The stepping stone effects of training contracts: testing this hypothesis for the Spanish Labour Market

David Troncoso-Ponce [1]
Department of Economics
Universidad Pablo de Olavide, Spain

J. Ignacio García-Pérez
Department of Economics
Universidad Pablo de Olavide, Spain

Yolanda Rebollo-Sánz
Department of Economics
Universidad Pablo de Olavide, Spain

[Very preliminary version]

Abstract

Training contracts is the typical tool to reduce unemployment incidence and to favour job stability for workers with low educational attainment levels. In this paper, we investigate whether training contracts increase the transition rate to regular work. In that case, training contracts may enhance the acquisition and accumulation of skills that outwith their low educational attainment levels. We use longitudinal administrative data of young individuals to estimate a multi-state duration model, applying the "timing of events" approach. To deal with selectivity, the model incorporates both transitions from employment and from unemployment, it allows for competing risk at each state, and unobserved determinants of the transition rates. Our results unambiguously show that training contracts serve as stepping-stones towards regular employment. They reduce the incidence of unemployment and they substantially increase the fraction of low qualified young workers who have regular work within a few years after entry into a training contract, as compared to a situation with other kind of temporary contract. However, these positive effects are only present when the worker moves from one job to another without passing through unemployment. Being fired from a training contract or not finding a new job just after the end of the training contract translates a bad signal to potential employers which makes these workers indistinguishable from the rest of temporary workers.

Keywords Duration analysis; Training contracts; Stepping-stone effect; Unobserved heterogeneity; Temporary contracts

JEL classification C41, J64

[1] Corresponding author (David Troncoso).
E-mail address: dtropon@upo.es

1. Introduction

During the current big recession the unemployment rate has increased across many European countries and this increase has been particularly high for young workers and especially for low educated ones. The number of young people out of work in the OECD area is nearly a third higher than in 2007 and set to rise still further in most of the countries with already very high unemployment in the months ahead. Youth unemployment rates exceeded 25% in nine OECD countries at the end of the first quarter of 2013, including Ireland, Italy, Portugal, Spain and Greece. The sharp increase in youth unemployment has lead the European Union to send a clear message that more must be done to provide youth with the skills and help they need to get a better start in the labour market and progress in their career.

One of the countries where this situation is more dramatic is Spain. According to Spanish Labour Force Survey (LFS hereafter), there exist important differences in the unemployment rates by educational attainment levels. At the beginning of the Spanish economic crisis, by the second quarter of 2008, 31.4% of non-educated young workers were unemployed (16.9% among all young people). Two years later, in the middle of the economic crisis this rate raised to 52.1% (31.6%), and six years after (2014) the unemployment rate reached 56.9% (39.4%). These numbers show the weakness of an important segment of the Spanish young workforce, and highlight the need to carry out economic policy actions oriented to solve this important social problem.

As in many European countries, the training or vocational contract has been the preferred tool within the sets of Active Labour Market Policies (ALMP) in Spain to facilitate the integration of young workers in the labour market. Especially for low educated ones which in 2014 still represented 8.1% of the young population. The main aim of this type of contract is to reduce youth unemployment at the same time that to improve the skills of young workers. As in other countries, in Spain this contract implies an agreement between the worker and the firm, in which the latter commits to invest in workers' training. However, little is known on whether this contract effectively help low skill workers to acquire the skills needed to decrease unemployment incidence and the strong level of job turnover suffer for many low educated workers.

In this paper, we analyze the effect of this active labour market policy, on the subsequent career development of young individuals. For that purpose, we compare the labour market career of workers who get a training contract in their first spell of

employment relative to the ones who get other temporary contract types at their first spell of employment. The idea is to test whether the investment in training within the company has any impact on both employability and job stability for the workers who benefited from this contract. In particular we analyzed the time needed to find a permanent job.

An important issue in the ALMP evaluation literature is the difficulty of controlling for selection biases that may lead to specious positive or negative programme effects. We use longitudinal administrative data of individuals to estimate a multi-state duration model, applying the "timing of events" approach (Abbring and Van den Berg, 2003). To deal with selectivity, the model incorporates transitions from unemployment to temporary jobs and unobserved determinants of the transition rates.

An important advantage of the dataset we used over survey data is that we have detailed information of all the employment and unemployment records of each worker since they first entered the labour market allowing us to trace workers' employment and unemployment histories over an extended period of time. Using the information provided by this database we can set up an evaluation exercise. In particular, we analyzed the labour market history, with a ten years time horizon, of two different groups: those who began their career through a Training contract –*treated* workers-, and those who did it through any other type of temporary contract –*control* group.

To perform this evaluation analysis we develop a mixed proportional hazards rate model with multiple states –employment and unemployment, and allowing competing risks for each state. For the employment state the competing risk are: exit to unemployment; exit to a temporary contract; and exit to a permanent job. And for the unemployment state they are: exit to temporary contract and exit to a permanent job. This specification allows us a precise control of the different labour market transitions an individual can experience before entering into a permanent contract –which is our absorption state. We also control for the presence of unobserved heterogeneity. In addition to this, we include an equation to control for the initial conditions that have an impact on the type of the employment contract under which the individual has during his first working experience. Moreover, in this equation, the unobservable factors that influence this initial condition are considered to be correlated with the unobservable components affecting both employment and unemployment exit rates in our model.

The results obtained show that training contracts notably favour job stability of workers who start their first spell of employment with this type of contract. These gains in job stability come from different sources. First, workers who held training contracts have a lower probability of exit to unemployment during the first year of the contract (10.5%) than workers who hold other types of temporary contracts (24.7%). Hence they do not suffer from high job turnover as the "typical" temporary worker does. Second, workers benefited from a training contract have a much higher probability of having a job-to-job transition into a permanent contract, than other temporary workers. The differences found are striking. Although they are almost inexistent after 12 months in the job, by the end of the second year of the contract, the exit probability to a permanent contract is 30.4% for workers holding a training contract, while it is only 3.9% for workers holding other kind of temporary contracts. Moreover, at the end of the third year, these differences get even higher: 44% and 4.7%, respectively. These rates also show the importance of the *treatment* duration on the job-to-job rate, and particularly on job stability, for those hired under this type of contract.

However, these positive outcomes disappear when the worker is not able to get a job-to-job transition and goes to unemployment after working under a training contract. Indeed, we get that going through a period of unemployment implies a penalty in the professional career of all workers in our sample, reflected in reduced and constant exit rates to a permanent job. Moreover, we observe that this exit rate equals to that of those who have previously been employed through a Temporary contract (around 5%). Furthermore, we observe that the exit rate from unemployment to a Temporary job also equal among those who have just been employed through a Training Contract, and those who have just been employed under a Temporary one.

