker's outside is higher and the threshold productivity level increases and, thus, it makes more difficult the conversion of temporary contracts into permanent. Besides, the equilibrium value of θ diminishes. Higher firing costs make permanent contracts less profitable, and, thus, they increase the threshold productivity level. Furthermore, they diminish the equilibrium value of θ . A higher destruction rate of temporary contracts makes more profitable the conversion into permanency and, thus, it diminishes the threshold productivity level. Besides, it yields a lower equilibrium value of θ . A higher destruction rate of permanent contracts makes less profitable the conversion into permanency, and, thus, it increases the threshold productivity level. Besides, it yields a lower equilibrium value of θ .

3 The Empirical Results

The aim of this section is to test whether there are significant different conversion patterns for skilled and unskilled workers (segmentation equilibrium) or similar ones (full conversion and no conversion equilibrium). In addition, we test for other worker's characteristics. We do so using a competing risks model with multi-spells focusing on Spain. A study of Spain is especially compelling for many reasons. First, as in the theoretical model, the Spanish labor market is a "two-tier system", in which firing costs only apply to the termination of permanent contracts. Secondly, Spain provides a fascinating case of study since the share of temporary contracts is the highest in Europe (see Table 15 and Figure 2). Whereas the average share of temporary contracts in the European Union of 15 States has remained around 12% during the nineties, in Spain has remained far beyond the 30%. For this purpose, we use the ECHP that has a longitudinal structure and contains abundant information on workers' transitions across labor market states and the type of contract held.

3.1 Data and variables

We use individual records from the six first waves of the ECHP (1994-1999)⁸. The ECHP has been designed to compare different aspects of European countries and annually interviews a representative sample of 80.000 households, of which 8.000 are Spanish. The same individuals are reinterviewed each successive year, and if they leave their original households to form a new one, all adults' members of these new households are also interviewed. Similarly, children in original households are interviewed when they are sixteen. The sample remains broadly representative of the Spanish population.

In the ECHP an extensive effort is made to collect detailed information about several aspects of individuals, including labor market histories. At each date of interview, individuals are asked detailed questions related to their current employment status (type of contract, occupation, industry, size of firm, etc).

⁸The wave of 1994 is only used to obtain the starting points of spells since it does not contain information about the type of contracts.

More importantly, individuals are asked to recall start date of current job and finish date of last job. Recently, some studies have used this dataset for workers' transition analysis such as Jolivet et al (2004) and D'Addio and Rosholm (2004).

A key point of this kind of analysis relies on what we include as a temporary contract. In contrast to previous works, as Guell and Petrongolo (2004), we restrict ourselves to a narrow definition of a temporary contract. As a temporary contract we include fixed-term contract, casual work and other arrangements for workers who are working with an employer in paid employment more than fifteen hours a week. Hence, we exclude "contrato en prácticas"⁹ and other variety of training contracts. With this definition we want to consider just those contracts which are susceptible of becoming a bridging function to permanency.

In order to test the main prediction of the theoretical model, we are interested both in analyzing the determinants of transitions from temporary employment to other states and how long do temporary contracts last. Therefore, we select only those individuals who had a temporary contract at least twice in the period analyzed. It should be noted that in Spain the vast majority of new contracts start with a temporary contract (see Table 14). For other countries, other works such as Zijl et al (2004) focus on a sample of unemployed and analyze the different transitions from unemployment.

The duration of each spell is constructed using information of the individual questionnaire from the successive waves. Spell duration is defined as months in the same job with the same employer and not involving a promotion in a permanent position. To each job spell we have attached a vector of demographic, household, job related and local labor market conditions, and the details of previous labor market status. As the dataset is annual¹⁰, we determine the spell duration relying on the information concerning to the type of contract held and main activity. We can determine the start (last) date of the spell using the variable, month starting the current job (month finishing the last job).

We are also interested in where workers go at the conclusion of a temporary job. The data allow us to distinguish among four states: a) having a permanent position¹¹ (regardless of the firm)¹² b) unemployment¹³ c) other states as inactivity d) other temporary contract¹⁴. For the empirical analysis purposes, we merge three of the states: unemployment, inactivity and temporary in other firm, since all these states correspond to "negative" transitions. The transi-

⁹ A contract introduced in Spain in 1993 intended to provide training to the workers.

¹⁰ Despite its annual nature, retrospective information on past labour market status in the last five years enables to identify short spells. Moreover, it is interesting to note that the average duration of temporary contracts in Spain lied around 13/16 months in the nineties (see Arranz and Serrano (2004)).

¹¹ It is considered an absorption state since in our sample it is observed that workers do not move from a permanent contract to other states.

¹² When the individual obtains a permanent position in the same firm we have no information about the timing. We assume that in this case the spell finishes in december.

¹³ In order to define this state we use the LFS classification.

¹⁴ As no direct information is provided, we follow the variable year starting the current job and year finishing last job during different waves in order to obtain if the individual switches the contract.

tion to permanency allows us to test the stepping-stone hypothesis whereas the transition to "other states" will be useful to contrast whether some temporary contracts are dead-end jobs by themselves.

Finally, censoring occurs at either wave six or at the point whether the individual drops out the survey.

One particular advantage of our dataset is that it allows to obtain more than one single spell per individual. We have 2756 individuals and the final sample provides 3793 spells. We use up to four spells per individual. Jobs that start prior to the wave one are discarded, since we have not information about start date and duration. We also drop some spells because we have missing information about the elapsed duration.

The explanatory variables¹⁵ used in our analysis include: a continuous variable for age; a dummy for marital status; education levels included as categorical variables, that is, two dummies measuring the level of education. These variables allow us to establish whether more educated workers are more likely to make transitions to permanency and less likely to go to "negative states"; a variable measuring previous labor market attachment are introduced to identify the impact of previous unemployment on future transitions, a dummy reflecting whether the individual has been long term unemployed; a dummy to indicate if the individual works in the public sector; short-term macroeconomic variations were controlled for through the introduction of a variable measuring the unemployment rate disaggregated by sex and area at the starting point of each spell.

Descriptive statistics are provided in Table 6. Table 7 shows the transition in successive spells by destination. We observe 832 permanent spells and it should be noticed that 678 are made in the first spell. By contrast, we observe a rough persistence of transitions to "other states", 687 are made after the second spell out of 2070.

In Table 8 we provide the duration patterns by destination states. We can observe that many individuals move from temporary contracts to "other states" in the 12-24 months (42.6%). This clearly indicates two different patterns of transitions.

Finally, in Figures 3 and 4 we provide the Kaplan-Maier survival functions for both transition rates disaggregated by education level for exit to permanency and for exit to "other states". The differences between the survival functions to permanency are remarkable indicating a big influence of education. At the start of the spell they are quite similar, but past twelve months of a temporary contract the survival rate of high educated workers becomes much smaller.

The survival functions to "other states" also indicate the important role of education in the exit rates from temporary contracts. We observe that high educated workers have a lower exit rate to "other states" than low educated workers. The difference between the survival functions becomes larger with the duration of the temporary contract.

¹⁵ Given the difficulties of convergence in the estimation of the econometric model, we restrict to a limited set of explanatory variables.

3.2 The Econometric Model

In this section we are going to present the econometric model, a competing risks framework¹⁶. Formally, a competing risks model is a duration model where the unobserved duration is the shortest of a number of latent durations (T_1, T_2) . In addition, it is also typically assumed that the identity of the shortest duration is observed, that is, the observed duration is $T = \min(T_1, T_2)$, where T_1 and T_2 are realizations of these two risks. In our model, T_1 and T_2 are, respectively, the length of a spell of temporary contract ended in permanency and in "other states" (which includes inactivity, unemployment and a new temporary contract as it was explained in the previous section).

First, we are going to assume that the durations T_1 and T_2 vary with observable characteristics. In order to specify the model, we focus on the correlated hazard rate. Therefore, the hazard is defined as the probability of exiting from a state in a short interval of length dt after t ,

$$\lim_{dt \rightarrow 0} \frac{\Pr(t < T < t + dt)}{dt}$$

Suppose we observe more than one spell per individual. The specification of the hazard rates for all spells of type k takes the logistic hazard form. Then,

$$\theta_1(t_k) = \Pr(T_1 = t_k | T_1 \geq t_k) = F[\alpha_0(t_k) + \beta_1 X]$$

$$\theta_2(t_k) = \Pr(T_2 = t_k | T_2 \geq t_k) = F[\alpha_1(t_k) + \beta_2 X]$$

where $\alpha_0(t)$ and $\alpha_1(t)$ are the baseline hazard that are modeled in a flexible way, with t and t^2 and X is a vector of individual, sectorial and aggregate parameters.

We consider as Prentice and Gloeckler (1978) and Meyer (1990) that (T_1, T_2) has a continuous positive density conditional on X , but T is a set of grouped events. This approach provides a useful perspective for both statistical and computational point of view as has been noted by a great number of authors as Meyer (1990) and Meghir and Whitehouse (1997)¹⁷.

The individual loglikelihood for each spell of each individual to each transition is defined as:

$$\begin{aligned} \log L_{1ik} &= \sum_{t_k=1}^{T_k-1} ((1 - \delta_{1ik}) \log(1 - \theta_{1i}(t_k)) + \delta_{1ik} \log(\theta_{1i}(T_k))) \\ \log L_{2ik} &= \sum_{t_k=1}^{T_k-1} ((1 - \delta_{2ik}) \log(1 - \theta_{2i}(t_k)) + \delta_{2ik} \log(\theta_{2i}(T_k))) \end{aligned}$$

¹⁶ See Lancaster (1990) for a detailed discussion of a competing risk models.

¹⁷ See Han and Hausman (1990) for the identifiability of this kind of models.

where T_k is the length of k -spell, δ_{1ik} is equal to 1 if the spell k exits state 1 and δ_{2ik} is equal to 1 if the spell k exits state 2. In absence of unobserved heterogeneity, each spell can be considered as conditionally independent and the likelihood function can be maximized separately.

3.3 Unobserved Heterogeneity

An alternative to the above model is one where the transition equations depend on unobserved heterogeneity. In this case, estimation becomes more complicated since the transition probabilities cannot be treated a priori as independent conditional on the unobservables, and the spells cannot be treated separately. Better individuals have a higher transition rate to permanency than bad ones. To deal with this selectivity inflow, we need to specify the likelihood function for all transitions for any individual and integrate out the random effects. If the random effects are not included in this way, we cannot interpret our results in a causal way. The inclusion of unobserved heterogeneity also allows for measurement errors in the dependent variable as well as omitted unobserved covariates.

We introduce two unobserved random vectors, u_j , $j = 1, 2$, where 1 is equal to permanency and 2 is equal to "other states"¹⁸. Then, the previous hazard rates take the form:

$$\theta_j(t, u_j) = F[\alpha_0(t_k) + \beta_1 X + u_j]$$

We assume that the heterogeneity term vary for a given individual, as it was assumed by Bonnal et al (1997), van den Berg et al (2002) and Zijl et al (2005). In this case, the marginal individual likelihood, given X contribution and $u = [u_1, u_2]$ for a given individual is:

$$L_i = \int \prod_{j=1}^2 \prod_{k=1}^{m_i} \left(\prod_{t_k=1}^{T_k-1} (1 - \theta_{ji}(t_k, u_{ji})) \right)^{(1-\delta_{jik})} \prod_{j=1}^2 \theta_{ji}(T_k, u_{ji})^{\delta_{jik}} dG(u)$$

where, as before, $\delta_{jik} = 1$ if individual moved to state j in the k spell.

Following the work of Heckman and Singer (1984), we consider G a bivariate discrete distribution, yielding a mixture proportional model. In this sense, Flinn and Heckman (1983), Honoré (1993) and Abbring and van den Berg (2003) show that the mixed proportional hazard model with multispells data is identified under much weaker assumptions. We assume that each transition rate has two mass points (u_1^1, u_2^1) and (u_1^2, u_2^2) that gives us a distribution with four points of support. The associated probabilities are as follows:

$$\begin{aligned} \Pr(u_1 = u_1^1, u_2 = u_2^1) &= p_1 & \Pr(u_1 = u_1^2, u_2 = u_2^1) &= p_2 \\ \Pr(u_1 = u_1^1, u_2 = u_2^2) &= p_3 & \Pr(u_1 = u_1^2, u_2 = u_2^2) &= p_4 \end{aligned}$$

¹⁸It could be argued that it has to be integrated also the transition from unemployment to temporary, but in this case the results are quite dependent of functional forms (see van den Berg (2001)).

where $0 \leq p_i \leq 1, i = 1, \dots, 4$. We model $p_i = \frac{\exp(\alpha_i)}{1 + \sum \exp(\alpha_i)}$ to have a multinomial logit specification. Notice that we have to estimate jointly the likelihood function because of the introduction of unobserved heterogeneity.

3.4 Results

The parameters estimates are presented in Tables 9 and 10. As indicated in the previous subsection, we distinguish between two model specifications. In Table 9 we show the estimates of the covariate effects and the baseline hazards of the model without unobserved heterogeneity in the transition rates. Table 10 shows the estimates of the covariate effects and the baseline hazards of the model with correlated unobserved heterogeneity and Table 11 shows the estimates of the parameters of the distribution of the correlated unobserved heterogeneity. We use a bivariate discrete distribution with two mass points of support on each margin. We, thus, estimate four mass points of support and four associated probabilities. No further improvement in the likelihood function could be achieved by adding further points of support.

From Tables 9 and 10 we observe that some of the estimated covariate effects differ substantially between the two model specifications. Moreover, the model allowing for correlated unobserved heterogeneity in the exits rate yields a considerable higher likelihood than the model without unobserved heterogeneity. For this reason, we focus on the estimates of the model with correlated unobserved heterogeneity, although we briefly discuss the differences between the two specifications.

We first examine the transition rate from temporary to permanency. Our purpose is to investigate whether integrate transitions depend on workers' characteristics and, particularly, in workers' skills.

We find that workers with high education have a strong probability of finding a permanent job and this effect becomes stronger when we control for unobserved heterogeneity. Moreover, secondary education also has a positive effect in this transition. This result suggests that for more educated workers temporary contracts serve as a stepping stone.

Other interesting results are worth to mention. Age is very significant and negative, indicating that this transition is more likely to be made by younger people. In the model without unobserved heterogeneity, to be a woman decreases the exit rate to permanency, but this effect completely disappears in the model with unobserved heterogeneity. A particular strong effect is obtained for married people. Workers that have experienced a long-term unemployment spell are significantly less likely to gain permanency.

labor market conditions drop from -0.064 to -0.033 when we control for unobserved heterogeneity, but continue being significant. This indicates that adverse labor market conditions decrease the rate to obtain a permanent contract. Moreover, sector dummies show that renewal rates into permanency are higher in services. Public sector workers have lower rates of exit into permanency than

those in the private sector¹⁹.

Next, we analyze the transition from temporary jobs to "other states". This transition serves to test whether temporary contracts represent for low educated workers dead-end jobs. Not surprisingly, the estimates change substantially when we control for unobserved heterogeneity.

As opposed to the former transition, high educated workers have lower rates of exit into "other states" than no qualified workers. Secondary education also plays an important role in this transition. It is interesting to emphasize that this value becomes larger when we control for unobserved heterogeneity (-0.120 to -0.165). These results suggest that temporary contracts seem to be dead end jobs for low educated workers.

We summarize other interesting results. This probability is higher for females than males. Workers who have experienced long-term unemployment spells have a higher probability of ending in "other states". Sector effects also emerge in the data. Individuals employed in agriculture have the highest probability of ending in unemployment. When we control for unobserved heterogeneity sector effects highly increase.

Our results suggest that workers' skills play a key role in all the transitions. More specifically, for more educated workers temporary contracts serve as stepping stone. By contrast, low educated workers seem to experiment a penalty, that is, this group of workers seem to get stuck in temporary contracts. Most importantly, controlling for unobserved heterogeneity is quite important in order to obtain clear estimates. These results are consistent with the existence of a segmentation equilibrium in our theoretical model, in which two opposite dynamics of temporary contracts emerge for high and low skilled workers.