The structure of the paper is as follows. Section 2 describes data used and sample selection. Section 3 reviews existing empirical literature. Section 4 briefly presents a descriptive analysis of data. The econometric model and the estimation results obtained are described in Section 5 and 6, respectively. Section 7 shows the importance of controlling for the presence of unobserved heterogeneity, and Section 8 focuses on the stepping-stone effect hypothesis. Section 9 presents the results of estimating by educational levels and discusses the differences obtained. Finally, Section 10 concludes.

2. Data

We use administrative longitudinal data from the Spanish Social Security database, the waves 2011 to 2013 of the Continuous Sample of Working Histories (hereafter CSWH). The CSWH is compiled annually and every year comprises a 4 percent non-stratified random sample of the population registered with the Social Security Administration. Hence, the initial database includes all individuals who came into contact with the Social Security system -- including both wage and salary workers and recipients of Social Security benefits, namely, unemployment benefits, disability, survivor pension, and maternity leave[2].

In addition to age, gender, nationality, state of residence (*Comunidad Autónoma*), education, and presence of children in the household, the CSWH provides highly detailed information about the worker's previous job. More specifically, we observe the dates the employment spell started and ended, the monthly earnings history, the contract type (permanent versus fixed-term), the occupation and industry, public versus private sector, and the firm size.[3] The CSWH also informs us on the reason for the end of the employment spell (quit versus layoff), and whether the worker receives unemployment benefits and the type (UI versus UA). We compute the duration of each unemployment episode by measuring the time between the end date of the worker's previous contract and the start date of the new one.

2.1. Sample selection

The sample finally used in the analysis is defined by the type of active labour market policy analysed. The training contract is a fixed-term contract (with a maximum duration of 3 years) addressed to young workers (between 16 and 30 years old) who lack acknowledged vocational qualification. The aim of this contract is twofold: first, candidates need to complete some kind of formal educational qualification during the duration of the contract; second, the skills acquired through qualifications are directly applied to the hiring company.

[2] García-Pérez (2008) and Lapuerta (2010) contain a deep exposition about features of CSWL as well as all necessary techniques to perform a duration analysis using working lives information.

[3] Earnings are deflated using the Spanish CPI (2011, Base).

In correspondence with the aim of the training contract, our selected sample is composed of newly incoming young workers aged between 16 and 30 years old who started their working career from the year 2000 onwards and for whom their fist employment spell was a low qualified one[4]. The strategy followed to analyze the effect of a Training Contracts in our model is to split sample in two groups of individuals: those who have been employed through a Training Contract versus those who have been employed with other type of temporary contract. The purpose of this selection is to get a sample of workers as homogeneous as possible, for whom the observable differences are only due to the type of labour contract by which they have start their working career. In our final sample we have that 24.30% started with a training program, 66.77% started with another kind of temporary contract and 8.93% started with a Permanent Contract[5] .

Table 1 Descriptive statistics

	Training Contract	**Temporary Contract**
Total spells	20,352	210,070
Completes	19,172	195,723
Censured	1,180	14,347
By Gender		
Male	64.17 %	63.47 %
Female	35.83 %	36.53 %
By age		
16-19 years old	70.37 %	21.48 %
20-23 years old	26.04 %	38.99 %
24-27 years old	2.70 %	25.27 %
28-30 years old	0.69 %	8.96 %
31 and older	0.20 %	5.29 %
By employment duration		
1 to 6 months	51.17 %	77.88 %
6 months to 1 year	16.40 %	13.21 %
1 to 2 years	28.47 %	5.87 %
2 to 3 years	3.70 %	1.74 %
More than 3 years	0.26 %	1.30 %
By qualification level		

[4] In the CSWL we have information on the qualification level of each employment spell, so we can observe the qualification level of workers on the job. In this paper, we differentiate four qualification levels: High qualification, Mid-high qualification, Mid-low qualification and Low qualification.

[5] We think that this last group might have different observable, and especially unobservable, characteristics. So these can distinguish them from other workers in the sample. Therefore, to avoid obtaining estimates biased motivated by this fact, we have remove the observations of this group of individuals. However, we do use the information from their first employment spell (that is, the corresponding to the first quarter, since our model defines a quarterly duration) for the identification of Initial Conditions equation defined in the likelihood function of our model. Doing this , we allow that unobservable factors affecting the probability of first access to the labor market through a certain type of labor contract (these are, Training, Temporary or Permanent) are correlated with unobserved components affecting employment exit rates in subsequent jobs through the career path.

High qualif.	-	2.57 %
Mid-High qualif.	-	7.78 %
Mid-Low qualif.	-	39.55 %
Low qualif.	100.00 %	50.10 %

3. Related Literature

There exists previous empirical literature that deals with the evaluation of specific contract regulations as a tool to enhance labour market careers for certain group of workers. Typically these papers test the stepping-stone effect of different kind of temporary contracts. For instance, Marloes de Graaf and Van den Berg (2011) investigate whether temporary work increases the transition rate to regular work. Their results unambiguously show that temporary jobs serve as stepping-stones towards regular employment. They shorten the duration of unemployment and they substantially increase the fraction of unemployed workers who have regular work within a few years after entry into unemployment, as compared to a situation without temporary jobs. However, these authors analyzed only transitions from unemployment.

Van den Berg, Holm, and Van Ours (2002) analyze the carrier paths in the medical profession. They also apply "timing-of-event" approach to analyze the existence of a stepping-stone effect. The methodology proposed in this article attempts to identify a causal effect of treatment by controlling for the presence of unobserved heterogeneity both in the selection to the treatment and in the exit rates analyzed.

However, we have not find any empirical paper that deals with the role of training contracts on future prospects of workers taking into account on only the short-run effects but also the medium run effects.

[To be completed]

4. Descriptive analysis

In this section we present the empirical exit rates from employment and unemployment. To compare like-minded workers, this analysis focuses on the first spell of employment in their working lives. Specifically, we divide our sample in two different groups: those

workers who began their working life through a training contract, and those who did through another kind of temporary contract.

The competing risks for the exit from employment are: 1) unemployment; 2) temporary contract; and 3) permanent contract. Figures 1 and 2 show the exists rates from employment by type of contract and gender. On the other hand, from the unemployed state, there are two competing risks: exit into a temporary contract or exit into a permanent job. The exit rates for the unemployment state are presented in Figures 3 and 4.