In Table 11 we present the results for the unobserved heterogeneity distribution. The parameter of p_1 is in the boundary of the parameter space ($p_1 = 0$). We compute the standard errors of the other parameters conditional on this. This indicates that there are three groups of individuals in the sample. The first group, (39 % of the population) has a relative low hazard rate to permanency ($u_1 = -6.795$), but also a relative low-hazard rate to go to "other states" ($u_2 = -7.824$). There exists a second group (40% of the population) with a high entry rate into permanency ($u_1 = -5.635$) and a high entry rate into "other states" ($u_2 = -4.881$). Finally, there exists a third group (20% of the population) with a low entry rate into permanency ($u_1 = -6.795$) and a high entry rate into "other states" ($u_2 = -4.881$).

In Figures 5 and 6, we present the predicted hazard for the transition to permanent and to "other states", respectively, for workers with higher education and workers with primary education evaluated in the reference categories and in the mean of age and unemployment rate.

In Figure 5, we can observe that the predicted transition rate to permanency

¹⁹This result is consistent with Dolado et al (2002). They find that the public sector has increased a lot the proportion of temporary hires for this period due to the fiscal consolidation pursued by the Spanish government after the Maastricht Treaty. This change in the hiring behavior of the public sector has also been reflected in a higher exit of public workers into unemployment.

is twice larger for higher educated workers than for non-educated. It is also interesting to note that the hazard rate increases with time until the 35 months and in this month starts decreasing. It can be interpreted as firms converting workers into permanent at the end of legal time. These results are consistent with Guell and Petrongolo (2004).

By contrast, In Figure 6, we can observe that for non-educated workers the transition rate to "other states" is 1.5 larger than for higher educated workers.

3.4.1 Specification Tests

Finally, we check the robustness of our results. It could be argued that focusing on a sample of population of workers between 16 and 65 can bias our results. For this reason, we restrict the sample to individuals younger than 35 in the first spell.

The results for the model with correlated heterogeneity are presented in Table 12. We observe that the main results do not change. More importantly, the role of education becomes more important in the transition to permanency, although secondary education is not significant in the transition to "other states".

This result reinforces the idea that skills play a key role in all the transitions: for high skilled workers temporary contracts serve as a stepping stone, whereas for low skilled workers seem to be dead-end jobs.

4 Conclusions

In this paper we analyze the dynamics of temporary jobs in a labor market characterized by worker's skill heterogeneity and employment protection.

In the first part of the paper we construct a labor market that incorporates skill differences across workers in order to identify under which conditions temporary contracts are a way for workers to access to permanent contracts (stepping stone effect) or they are dead-end jobs without any good prospect (trap effect).

We find that there are three possible cases which imply different conversion rates. The first one is the *no conversion equilibrium* (conversion rate is zero) in which it is not worthwhile for firms to convert temporary jobs into permanent neither if they are matched with a skilled or an unskilled worker. In this case, temporary contracts are dead-end jobs for both groups of workers (trap effect). The second one is the *full conversion equilibrium* (conversion rate is one) in which it is beneficial for firms to convert temporary jobs into permanent no matter the type of worker they are matched to. In this case, temporary contracts are a way to access to permanent contracts for both group of workers (stepping-stone effect). Finally, the *segmentation equilibrium* (conversion rate lies between zero and one) in which firms only convert temporary jobs into permanent when matched with a skilled worker. In this case, the stepping stone effect dominates for skilled workers, while the trap effect dominates for unskilled workers. The

emergence of one equilibrium over the other will depend crucially on the firing costs, among other factors.

The second part of the paper tests whether there are significant different conversion patterns (segmentation equilibrium) for skilled and unskilled workers or similar ones (full conversion/ no conversion equilibrium). In addition, we test for other worker's characteristics.

Our results suggest that workers' skills play a key role in all the transitions and they are consistent with the existence of a segmentation equilibrium in our theoretical model, in which two opposite dynamics of temporary contracts emerge for high and low skilled workers. More specifically, for high educated workers temporary contracts serve as stepping stone. By contrast, low educated workers seem to experiment a penalty, that is, this group of workers seem to get stuck in temporary contracts. In this sense, we observe that the predicted transition rate to permanency is twice larger for higher educated workers than for low educated and in the transition rate to "other states" it is 1.5 larger for low educated workers than for high educated workers. Most importantly, controlling for unobserved heterogeneity is quite important in order to obtain clear estimates.

References

- [1] Abbring, J.H. and G.J. van den Berg (2003) " The identifiability of the mixed proportional hazards competing risks model" *Journal of the Royal Statistical Society Series B* **65** (3), 701 - 710.
- [2] Alba-Ramirez, A. (1998) "How Temporary is Temporary Employment in Spain" *Journal of Labor Research* **19**, 695-710.
- [3] Arranz, J.M. and C. García-Serrano (2004) "Qué ha sucedido con la estabilidad del empleo en España?. Un Análisis desagregado con datos de la EPA: 1987-2003", *Instituto de Estudios Fiscales* **4**.
- [4] Blanchard, O. and A. Landier (2002) "The Perverse Effects of Partial Labor Market Reform: Fixed Duration Contracts in France", *Economic Journal* **112**, F214-F244.
- [5] Booth, A., M. Francesconi and J. Frank (2002) "Temporary Jobs: Stepping Stones or Dead-ends" *Economic Journal* **112**, F189-F213.
- [6] D'Addio, M. C. and M. Rosholm (2004) "Exits from Temporary Jobs in Europe: A Competing Risks Analysis" mimeo.
- [7] Dolado, J. J, C. Garcia-Serrano, and J.F. Jimeno (2002) "Drawing Lessons from the Boom of Temporary Jobs in Spain" *Economic Journal* **112**, F270-F295.

- [8] Flinn, C.J. and J. J. Heckman (1983) "The Likelihood Function of the Multivariate-Multiepisode Model" in Basmann, R. and Rodhes, G. editors *Advances in Econometrics*, vol.1 35-95.
- [9] Guell, M. and B. Petrongolo (2004) "How Binding are Legal Limits? Transitions from Temporary to Permanent Work in Spain" *IZA discussion paper* **782**.
- [10] Han, A. and J. Hausman (1990) "Flexible Parametric Estimation of Duration and Competing Risk Model" *Journal of Applied Econometrics* **5** (1), 1-28.
- [11] Heckman, J. and B. Singer (1984) "A Method for Minimizing the Impact of Distributional Assumptions in Econometric Models for Duration Data" *Econometrica* **52**, 271-320.
- [12] Honoré, B.E (1993) "Identification Results for Duration Models with Multiple Spells" *Review of Economics and Statistics* **60**, 241-246.
- [13] Jolivet, G., F. Postel-Vinay and J.M. Robin (2004) "The Empirical Content of the Job Search Model: Labor Mobility and Wage Distributions in Europe and the US" mimeo.
- [14] Lancaster, T. (1990) *Econometric Analysis of Transition Data*. Cambridge University Press: Cambridge.
- [15] Meghir, C. and E. Whitehouse "Labor market transitions and retirement of men in the UK" *Journal of Econometrics* **79**, 327-354.
- [16] Meyer, B.D. (1990) "Unemployment insurance and unemployment spells" *Econometrica* **58** (4), 757-782.
- [17] Prentice, R.L and L.A. Gloeckler (1978) "Regression analysis of grouped survival data with application to breast cancer data" *Biometrics* **34**, 57-67.
- [18] Toharia, L. (1996), "Empleo y paro en España: Evolución, Situación y Perspectivas" *Ekonomiaz* **35**, 36-61.
- [19] van den Berg, G.J. (2001) "Duration models: specification, identification and multiple durations", in Heckmand, J. and E. Leamer, eds, *Handbook of Econometrics* **vol. 5**, Chapter 55. Nort Holland, Amsterdam.
- [20] van den Berg, G.J., A. Holm and J.C. van Ours (2002) "Do stepping-stone jobs exists? Early career paths in the medical profession" *Journal of Population Economics* **15**, 647-665.
- [21] van Ours, J. C. (2004) "The locking-in effect of subsidized jobs" *Journal of Comparative Economics* **32**, 37-55.
- [22] Wasmer, E. (1999) "Competition for Jobs in a Growing Economy and the Emergence of Dualism" *Economic Journal* **109**, 349-371.

- [23] Zijl, M., A. Heyma and G.J. van den Berg (2004) "Stepping-stones for the unemployed: the effect of temporary jobs on the duration until regular work" *IZA discussion paper* **1241**.

5 Appendices

Appendix 1. Proof of Proposition 3

A steady-state equilibrium in this model is a collection of three variables $\{\theta, u, \eta\}$ that satisfy the following conditions:

- (a) firm vacancy creation satisfies free entry condition
- (b) the flow of H-type workers into and out of unemployment is equal, and the same for L-type workers.

Applying free entry condition to (10), we obtain:

$$k + (r + l(\theta))c = \eta l(\theta) J_{HT} + (1 - \eta) l(\theta) J_{LT} \quad (13)$$

Using (3), $J_{iT} = (1 - \beta) S_{iT}$. (13) can be rewritten as:

$$(1 - \beta) [\eta S_{HT} + (1 - \eta) S_{LT}] - \frac{k + (r + l(\theta))c}{l(\theta)} = 0 \quad (14)$$

The flow of workers into and out of unemployment depends on the type of equilibrium.

Case (i). No conversion equilibrium.

This equilibrium arises if match between a firm and any type of workers is never profitable under a permanent contract. From Lemma 2, this happens when $y_L < y_H < \bar{y}$.

We have to prove that this equilibrium exists and it is unique.

From Corollary 1, (12) can be rewritten as:

$$S_{LT} = S_{HT} = \frac{y - z - rc}{r + \lambda + \beta h(\theta)} \quad (15)$$

Since in this case a permanent contract is never profitable and, therefore, $S_{LP} < f$ and $S_{HP} < f$.

From (15), free entry condition (14) in a no conversion equilibrium is given by:

$$\frac{k + (r + l(\theta))c}{l(\theta)} = (1 - \beta) \left[\frac{y - z - rc}{r + \lambda + h(\theta)\beta} \right] \quad (16)$$

Condition (b) in a no conversion equilibrium implies:

For H-type workers:

$$h(\theta) \eta u = \lambda (\mu - \eta u) \quad (17)$$

For L-type workers:

$$h(\theta) (1 - \eta) u = \lambda (1 - \mu - (1 - \eta) u) \quad (18)$$

The two steady-state conditions can be solved for η and u in terms of θ .

This yields:

$$\eta = \mu \quad (19)$$

$$u = \frac{\lambda}{\lambda + h(\theta)} \quad (20)$$

Therefore, a no conversion equilibrium is a vector of endogenous variables $\{\theta^*, u^*, \eta^*\}$ satisfying conditions (14), (19) and (20), that is, the free entry condition and the two steady state conditions.

To solve for the equilibrium given our assumptions on $m(v, u)$, (16) has a unique solution for θ . If we insert this solution on (19) and (20) we get a unique solution for η and u . Therefore, when we have a no conversion equilibrium, it is unique.

Case (ii). Full conversion equilibrium.

This equilibrium arises if it is always profitable for the employer to convert a temporary job into permanent for any type of worker. From Lemma 2, this happens when $\bar{y} \leq y_L < y_H$. We now proceed to prove that this equilibrium exists and it is unique.

From Corollary 1, (12) can be rewritten as:

$$S_{LT} = \frac{y - z - rc - \lambda(1 - p)f}{r + \lambda + \beta h(\theta)} + \frac{\lambda(1 - p)}{r + \lambda + \beta h(\theta)} S_{LP} \quad (21)$$

$$S_{HT} = \frac{y - z - rc - \lambda(1 - p)f}{r + \lambda + \beta h(\theta)} + \frac{\lambda(1 - p)}{r + \lambda + \beta h(\theta)} S_{HP} \quad (22)$$

Solving (21) and (22) with (12) we have:

$$S_{LT} = \frac{(r + \phi)(y - z - rc) + \lambda(1 - p)(y_L - \phi f - z - rc)}{r^2 + (\phi + \lambda + \beta h)r + \beta h(\phi + \lambda(1 - p)) + \lambda\phi} \quad (23)$$

$$S_{HT} = \frac{(r + \phi)(y - z - rc) + \lambda(1 - p)(y_H - \phi f - z - rc)}{r^2 + (\phi + \lambda + \beta h)r + \beta h(\phi + \lambda(1 - p)) + \lambda\phi} \quad (24)$$

From (23) and (24), free entry condition (14) in a full conversion equilibrium is given by:

$$(1 - \beta) \left[\begin{array}{c} \eta \left(\frac{(r+\phi)(y-z-rc) + \lambda(1-p)(y_H - \phi f - z - rc)}{r^2 + (\phi + \lambda + \beta h)r + \beta h(\phi + \lambda(1-p)) + \lambda\phi} \right) + \\ (1 - \eta) \left(\frac{(r+\phi)(y-z-rc) + \lambda(1-p)(y_L - \phi f - z - rc)}{r^2 + (\phi + \lambda + \beta h)r + \beta h(\phi + \lambda(1-p)) + \lambda\phi} \right) \end{array} \right] - \frac{k + (r + l(\theta))c}{l(\theta)} = 0 \quad (25)$$

Condition (b) in a full conversion equilibrium implies:

For H-type workers:

$$h(\theta) \eta u = \lambda(p + (1-p)\phi)(\mu - \eta u) \quad (26)$$

For L-type workers:

$$h(\theta)(1 - \eta)u = \lambda(p + (1-p)\phi)(1 - \mu - (1 - \eta)u) \quad (27)$$

The two steady-state conditions can be solved for η and u in terms of θ . This yields:

$$\eta = \mu \quad (28)$$

$$u = \frac{\lambda(p + (1-p)\phi)}{\lambda(p + (1-p)\phi) + h(\theta)} \quad (29)$$

Therefore, a full conversion equilibrium is a vector of endogenous variables $\{\theta^*, u^*, \eta^*\}$ satisfying conditions (25), (28) and (29).

To solve for the equilibrium given our assumptions on the matching function, (25) as a unique solution for θ . If we insert this solution on (28) and (29) we get a unique solution for η and u . Therefore, when we have a full conversion equilibrium, it is unique.

Case (iii). Segmentation equilibrium

A segmentation equilibrium arises when it is only profitable for a firm to convert a temporary contract into permanent with a skilled worker. From Lemma 2, this happens when $y_L < \bar{y} \leq y_H$. We have to prove that this equilibrium exists and it is unique.

From Corollary 1, (12) can be rewritten as:

$$S_{LT} = \frac{y - z - rc}{r + \lambda + \beta h(\theta)} \quad (30)$$

$$S_{HT} = \frac{y - z - rc - \lambda(1-p)f}{r + \lambda + \beta h(\theta)} + \frac{\lambda(1-p)}{r + \lambda + \beta h(\theta)} S_{HP} \quad (31)$$

From (11), (31) becomes:

$$S_{HT} = \frac{(r + \phi)(y - z - rc) + \lambda(1-p)(y_H - \phi f - z - rc)}{r^2 + (\phi + \lambda + \beta h)r + \beta h(\phi + \lambda(1-p)) + \lambda\phi} \quad (32)$$

From (30) and (32), free entry condition (14) is given by:

$$(1 - \beta) \left[\eta \left(\frac{(r + \phi)(y - z - rc) + \lambda(1 - p)(y_H - \phi f - z - rc)}{r^2 + (\phi + \lambda + \beta h)r + \beta h(\phi + \lambda(1 - p)) + \lambda \phi} \right) + \right. \\ \left. (1 - \eta) \left(\frac{y - z - rc}{r + \lambda + \beta h(\theta)} \right) \right] - \frac{k + (r + l(\theta))c}{l(\theta)} = 0 \quad (33)$$

Conditin (b) in a segmentation equilibrium implies:

For H-type workers:

$$h(\theta) \eta u = \lambda(p + (1 - p)\phi)(\mu - \eta u) \quad (34)$$

For L-type workers:

$$h(\theta)(1 - \eta)u = \lambda(1 - \mu - (1 - \eta)u) \quad (35)$$

The two steady-state conditions can be solved for η and u in terms of θ . This yields:

$$\eta = \frac{\frac{\lambda(p + (1 - p)\phi)}{\lambda(p + (1 - p)\phi) + h(\theta)} \mu}{\frac{\lambda}{\lambda + h(\theta)}(1 - \mu) + \frac{\lambda(p + (1 - p)\phi)}{\lambda(p + (1 - p)\phi) + h(\theta)} \mu} \quad (36)$$

$$u = \frac{\lambda}{\lambda + h(\theta)}(1 - \mu) + \frac{\lambda(p + (1 - p)\phi)}{\lambda(p + (1 - p)\phi) + h(\theta)} \mu \quad (37)$$

Therefore, a segmentatin equilibrium is a vector of endogenous variables $\{\theta^*, u^*, \eta^*\}$ satisfying conditions (33), (36) and (37), that is, the free entry condition and the two steady state conditions.