These Figures show importance differences in the dynamics of the exit rates from employment for workers holding a training contract relative to workers holding a other kind of permanent contract. For the first group of workers we have that 40% of men (and somewhat less for women) who are employed at least two years go directly (job-to-job) to a Permanent job. And this percentage raises to 50% for those who exhaust the maximum legal duration of this type of labour contract (36 months). However workers employed with other temporary contracts, don't experience theses pronounced speaks neither to a permanent job nor to another Temporary job. And two hazard rate (both to a Temporary and a Permanent job) remain a pattern practically constant with the duration spell. It seems that the possible effect of this type of labour contract is being reflected through the direct transition (job-to-job) from these contract into other Temporary contract, and especially into a Permanent job.[6]

[6] Much of these direct transitions into a permanent job are experiences within the same firm where the worker has been trained through the Training Contract. So we think that many of these labor contracts are performing as an investment in human capital and as signaling to the worker within the firm. As a part of our future research agenda, we will introduce in our econometric model a specific risk of these direct transitions (job-to-job) into the same employer. In this paper we focus on a broader objective, that is to analyze transitions into a permanent job without identifying firms of origin and destination.

Figure 1 Exit from employment. Kaplan-Meier estimates (first spell). Males.

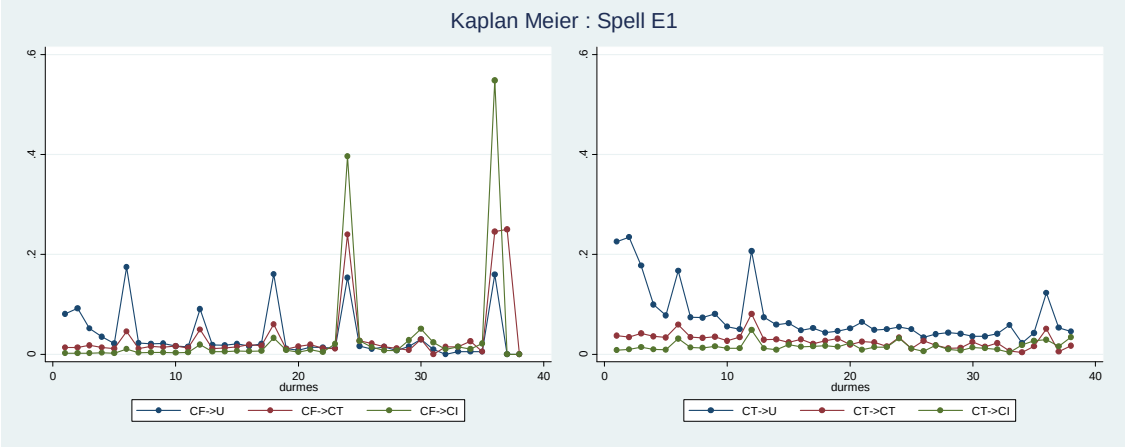


Figure 2 Exit from employment. Kaplan-Meier estimates (first spell). Females.

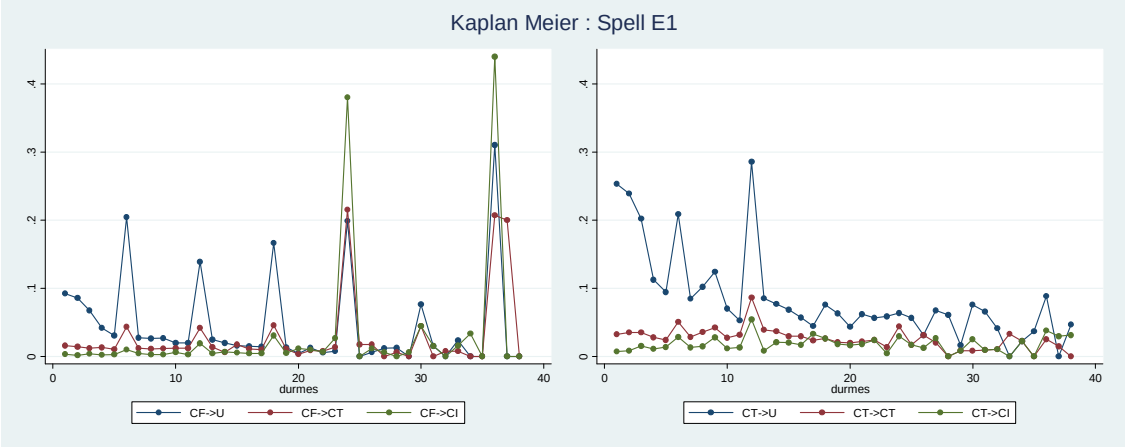


Figure 3 Exit from unemployment. Kaplan-Meier estimates (first spell). Males.

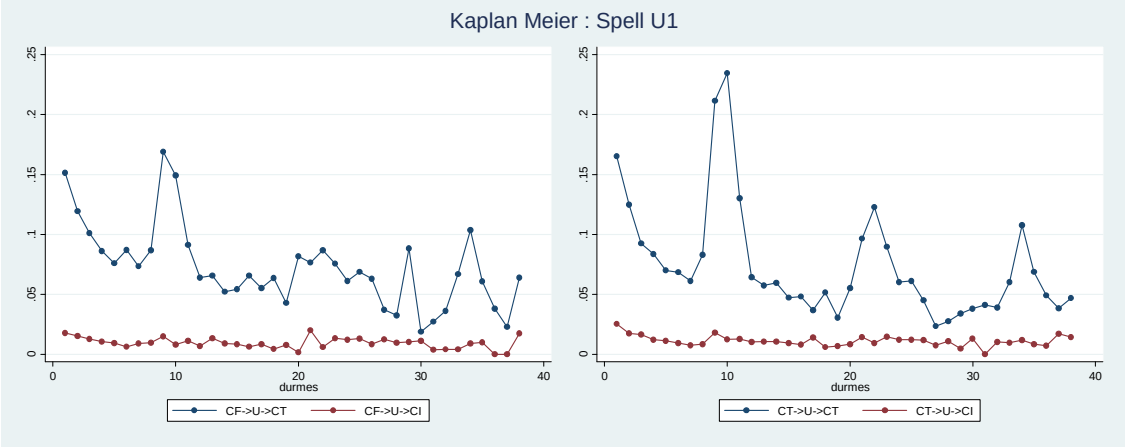
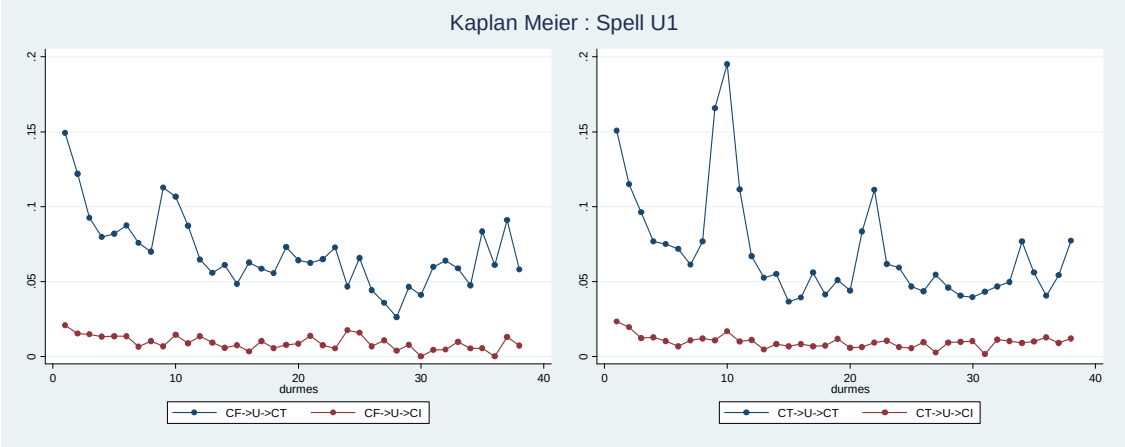


Figure 4 Exit from unemployment. Kaplan-Meier estimates (first spell). Females.