To solve for the equilibrium given our assumptions on the matching function, (33) has a unique solution for θ . If we insert this solution on (36) and (37) we get a unique solution for η and u . Therefore, when we have a no conversion equilibrium it is unique.

Appendix 2. Matching segmented technology

Assume now that the matching technology with two types of workers is as follows: the total number of matchings is a constant returns to scale function in $m(v, u)$. Firms, ranking workers H and L , choose the first type of worker so that there are $m_H = m(v, \eta u)$ hires with H -type workers and $m_L = m(v, u) - m(v, \eta u)$ hires with L -type workers.

The ratio of vacancies to the number of unemployed of type- i is denoted by θ_i , where $i \in \{H, L\}$ and $\theta = \theta_H + \theta_L$.

The arrival rate of vacancies to workers of type- H is denoted by:

$$h_H = \frac{m_H}{\eta u} = \frac{m(v, \eta u)}{\eta u} = m(\theta_H, 1) \quad (38)$$

The arrival rate of vacancies to workers of type- L is denoted by:

$$\begin{aligned}
h_L &= \frac{m(v, u)}{(1 - \eta)u} - \frac{m(v, \eta u)}{(1 - \eta)u} \\
h_L &= \frac{h(\theta)}{1 - \eta} - \frac{\eta h_H}{1 - \eta} \\
h_L &= \frac{h(\theta) - \eta h_H}{1 - \eta}
\end{aligned} \tag{39}$$

Notice that $\frac{\partial h_L}{\partial \eta} < 0$, that is, as the proportion of H -type workers among the unemployed increases, decreases the probability of matching of L -type workers.

Using (38) and (39), we obtain:

$$h(\theta) = \eta h_H + (1 - \eta) h_L$$

On the other hand, vacancies meet unemployed workers at the rate:

For H -type workers:

$$l_H = \frac{m_H(v, \eta u)}{v} = m_H\left(1, \frac{1}{\theta_H}\right) = \theta_H h_H$$

For L -type workers:

$$l_L = \frac{m_L(v, (1 - \eta)u)}{v} = m_L\left(1, \frac{1}{\theta_L}\right) = \theta_L h_L$$

In deriving the asset value equations, (9) and (10) now become:

$$\begin{aligned}
rU_i &= z + h_i(W_{iT} - U_i) \\
rV &= -k + l_H(J_{HT} - V) + l_L(J_{LT} - V)
\end{aligned}$$

In deriving the equilibrium, the surplus of a job in a permanent and temporary contract occupied by a worker of type $i \in \{H, L\}$ (11) and (12) now become:

$$S_{iP} = \frac{y_i - z + r(f - c)}{r + \phi} - \frac{\beta h_i}{r + \phi} S_{iT} \tag{40}$$

$$S_{iT} = \frac{y - z - rc - \lambda(1 - p)f}{r + \lambda + \beta h_i} + \frac{\lambda(1 - p)}{r + \lambda + \beta h_i} (\max\{f, S_{iP}\}) \tag{41}$$

We have two threshold productivity values, one for each type of worker:

$$\begin{aligned}
\bar{y}_H &= z + \frac{\beta h_H}{r + \lambda + \beta h_H} (y - z) + \left(1 - \frac{\beta h_H}{r + \lambda + \beta h_H}\right) rc + \phi f \\
\bar{y}_L &= z + \frac{\beta h_L}{r + \lambda + \beta h_L} (y - z) + \left(1 - \frac{\beta h_L}{r + \lambda + \beta h_L}\right) rc + \phi f
\end{aligned}$$

Since $h_H > h(\theta) > h_L$ for any $0 < \eta < 1$,

$$\overline{y}_H > \overline{y} > \overline{y}_L$$

Therefore,

- There exists a full conversion equilibrium if

$$\begin{aligned} y_H &\geq \overline{y}_H \\ y_L &\geq \overline{y}_L \end{aligned}$$

- There exists a segmentation equilibrium if

$$\begin{aligned} y_H &\geq \overline{y}_H \\ y_L &< \overline{y}_L \end{aligned}$$

- There exists a no conversion equilibrium if

$$\begin{aligned} y_H &< \overline{y}_H \\ y_L &< \overline{y}_L \end{aligned}$$

Appendix 3. Comparative statics

Table 1: Benchmark Simulation

Type of Equilibrium	$\bar{y}$	θ
Segmented	0.8249	1.017

Table 2: Comparative Statics for z

z	0.2	0.4	0.6	0.8
Type of Equilibrium	Segmented	Segmented	Segmented	Segmented
$\bar{y}$	0.8249	0.8301	0.839	0.864
θ	1.017	0.4862	0.1466	0.0055

Table 3: Comparative statics for f

f	0.01	0.2	0.4	0.6
Type of Equilibrium	Segmented	Segmented	Segmented	Segmented
$\bar{y}$	0.8064	0.8249	0.8445	0.864
θ	1.0228	1.017	1.0109	1.0048

Table 4: Comparative statics for λ

λ	0.2	0.3	0.4	0.5
Type of Equilibrium	Segmented	Segmented	Fully Conversion	Fully Conversion
$\bar{y}$	0.8814	0.8249	0.7806	0.7405
θ	1.1736	1.017	0.9826	0.9410

Table 5: Comparative statics for ϕ

ϕ	0.05	0.1	0.15	0.2
Type of Equilibrium	Segmented	Segmented	Segmented	Segmented
$\bar{y}$	0.8169	0.8249	0.8336	0.8425
θ	1.0452	1.017	0.9981	0.9845

Appendix 4. Tables

Table 6: Summary statistics

	Mean	Std	Max	Min
Age	31.04	10.13	66	16
Woman	0.38	0.48	1	0
Unemployment Rate	0.17	0.05	0.29	0.10
Married	0.46	0.50	1	0
Other States	0.53	0.50	1	0
Agriculture	0.07	0.25	1	0
Industry (reference category)	0.40	0.49	1	0
Services	0.52	0.50	1	0
Primary Education (reference category)	0.70	0.46	1	0
Secondary Education	0.18	0.39	1	0
Higher Education	0.12	0.32	1	0
Public Sector	0.12	0.32	1	0
Long Term Unemployed	0.38	0.48	1	0

Note: All characteristics referred at the beginning of the spell.

Table 7: Number of spells by destination

	First spell	Second Spell	Third Spell	Fourth Spell	TOTAL
Censored	695 (25.2%)	170 (19.7%)	24 (15.6%)	2 (11.1%)	891 (23.5%)
Permanent	678 (24.6%)	144 (16.6%)	8 (5.2%)	2 (11.1%)	832 (21.9%)
Other States	1383 (50.2%)	551 (63.7%)	122 (79.2%)	14 (77.8%)	2070 (54.6%)
TOTAL	2756 (100%)	865 (100%)	154 (100%)	18 (100%)	3793 (100%)

Table 8: Number of spells by duration in months

N. of months	Censored	Permanent	Other states	TOTAL
1-6	132 (14.8%)	60 (7.2%)	193 (9.3%)	385 (10.2%)
7-12	317 (35.6%)	306 (36.8%)	606 (29.3%)	1229 (32.4%)
13-24	301 (33.8%)	356 (42.8%)	1009 (48.7%)	1666 (43.9%)
25-80	141 (15.8%)	110 (13.2%)	262 (12.7%)	513 (13.5%)
TOTAL	891 (100%)	832 (100%)	2070 (100%)	3793 (100%)

Table 9: Estimation results without unobserved heterogeneity

	Exit to permanent	Exit to other states
<i>Covariates</i>		
Age	-0.012 (0.004)	-0.005 (0.003)
Unemployment Rate	-0.064 (0.009)	-0.003 (0.005)
Woman	-0.183 (0.081)	0.192 (0.051)
Married	0.287 (0.087)	-0.046 (0.055)
Agriculture	-0.039 (0.178)	0.390 (0.087)
Services	0.278 (0.083)	-0.039 (0.054)
Secondary Education	0.227 (0.094)	-0.120 (0.063)
Higher Education	0.584 (0.105)	-0.552 (0.090)
Public Sector	-0.422 (0.123)	0.012 (0.076)
Long Term Unemployed	-0.198 (0.077)	0.174 (0.047)
Constant	-4.913 (0.230)	-6.573 (0.191)
<i>Duration dependence</i>		
t	0.198 (0.013)	0.1340(0.112)
t ²	-0.003 (0.0003)	-0.004(0.020)
Log Likelihood	-5200	
Number of Spells	3793	

Note: Standard errors in parenthesis.

Table 10: Estimation results with correlated unobserved heterogeneity

	Exit to permanent	Exit to other states
<i>Covariates</i>		
Age	-0.013 (0.005)	-0.009 (0.004)
Unemployment Rate	-0.033 (0.019)	0.001 (0.015)
Woman	0.088 (0.097)	0.266 (0.068)
Married	0.277 (0.104)	-0.035 (0.071)
Agriculture	-0.071 (0.208)	0.428 (0.117)
Services	0.286 (0.099)	-0.030 (0.070)
Secondary Education	0.268 (0.115)	-0.165 (0.084)
Higher Education	0.688 (0.132)	-0.655 (0.114)
Public Sector	- 0.589 (0.145)	-0.054 (0.097)
Long Term Unemployed	- 0.305 (0.093)	0.171 (0.062)
<i>Duration dependence</i>		
t	0.273 (0.018)	0.252 (0.011)
t^2	-0.004 (0.0004)	-0.004 (0.0003)
Log Likelihood	-5100	
Number of Spells	3793	

Note: Standard errors in parenthesis.

Table 11: Estimation results for unobserved heterogeneity distribution

Mass point	Estimate	Standard Error
<i>Exit to permanent</i>		
u_1^1	-5.635	0.225
u_1^2	-6.795	0.183
<i>Exit to other states</i>		
u_2^1	-7.824	0.320
u_2^2	-4.881	0.133
Probability		
p_2	0.389	0.031
p_3	0.399	0.056
p_4	0.212	-

Table 12: Estimation results with correlated unobserved heterogeneity for young workers

	Exit to permanent	Exit to other states
<i>Covariates</i>		
Age	-0.003 (0.014)	-0.045 (0.009)
Unemployment Rate	0.038 (0.019)	-0.013 (0.019)
Woman	-0.094 (0.011)	0.197 (0.08)
Married	0.370 (0.125)	0.084 (0.09)
Agriculture	-0.303 (0.26)	0.338 (0.147)
Services	0.188 (0.112)	-0.02 (0.081)
Secondary Education	0.284 (0.124)	-0.069 (0.091)
Higher Education	0.693 (0.148)	-0.429 (0.126)
Public Sector	-0.674 (0.171)	-0.254 (0.117)
Long Term Unemployed	- 0.356 (0.109)	0.255 (0.075)
<i>Duration dependence</i>		
t	0.265 (0.02)	0.244 (0.012)
t^2	-0.004 (0.0004)	-0.003 (0.0003)
Log Likelihood	-4900	
Number of Spells	2664	

Note: Standard errors in parenthesis. Restricted sample: only workers with less than 35 years old.

Table 13: Estimation results for unobserved heterogeneity distribution for young workers

Mass point	Estimate	Standard Error
<i>Exit to permanent</i>		
u_1^1	-5.74	0.38
u_1^2	-5.86	0.290
<i>Exit to other states</i>		
u_2^1	-7.78	0.490
u_2^2	-3.958	0.248
Probability		
p_2	0.388	0.036
p_3	0.407	0.065
p_4	0.205	-

Appendix 5. The Institutional Background

Spanish legislation on labor contracts is contained in the Workers ‘Statute of 1980 (Estatuto de los Trabajadores). This law when it was created considered indefinite contracts as the general case, whereas temporal contracts were intended to be used only for jobs whose nature was temporary (seasonal jobs, temporal substitution of permanent workers, etc).

Later on, it has been modified four times with the 1984, 1994, 1997 and 2001 reforms. The reform of 1984 introduced flexibility²⁰ establishing that it is no longer necessary that the activity associated to the job is of temporary nature. These contracts can be signed for a period between a minimum of six months and a maximum of three years. After three years, the contract cannot be renewed and the worker must be either fired or offered a permanent contract. In the former case, the firm cannot employ another worker for this job. In the case the dismissal is considered ”fair” by a judge, the worker receives the wage of 20 days per year of seniority. If considered ”unfair” by the judge, the worker receives the wage of 45 days per year of seniority for at least one year.

The 1994 and 1997 reforms, promoted permanent contracts by reducing their firing costs. In the 1994 reform it was almost eliminated the general applicability of temporary contracts (only was maintained for workers older than 45, disabled and long-term unemployed). and, moreover, firing legislation was modified to reduce the firing costs. The 1997 reform created a new type of permanent contract, with lower severance costs in case of unfair dismissal (33 days wage per year) and with fiscal incentives in the first two years of the contract (reductions of employers’ payroll taxes).

Finally, the 2001 reform extended the use of the new type of permanent contracts created in the 1997 reform and extended their use to other groups of workers. It was also introduced a severance payment of 8 days’ wages per year of seniority in temporary contracts not renewed.

²⁰For more details, see Toharia and Malo (1999).

Appendix 6. Descriptive Tables and Figures

Figure 1: Flows of the labor market

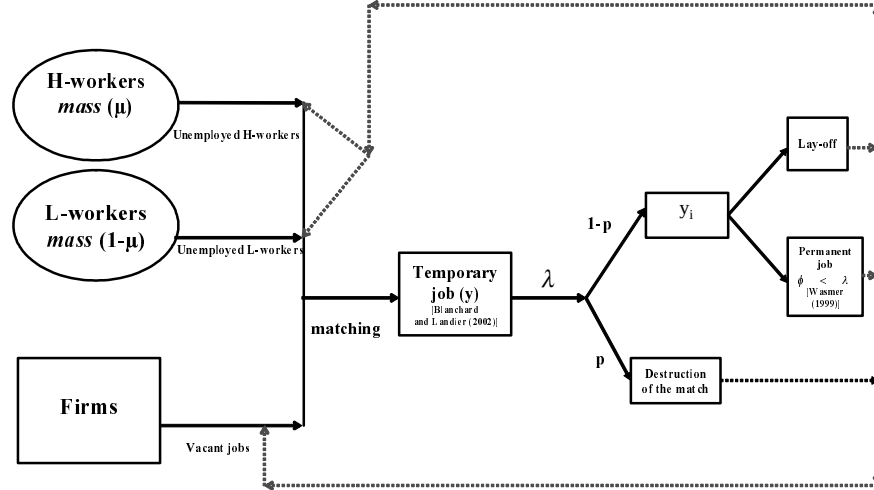


Table 14: Distribution of new contracts in percentage

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Permanent	5%	4.8%	5.1%	5.1%	5.1%	4.1%	2.9%	4.7%	3.8%	4.3%	5.8%
Temporary	95%	95.2%	94.9%	94.9%	94.9%	95.9%	97.1%	95.3%	96.2%	95.7%	94.2%