Hence, this empirical evidence initially points that training contracts might favour the stability of low educated young workers since they notably increase the transition probability into a permanent contract. Let's test whether this initial result remains once we control properly for observed and unobserved characteristics as well as for selection issues.

5. Econometric model

We have developed a duration model to jointly estimate employment and unemployment exit rates, using a mixed proportional hazards model with multiple competing risks depending on the specific state in which the individual is, and controlling for the presence of unobserved heterogeneity, both for unemployment and

employment exits. In addition, we include an equation to control for the initial conditions that affect the type of labour contract by which the individual had in his first spell of employment. This equation also allows for unobservable factors that affect this initial condition to be correlated with unobservable components affecting employment exit rates in our model.

The different exits depend on the specific state of the individual (if employed or unemployed). From an employment state, the individual faces three competing risks: exit to unemployment, to a temporary contract[7], or to a permanent contract[8]. On the other hand, from the unemployed state, there are two competing risks: exit into a temporary contract or exit into a permanent job.

To control for the presence of unobserved heterogeneity we estimate our model following the work of Heckman and Singer (1984), according to which no distribution for unobserved components should be impose a priori, modelling the distribution of unobserved heterogeneity nonparametrically. Specifically, we assume the presence of two different values of heterogeneity, one for employment exit and the other one for the unemployment's. Also, we allow the existence of a specific heterogeneity component for each type of exit. And, as mentioned before, given the importance that the literature gives to the initial conditions problem (see Wooldridge, 2005), we have included an equation (using a multinomial logit) to control for observable and, specially, unobservable factors which explain the entry into the labour market of the individual through a three different types of labour contracts: Training contract, Temporary contract , or Permanent contract.[9] The main purpose of including this equation is to

[7] Exit to a Temporary contract (either from employment or from unemployment) also contains the exits to another Training contract. It is due to small sample reasons, because of the number of observations of exits to a Training Contract is very reduced, since over 60% of employment spells under this type of labor contracts are held on the first work experience in the working lives. Therefore, for reasons of computation, we cannot identify a specific risk in our model to control for exit to a Training Contract. Thus, we have included this specific exits into the rest of Temporary contracts. However, this fact does not prevent us to differentiate them, because we have included explanatory variables to the control for under what type of labor contract is the worker employed, and which type of contract was prior to the current period.

[8] In this paper, we consider the event to find a permanent job as an *absorption state*, by which once the worker has find this type of job, he leaves the sample and its remaining labor history is removed from our estimation sample from that time.

[9] In relation to the concept of *absorption state* explained above, we remove from our estimation sample the remain working lives of those individuals who begin through a Permanent job. We do this because we believe that workers who begin their working career through a Permanent job may have different features of the rest of our sample, assuming that it could be a possible source of bias in our estimates. Therefore, in our model this group of workers only contributes to the likelihood function through the initial conditions equation. This means eliminating the entire working career of a total of 4,953 individuals who represent 8.93% of all individuals who begin their working lives in our sample. Thus, we guarantee that in our model we are analyzing the effect on exit rates of only two types of labor contract: Training Contract versus other Temporary one.

correlate the unobservable component that explains the entry into the labour market through a particular type of contract (training, temporary or permanent) to the factors, also unobserved, that affect employment exit rates throughout their future career path. Unlike Abbring and Van den Berg (2003), we introduce these unobserved components -that influence the participation in the treatment (defined here as the Training contract)- in the initial conditions equation. So, doing this, we have not estimating an isolate causal effect for the treatment, because, although we can guarantee that there's not exist anticipation effects, in the initial conditions equation there is not exogenous variability enough. However, we are not trying to estimate a causal effect of the treatment, but the differential effect in career paths of workers who have been employed under this type of labour contract.

5.1. Functional form of hazard rates

We estimate a discrete time duration model in intervals defined by quarters. In this model, we define the exit rate from every specific state towards each one of the competing risks faced by individuals. This exit rate follows a multinomial logit with the following general specification:

$$h_{S,D_S}(j \mid x^F_{S,D_S}(j), x^T_{S,D_S}(j), z^F_{S,D_S}, z^T_{S,D_S}, v_{S,D_S}) =$$

$$= \frac{\exp\left(\lambda^F_{S,D_S}(j) + x^F_{S,D_S}(j)\beta^F_{S,D_S} + z^F_{S,D_S}\alpha^F_{S,D_S} + \lambda^T_{S,D_S}(j) + x^T_{S,D_S}(j)\beta^T_{S,D_S} + z^T_{S,D_S}\alpha^T_{S,D_S} + v_{S,D_S}\right)}{1 + \sum_S \sum_{T_S} \exp\left(\lambda^F_{S,D_S}(j) + x^F_{S,D_S}(j)\beta^F_{S,D_S} + z^F_{S,D_S}\alpha^F_{S,D_S} + \lambda^T_{S,D_S}(j) + x^T_{S,D_S}(j)\beta^T_{S,D_S} + z^T_{S,D_S}\alpha^T_{S,D_S} + v_{S,D_S}\right)}$$

In each quarter the individual can stay in one of two specific states: employment or unemployment. This two states define the range of S = {E, U}, i.e. E = employment, and U = unemployment. The competing risks faced by the individual, which are specific to each state, define the range of D_S. Therefore D_E = {U, T, P}, where D_E = U implies exit to unemployment; D_E = T implies exit to a Temporary Contract; and D_E = P implies exit to a Permanent Contract. Similarly, defining the two possible risks from the state of unemployment, we define D_U = {T, P}. Therefore D_U = T implies exit to a Temporary Contract; and D_U = P implies exit to a Permanent Contract.

We suppose that explanatory variables may affect to exit rates differently if individual is employed under a Training contract or under a Temporary contract. Therefore we have

interacted all these explanatory variables with one of two dummies: a dummy that identifies if individual is employed under a Training contract (or if he comes from an employment spell under a Training Contract -for the unemployment state-), and a dummy that identifies if individual is employed under a Temporary contract (or if he comes from an employment spell under a Temporary Contract -for the unemployment state-). Using this type of specification, in practice we are estimating two different hazard rates, but we may impose a common unobservable heterogeneity component for two hazard rates.

$x^F_{S,D_S}(j)$ and $x^T_{S,D_S}(j)$ are two vectors that include time-varying variables specific to each state and to each competing risk. These vectors include variables such as the current age [10] of individual in each quarter of the current year, current age squared, the rate of employment growth, the interaction between the rate of employment growth and the logarithm of duration spell.

Variables $\lambda^F_{S,D_S}(j)$ and $\lambda^T_{S,D_S}(j)$ provide the baseline hazard on exit rates. Specifically, we introduce a flexible specification of the baseline hazard by defining these variables as dummies that identifies each quarter in duration spell.

Vectors z^F_{S,D_S} and z^T_{S,D_S} provide explanatory variables that are not time-varying. These are: gender of individual, the region, year dummies that allow differentiate periods before and after the Spanish economic crisis, industry dummies, and variables that provide information about the past work history of individual: number of temporary contracts has had to date, a dummy to differentiate if individual have had more than one Training contract, and the number of unemployment spells.

5.2. Unobserved heterogeneity

As explained above, we have defined unobserved heterogeneity component specific to each state and to each destination. So, we have several possible values that depend on the different values for the combination state-destination. In our model, we have defined v_{S,D_S} according to the following structure:

Regarding employment exit rates, since state S = E, and as we defined earlier, we have three possible destinations specific to state S = E, namely D_E = {U, T, P}. Therefore we

[10] In our model, we introduce through this variable the difference between the worker's current age in each quarter and the minimum legal age at which individuals can access to a Training Contract (16 years old), and that is the minimum age observed in our sample.

define the following unobservable heterogeneity components specific to employment exit rate:

1. Unobservable heterogeneity component specific to the exit from employment to unemployment:

$$v_{E,U} = k_{E,U} * \eta^{E}$$

2. Unobservable heterogeneity component specific to the exit from employment to a Temporary contract:

$$v_{E,T} = k_{E,T} * \eta^{E}$$

3. Unobservable heterogeneity component specific to the exit from employment to a Permanent contract:

$$v_{E,P} = k_{E,P} * \eta^{E}$$

The component η^{E} can take two possible values, namely $\eta^{E} = \{\eta_1^{E}, \eta_2^{E}\}$. Furthermore, we normalize the value $k_{E,U} = 1$. So that $v_{E,U} = \eta^{E}$.

With respect to unemployment exit rates, given that state S = U, and as we defined above, we have two possible competing risks specific to state S = U, given by D_U = {T, P}. Therefore we define the following unobservable heterogeneity components specific to unemployment exit rate:

1. Unobservable heterogeneity component specific to exit from unemployment to a Temporary contract:

$$v_{U,T} = k_{U,T} * \eta^{U}$$

2. Unobservable heterogeneity component specific to exit from unemployment to a Permanent contract:

$$v_{U,P} = k_{U,P} * \eta^{U}$$

The component η^{U} can take two possible values, namely $\eta^{U} = \{\eta_1^{U}, \eta_2^{U}\}$. Furthermore, we normalize the value $k_{U,T} = 1$. So that $v_{U,T} = \eta^{U}$.

5.3. Initial conditions

We have developed the initial conditions equation using a multinomial logit with the following specification:

$$h_S^{IS}(s \mid x^{IS}, v_S^{IS}) == \frac{\exp\left(x^{IS}\beta^{IS} + v_S^{IS}\right)}{1 + \sum_S \exp\left(x^{IS}\beta^{IS} + v_S^{IS}\right)}$$

In this equation the individual may go into the labour market through a Training Contract, or do it under a Permanent contract, versus alternative of being employed under a Temporary Contract. Therefore, we define the range S = {F, P}, where S = F implies to start their working life under a Training Contract; and S = P implies starting with a Permanent contract.

As we explained before, the main reason for introducing this equation in our model is to allow that unobserved components, that affect the type of labour contract under which the individual starts his working life, are correlated with unobserved factors that affect employment exit rates throughout their future career path. This is achieved by defining the unobserved component v_S^{IS}.

Thus, we define:

1. Unobservable heterogeneity component specific to those accessing with a Training contract:

$$v_F^{IS} = k_F^{IS} * \eta^E$$

2. Unobservable heterogeneity component specific to those accessing with a Permanent contract:

$$v_P^{IS} = k_P^{IS} * \eta^E$$

The component η^E is the same unobserved component we have included in the employment exit rates specification. Therefore, η^E can take two possible values, namely $\eta^E = \{\eta_1^E, \eta_2^E\}$. Thus, η^E is the common unobserved component that makes the correlation between unobserved factors that affect the type of labour contract under which the individual starts his working life, and those that affect employment exit rates throughout their future career path

5.4. Likelihood function

Once we have defined functional form of the different exit rates, the initial condition equation's, and the unobserved heterogeneity structure; we're going to define the likelihood function of our model.

Following the methodology of Heckman and Singer (1984), the unobserved heterogeneity is not restricted to a specific probability distribution. Thus, in the estimation process, we define the likelihood function using four mass-points obtained for different combinations of two values defined in the range of $\eta^E = \{\eta_1^E, \eta_2^E\}$ and $\eta^U = \{\eta_1^U, \eta_2^U\}$. To each point-mass is assigned a probability parameter which is estimated jointly with the rest of the model parameters. The probability parameters follows a multinomial logit, so that:

$$\pi_j = \frac{\exp(p_j)}{1 + \sum_{j=1}^{3} \exp(p_j)}, \text{ for j=1,2,3.}$$

As a result of this combination, we define four different types of individuals: 1) those who experience shorter episodes of both employment and unemployment; 2) those with shorter spells of employment and longer spells of unemployment; 3) those with longer spells of employment and shorter spells of unemployment; and 4) those who experience longer episodes of both employment and unemployment.