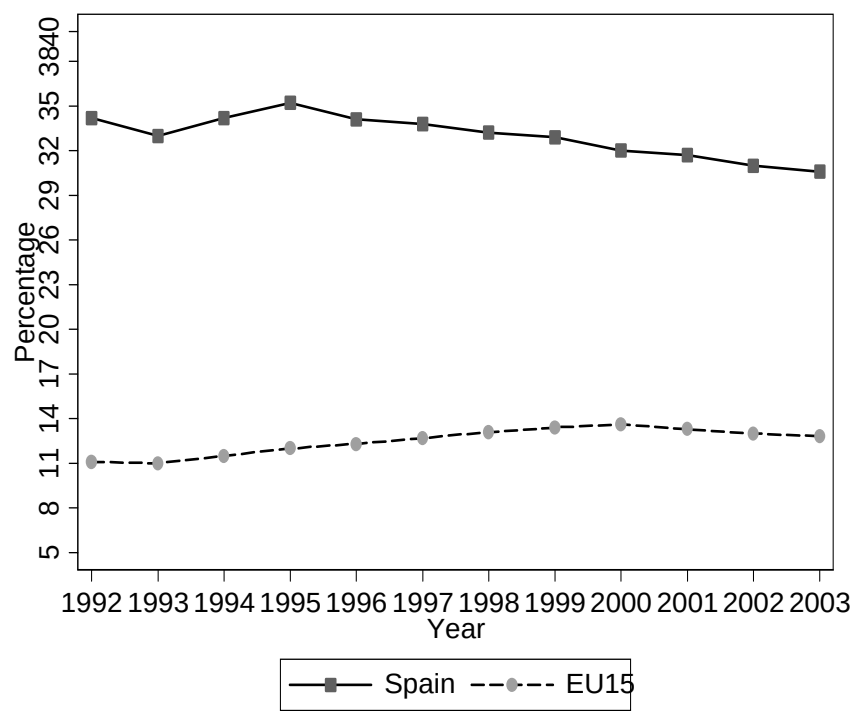
Source: Labour Force Survey.

Table 15: The proportion of temporary contracts in Europe (in percentage)

	Spain	UK	Sweden	Portugal	Netherlands	Italy	France	Germany	Denmark	EU15
1992	34.2	5.9	-	12.5	10.4	-	10.6	10.5	10.7	11.1
1993	33.0	6.3	12.0	11.5	10.5	6.2	10.9	10.3	10.6	11.0
1994	34.2	6.9	14.1	11.4	11.3	6.8	11.5	10.4	11.6	11.5
1995	35.2	7.2	14.7	12.0	11.4	7.4	12.4	10.5	11.6	12.0
1996	34.1	7.3	14.4	13.6	12.3	7.4	12.8	11.2	10.9	12.3
1997	33.8	7.6	15.1	15.4	11.8	7.9	13.4	11.8	10.6	12.7
1998	33.2	7.3	16.1	17.2	13.0	8.6	13.9	12.4	9.9	13.1
1999	32.9	7.0	16.5	18.7	12.3	9.5	14.5	13.0	9.6	13.4
2000	32.0	6.9	15.8	19.9	13.7	10.1	15.2	12.7	9.7	13.6
2001	31.7	6.7	15.2	20.4	14.3	9.8	14.6	12.4	9.2	13.3
2002	31.0	6.3	15.2	21.7	14.4	9.9	13.5	12.1	9.1	13.0
2003	30.6	6.1	15.1	21.1	14.6	9.9	12.9	12.2	9.3	12.8

Source: Eurostat.

Figure 2: The share of temporary contracts in Europe



Source: Eurostat

Figure 3: Transition to permanency

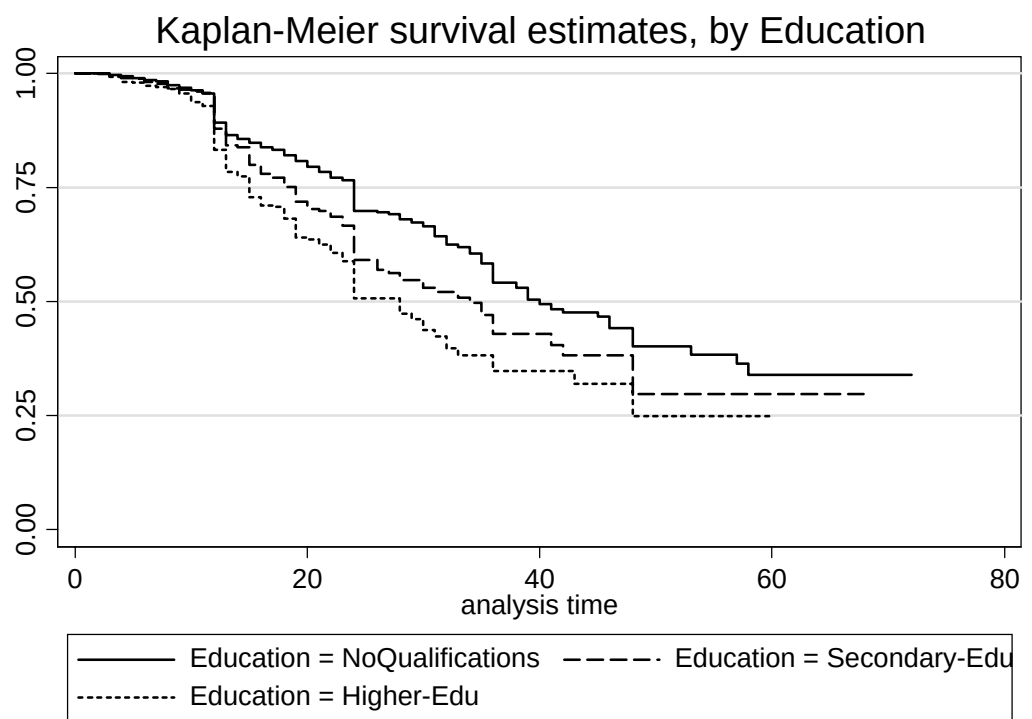
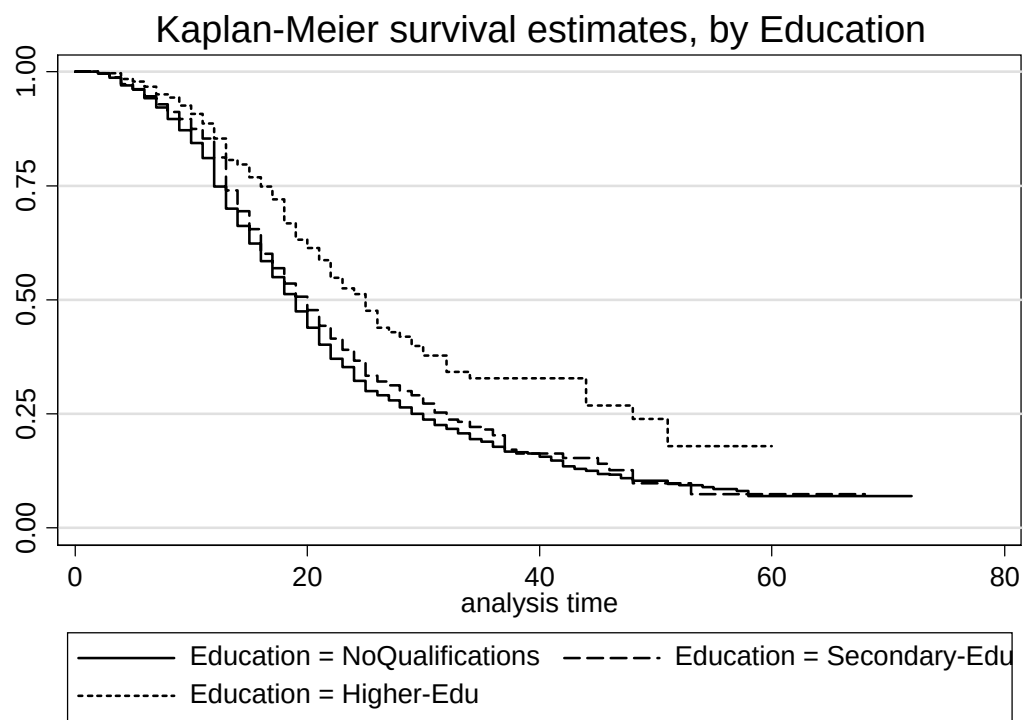