In the model, each mass-point is associated with an estimated probability, and these build the following four mass-points:

$$\pi_1 = \Pr(v_{U,T} = \eta_1^U, v_{U,P} = k_{U,P}\eta_1^U; v_{E,U} = \eta_1^E, v_{E,T} = k_{E,T}\eta_1^E, v_{E,P} = k_{E,P}\eta_1^E; v_F^{IS} = k_F^{IS}\eta_1^E, v_P^{IS} = k_P^{IS}\eta_1^E)$$
$$\pi_2 = \Pr(v_{U,T} = \eta_1^U, v_{U,P} = k_{U,P}\eta_1^U; v_{E,U} = \eta_1^E, v_{E,T} = k_{E,T}\eta_2^E, v_{E,P} = k_{E,P}\eta_2^E; v_F^{IS} = k_F^{IS}\eta_2^E, v_P^{IS} = k_P^{IS}\eta_2^E)$$
$$\pi_3 = \Pr(v_{U,T} = \eta_2^U, v_{U,P} = k_{U,P}\eta_2^U; v_{E,U} = \eta_1^E, v_{E,T} = k_{E,T}\eta_1^E, v_{E,P} = k_{E,P}\eta_1^E; v_F^{IS} = k_F^{IS}\eta_1^E, v_P^{IS} = k_P^{IS}\eta_1^E)$$
$$\pi_4 = 1 - \pi_1 - \pi_2 - \pi_3 = \Pr(v_{U,T} = \eta_2^U, v_{U,P} = k_{U,P}\eta_2^U; v_{E,U} = \eta_2^E, v_{E,T} = k_{E,T}\eta_2^E, v_{E,P} = k_{E,P}\eta_2^E; v_F^{IS} = k_F^{IS}\eta_2^E, v_P^{IS} = k_P^{IS}\eta_2^E)$$

The total likelihood function of the model is given by the following expression:

$$L_i = \prod_{i=1}^{N} \left[\sum_{m=1}^{4} \left(\pi_m \prod_{t=1}^{T_i} \left[l_{it}(\eta_m^U, \eta_m^E) \right] \right) \right]$$

And taking the logarithm of this function, we obtain:

$$\log L_i = \sum_{i=1}^{N} \log\left\{ \sum_{m=1}^{4} \left(\pi_m \prod_{t=1}^{T_i} \left[l_{it}\left(\eta_m^U, \eta_m^E\right) \right] \right) \right\}$$

Each of the four mass-point that compose the likelihood function takes the following expression:

$$l_{it}\left(\eta_m^U, \eta_m^E\right) = \left[\left(h_{E,U}\left(\eta_m^E\right)\right)^{I(y_{it}^e=1)} \left(h_{E,T}\left(k_{E,T}\eta_m^E\right)\right)^{I(y_{it}^e=2)} \left(h_{E,P}\left(k_{E,P}\eta_m^E\right)\right)^{I(y_{it}^e=3)} \left(1 - h_{E,U} - h_{E,T} - h_{E,P}\right)^{\left(1-I(y_{it}^e=1)-I(y_{it}^e=2)-I(y_{it}^e=3)\right)} \right]^{e}$$

$$\left[\left(h_{U,T}\left(\eta_m^U\right)\right)^{I(y_{it}^u=1)} \left(h_{U,P}\left(k_{U,P}\eta_m^U\right)\right)^{I(y_{it}^u=2)} \left(1 - h_{U,T} - h_{U,P}\right)^{\left(1-I(y_{it}^u=1)-I(y_{it}^u=2)\right)} \right]^{(1-e)}$$

$$\left[\left(h_F^{IS}\left(k_F^{IS}\eta_m^E\right)\right)^{I(y_{it}^{e1}=1)} \left(h_P^{IS}\left(k_P^{IS}\eta_m^E\right)\right)^{I(y_{it}^{e1}=2)} \left(1 - h_F^{IS} - h_P^{IS}\right)^{\left(1-I(y_{it}^{e1}=1)-I(y_{it}^{e1}=2)\right)} \right]^{e_1}$$

Due to model complexity and the estimation sample size, composed by quarterly expanded employment and unemployment spells, we need to program manually first and second derivatives, because the lack of these would imply that computation time requirements to get the model parameter estimates would be huge. Moreover, doing this, we guarantee a better accuracy of parameter estimates, and a more precise standard errors. Thus, we implement the optimization process by building our own likelihood function, our gradient vector containing the first derivatives (first order conditions equations), and our hessian matrix containing the second derivatives (second order conditions equations). Therefore, the improvement obtained thanks to this model is outstanding in terms of estimates accuracy and of the programming time required. Besides the model allows the possibility of estimating sample sizes that otherwise could not be implemented, thus ensuring the soundness of the coefficients obtained. To carry out this, we use Stata programming language (see Gould, Pitblado and Sribney, 2006). The main formulas for gradient vector and hessian matrix can be seen in the Technical Appendix.

6. Estimation results

It is important to know if training contracts are ―stepping stones , using Booth et al.'s (2002) terminology. If training contracts are not a stepping stone, then the problem becomes evident because there is a proportion of the population that given they low educational attainment levels will have strong difficulties to have a stable labour market career.

In this section we present the estimation results from the econometric model described in previous section. To show the effect of Training contract on employment and unemployment exit rates, we build predicted mean hazard rates by calculating the weighted average of estimated hazard rates from two types of individuals estimated (type I and type II), where the weights are given by estimated probabilities associated to each mass-point of the likelihood function defined in our econometric model. Tables A1 y A2 show these predicted mean hazard rates for employment and unemployment exits, and Figures 5 and 6 plots these rates. Moreover, to see the importance of introducing unobserved heterogeneity, Tables A3 and A4 show the predicted hazard rates calculated for each type of individual estimated (type I and type II), and Figures A5 and A6 plots these rates. Furthermore, the Results Appendix provides tables with the estimation results. Table A8 shows the coefficients of the initial conditions equation; and Tables A9 and A10 contain the coefficients from the parameters estimated of employment and unemployment hazard rates, respectively.

To analyze exit rates we group the explanatory variables into three groups: duration variables that explain the baseline hazard; variables containing previous labour history of the individual (in which we will focus in this section); and explanatory variables for control purposes. In this last group, we have included several control variables: 1) those relating to individual characteristics: gender, age and nationality; 2) variables to control for the business cycle, including dummies to differentiate between *pre* and *post* economic crisis period, and the employment growth rate, as well as its interaction with the logarithm of duration of employment and unemployment spells; 3) regional dummies to control for the regional effect on hazard rates; 4) variables concerning the characteristics of the employer: firm size, and the industry in which it has its economic activity.

6.1. Initial conditions

The 66.24% of spells of training contracts in our sample (20.352 spells) occurs right at the beginning of working life. This is a very important aspect, since our model must control for the factors that influence workers' selection to the treatment at the beginning of their careers. This justifies the inclusion of an initial conditions equation, linking the unobservable factors explaining the choice to treatment with unobservable components affecting rates from employment.

As explained above, we include this equation to control for the observable and unobservable factors that explain the individuals began their working life through a particular labour contract: Training Contract or Permanent Contract, against the alternative of being employed under a Temporary Contract.
The main objective of this equation is to allow unobservable factors affecting the start of the working life (through the type of labour contract) are correlated with unobservable factors that affect employment exit rates, namely $\eta^E = \{\eta_1^E, \eta_2^E\}$.

Table A7 shows the explanatory variables included in the initial conditions equation. These variables include information concerning to individual's personal characteristics (gender, age, educational level, nationality); characteristics of the employer (size, economic activity, public or private firm); and regional dummies.

By including this equation in our model, we avoid estimation biases that could lead to overestimate the possible effect of treatment (Training Contract). Thus, our model takes into account the unobservable characteristics of workers who first access to the labour market through a Training contract, against those who enter through another Temporary contract. Thereby, by introducing in our model heterogeneity components that affect the selection to treatment (to have a Training contract) and, specially, to allow this unobservable components are correlated with unobserved factors affecting employment exit rates, and in particular the probability of finding a permanent job,[11] we are correcting a major source of bias in our econometric estimates.

[11] Recall that the unobservable component that affects the selection to the treatment just at the beginning of working life is given by $v_F^{IS} = k_F^{IS} * \eta^E$, where η^E is the unobserved heterogeneity component that affects the exit from employment state. Therefore, this common factor correlate the unobservable factors that affect the selection to the treatment at the beginning of working life, with unobservable factors affecting employment exit rates throughout the entire working career.

6.2. Exit from employment

As we can see in Figure 5 and Table 2, the probability of exiting from a Training contract shows significant differences depending on the destination state. On the one hand, we can see that the probability of exiting to unemployment remains relatively stable throughout the entire duration of the contract, reaching values close to 14% in the main quarters of spell. [12] However, when we focus on the other competing risks —i.e. exit to another temporary contract, and exit to a permanent job—, we find that the employment hazard rates show a quite different pattern. Throughout the duration of Training contract, there exist only two quarters when treated workers can transit directly to another job with a very high probability. These peaks are observed in quarter 8 (two years of contract), and in quarter 12 (the maximum legal duration of Training contract). Thus, the probability of exiting to another temporary contract in quarter 8 reaches 25.48% (27.17% in quarter 12); and the probability of finding a permanent job in quarter 8 reaches 33.60% (49.69% in quarter 12). However, in quarters other than 8 and 12, these probabilities decreases to 4-8%, and to 1-3%, for exits to a temporary job and to a permanent one, respectively.

It seems that workers holding a Training contract have a layoff probability relatively constant throughout the duration of the Training contract (10-14%), and this is especially important for those who have employed less than two years: for these treated workers, the only way out is unemployment. This issue has a particular relevance, since over 40% of our sample of treated workers —those holding a Training contract— don't achieve to stay employed at least the two-year. This reflects that there is a high

[12] Training Contracts are more stable than the rest of Temporary Contracts. This differential effect varies according to the risk that the individual faces, but for the three possible exits the effect is negative. According to the structure of our model (previously discussed in the previous section), the "clean" effect of having a Temporary contract (other than Training) is included in the two components of the unobserved heterogeneity, η_1^E and η_2^E (depending on the type of worker). For example for Type 1, the effect of having a Temporary contract on the exit into unemployment is given by $v_{E,U} = \eta_1^E = -0.113$. Similarly, the effect of having a Temporary contract on the exit into another Temporary one is given by $v_{E,T} = k_{E,T} * \eta_1^E = 15.06 * (-0.113) = -1.702$. And finally, the effect of having a Temporary contract on the exit into a Permanent job is given by $v_{E,P} = k_{E,P} * \eta_1^E = 24.53 * (-0.113) = -2.772$. Therefore, to compare the differential effect of having a Training Contract on employment exit rates, we have to add to these heterogeneity components previously calculated the constant value estimated given by the coefficient called ***Training contract***, taking the following values, depending on the type of output: -1.597 in exit to unemployment; -1.659 to exit to a Temporary contract; and -2.471 to exit to a Permanent job. For example for Type 1, the effect of having a Training Contract on the exit to unemployment would be given by: $v_{E,U} - 1.597$, namely $-0.113 - 1.597 = -1.71$. The effect of having a Training Contract on the exit to a Temporary one is given by: $v_{E,T} - 1.659$, namely $-1.702 - 1.659 = -3.361$. Finally, the effect of having a Training Contract on the exit to a Permanent job is given by: $v_{E,P} - 2.471$, namely $-2.772 - 2.471 = -5.243$.

proportion of treated workers for whom the Training contract seems to have no (immediate) effect on their reemployment rates. However, workers who get to be employed for at least two years, face to direct reemployment probabilities (via job-to-job) to a temporary contract, and specially to a permanent job, very high.

This may be a consequence of a potential dual effect triggered by the Training contract, i.e. the Training contract may be creating a polarized group of treated workers: those who survive for at least two years (and whose reemployment rates are very high) and those who cannot be treated long enough to have reemployment probabilities and, therefore, they exit to unemployment. This might be explained by the fact firms use this type of contract strategically to recruit workers. It is quite possible that employers may be using the Training contract as a signalling device: the employer would hire the worker for the minimum time that the contract requires (i.e. one year), and throughout the year the employer can evaluate worker productivity.

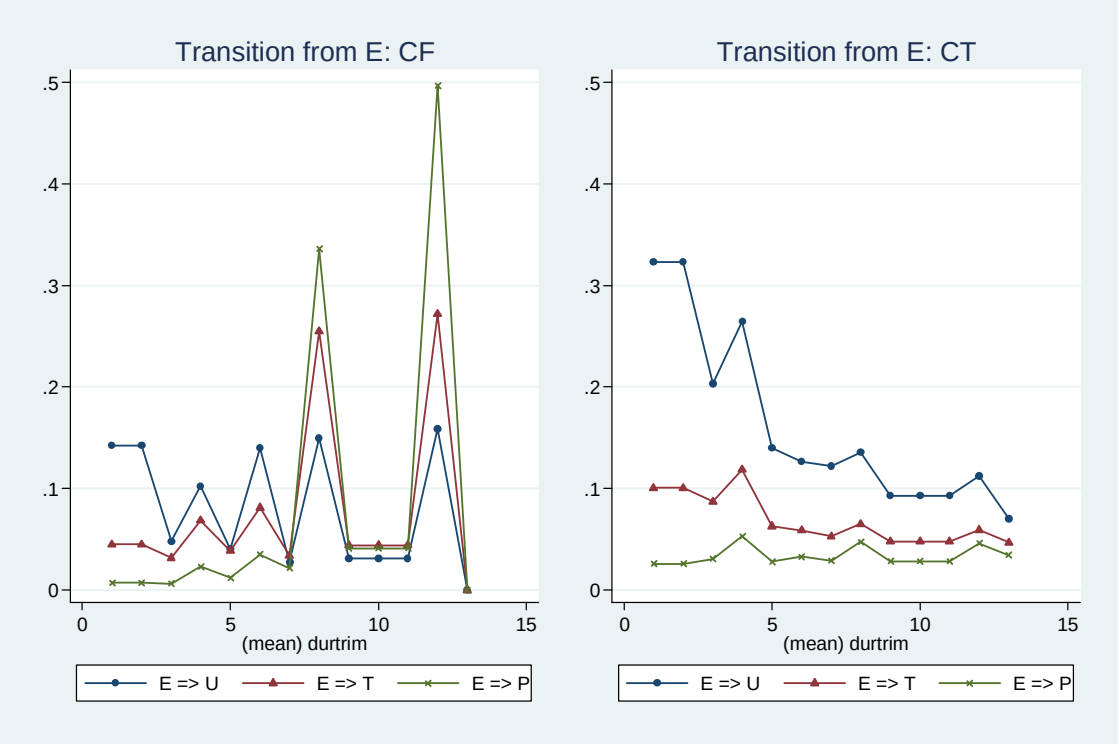
The firm can hire the worker for the minimum time established by the contract regulations, which is one year, and depending on employee productivity observed by the employer throughout this one year period, the firm may decide to renew the Training contract for six months periods up to three years (which is the maximum legal contract duration).