Figure 4: Transition to other states



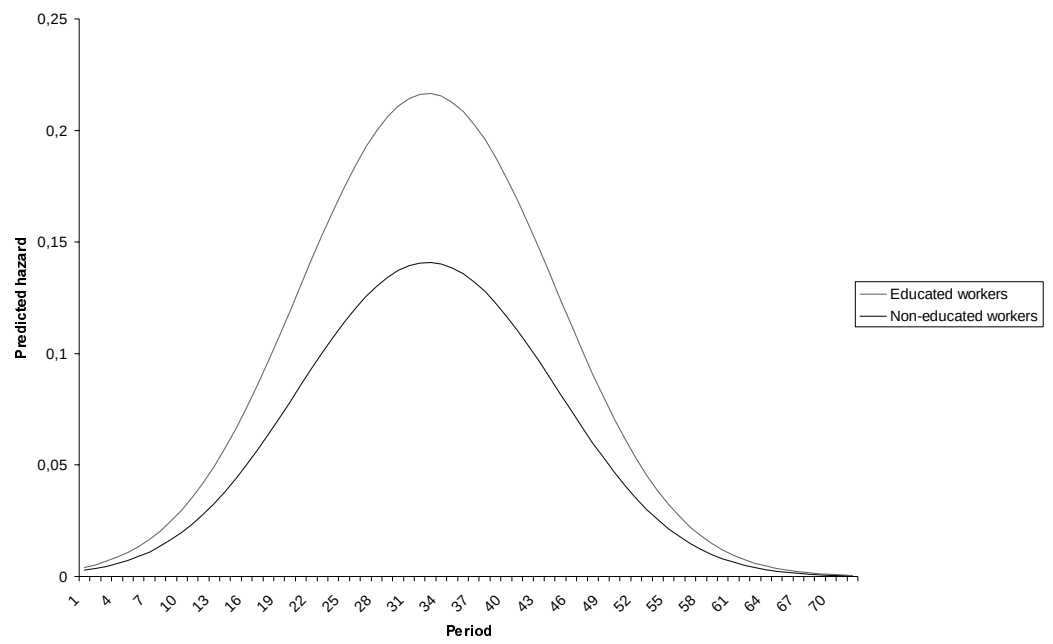
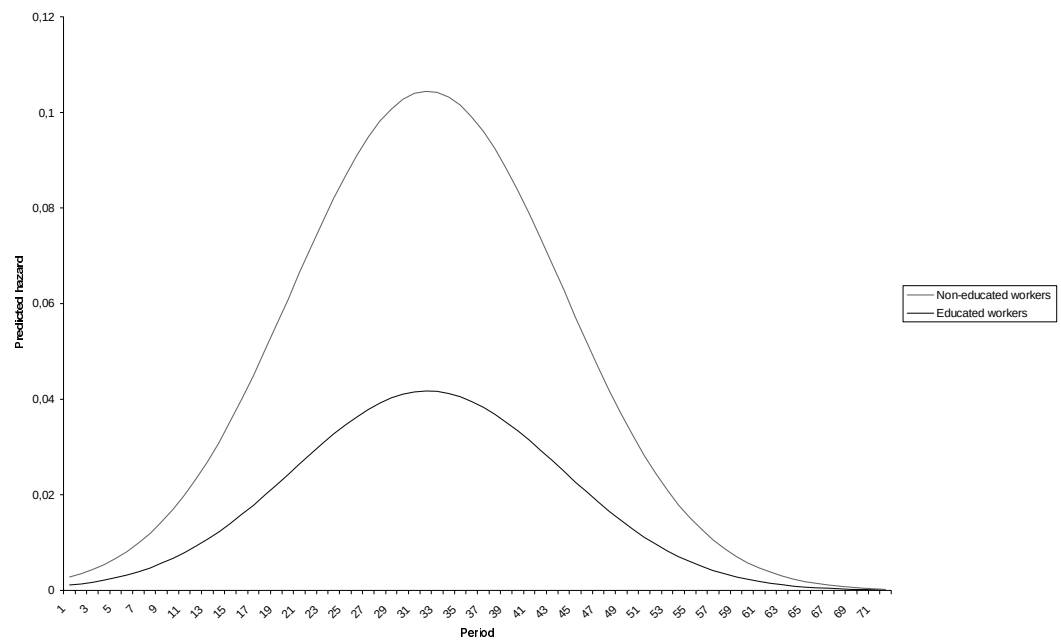


Figure 5: Predicted hazard in the transition to permanent jobs.

Figure 6: Predicted hazard in the transition to other states



RELACION DE DOCUMENTOS DE FEDEA

DOCUMENTOS DE TRABAJO

- 2005-19: "The Dynamic of temporary jobs: Theory and Some Evidence for Spain (The Role of Skill)", **Elena Casquel y Antoni Cunyat.**
- 2005-18: "The Welfare Cost of Business Cycles in an Economy with Nonclearing Markets", **Luis A. Puch**
- 2005-17: "Life Satisfaction among Spanish Workers: Importance of Intangible Job Characteristics", **Namkee Ahn.**
- 2005-16: "Persistence and ability in the innovation decisions", **José M. Labeaga y Ester Martínez-Ros.**
- 2004-15: "Measuring Changes in Health Capital", **Néboa Zozaya, Juan Oliva y Rubén Osuna.**
- 2005-14: "Discrete choice models of labour Supply, behavioural microsimulation and the Spanish tax reforms", **José M. Labeaga, Xisco Oliver y Amedeo Spadaro.**
- 2005-13: "A Closer Look at the Comparative Statics in Competitive Markets", **J. R. Ruiz-Tamarit y Manuel Sánchez-Moreno.**
- 2005-12: "Wellbeing and dependency among European elderly: The role of social integration", **Corinne Mette.**
- 2005-11: "Demand for life annuities from married couples with a bequest motive", **Carlos Vidal-Meliá y Ana Lejárraga-García.**
- 2005-10: "Air Pollution and the Macroeconomy across European Countries", **Francisco Álvarez, Gustavo A. Marrero y Luis A. Puch.**
- 2005-09: "The excess burden associated to characteristics of the goods: application to housing demand", **Amelia Bilbao, Celia Bilbao y José M. Labeaga.**
- 2005-08: "La situación laboral de los inmigrantes en España: Un análisis descriptivo", **Ana Carolina Ortega Masagué**
- 2005-07: "Demographic Uncertainty and Health Care Expenditure in Spain", **Namkee Ahn, Juan Ramón García y José A. Herce.**
- 2005-06: "EL NO-MAGREB. Implicaciones económicas para (y más allá de) la región", **José A. Herce y Simón Sosvilla Rivero.**
- 2005-05: "The real picture: Industry specific exchange rates for the euro area", **Simón Sosvilla-Rivero y Sonia Pangusión.**
- 2005-04: "A Residential Energy Demand System for Spain", **Xavier Labandeira, José M. Labeaga y Miguel Rodríguez.**
- 2005-03: "The Evolution of Retirement", **J. Ignacio Conde-Ruiz., Vincenzo Galasso y Paola Profeta.**
- 2005-02: "Housing deprivation and health status: Evidence from Spain" **Luis Ayala, José M. Labeaga y Carolina Navarro.**
- 2005-01: "¿Qué determina el éxito en unas Oposiciones?", **Manuel F. Bagüés.**
- 2004-29: "Demografía y empleo de los trabajadores próximos a la jubilación en Cataluña", **J. Ignacio Conde-Ruiz y Emma García**
- 2004-28: "The border effect in Spain", **Salvador Gil-Pareja, Rafael Llorca-Vivero, José A. Martínez-Serrano y Josep Oliver-Alonso.**

TEXTOS EXPRESS

- 2004-02: "¿Cuán diferentes son las economías europea y americana?", **José A. Herce.**
- 2004-01: "The Spanish economy through the recent slowdown. Current situation and issues for the immediate future", **José A. Herce y Juan F. Jimeno.**