This may be explained by the different characteristics (observable, and especially unobservable) of workers in the company: the more motivated workers could get to stay employed longer under the Training contract until they reach the legal limit duration of three years, and the less productive workers would leave out after reaching the completion (termination) of the contract, without the company's renewed.

Table 2 Predicted mean hazard. Exit from employment (main quarters)

	E => U		E => T		E => P	
	Training	Temporary	Training	Temporary	Training	Temporary
Quarter 1	14,26%	32,31%	4,50%	10,05%	0,71%	2,59%
Quarter 4	10,24%	26,42%	6,85%	11,87%	2,31%	5,31%
Quarter 6	14,01%	12,63%	8,11%	5,87%	3,51%	3,28%
Quarter 8	14,95%	13,57%	25,48%	6,51%	33,60%	4,75%
Quarter 12	15,87%	11,23%	27,17%	5,91%	49,69%	4,61%

Figure 5 Predicted mean hazard. Exit from employment



Previous work experience effect

We focus here on analyzing the effect of past labour history on the employment hazard rate. To achieve this, we have included in our model a set of variables to control for the effect that prior labour history accumulated by the individual can have on the exit rates. Specifically, we have included: 1) a dummy that identifies if individual has been employed under a Training contract twice or more times [13]; 2) a continuous variable that summarizes the total number of Temporary contracts under the individual has been employed until the current moment; and 3) a continuous variable that summarizes the total number of episodes of unemployment [14] that individual has had until the current moment.

[13] This may be due to extension of the current Training Contact within the same firm (whenever duration doesn't exceed the legal maximum of three years). This may also be due to a new Training Contract signed with a different employer. The rules governing this type of contract provides for this possibility, and allows workers to access more of one training contract, whenever worker get to a different qualification to that previously obtained in the previous one.

[14] In our sample, unemployment spells include both experiences collecting unemployment benefits (either from a contributory benefit, or a care one), and episodes that mediate between a drop out of a contribution relation with Social Security and the next employment. The latter cases could be called non-employment spells, because we don't observe the individual during period in the MCVL, but we know that neither he is employed nor is collecting any public benefit that involves a contribution relation with Social Security.

We can see that work experience has an important effect on the type of transitions, and especially for those who are employed under a Training contract, especially in the time it takes to find a permanent job. Thus, according to Table A8, we can observe that for the individuals who have previously had a Training contract, the probability of find a job (via job-to-job) raises, and the probability of going to unemployment reduces (the latter only for employees with a Temporary contract). This effect is much more pronounced for those who are in a Training contract, for whom we can observe that this effect is maximum in transitions from a Training contract to a Permanent job.

As Table A8 shows, workers with a Training contract, and previous experience in another Training contract, have a higher reemployment probability towards another Temporary contract (0.542), and especially towards a Permanent job (0.730). The effect of the previous experience variables on reemployment rates is much lower for Temporary workers (in addition, coefficient associated with the probability of exiting to a Permanent job is not statistically significant). Although for this group of workers we can see that the probability of leaving unemployment decreases with prior experience in a Training Contract.

Then, previous work experience increases the probability of moving into employment, and reduces the probability of exit to unemployment. And previous episodes of unemployment seems to have the opposite effect. Furthermore, we observe that all the variables that summarize the past labour history have a stronger effect on exit rates for those workers who are employed by a Training contract.

These results show that the positive effects of having had previously a Training contract on reemployment rates are only observed in those workers who are currently employed under a Training contract. It seems that to have had a Training contract has no effect on reemployment rates once the contract has ended, what reinforce our hypothesis through which this contract does not imply a stepping-stone effect on the future worker's career. In section 8, we discuss this issue more in depth by analyzing the effect of the most recent work experience on reemployment hazard rates.

6.3 Exit from unemployment

In this section we analyze the exit rates in two groups of workers analyzed: those who just had a Training contract (treated workers) and those who just had a Temporary one (control group). As explained above, in our model we define two different risks specific to unemployment state: exiting to a Temporary contract, and exiting to a Permanent job. Figure 6 shows the unemployment hazard rates for two groups of workers, and Table 3 contains the same hazard rates for the relevant quarters of the unemployment spell. As we can see in Figure 6, in contrast to what was observed in the employment hazard rates, the unemployment hazard rates are quite similar in two groups of workers analyzed.

As we did in previous section, to capture the effect of duration, we introduce a set of quarterly dummies, namely quarter 2 to quarter 9. The effect of duration is negative for exits from both type of labour contracts, except for the exit to a Permanent job for whose that, previously to the current unemployment state, have been employed under a Training contract. However this coefficient is not statistically significant. So, as expected, with increasing duration in the unemployment state, the probability of finding a job is reducing.

The probability that a treated worker, being unemployed, finds a Temporary contract in the first quarter of the spell of unemployment is 33.7% (34.8% for workers in the control group), and this probability is decreases as duration in the state of unemployment is increasing, with the exception of the quarters 4 and 8, when the exit rates increases until 29.03% and 24.46%, respectively. However, we can see that though unemployment hazard rates decreases as duration in unemployment spell is increasing, however this drop is not too large, since 21.76% of treated workers (15.56% of control workers) who are unemployed for at least a year and a half —in quarter 6— find a Temporary job. We are analyzing a sample of young workers, and we think that for those workers the incidence of negative effects from log term unemployment might be minimal. On the other hand, if we look at exit rates to a Permanent job, we can see that the probability of finding a Permanent job is very low, around 3-4% in both groups of workers, and this rate does not vary with the duration of the unemployment spell.

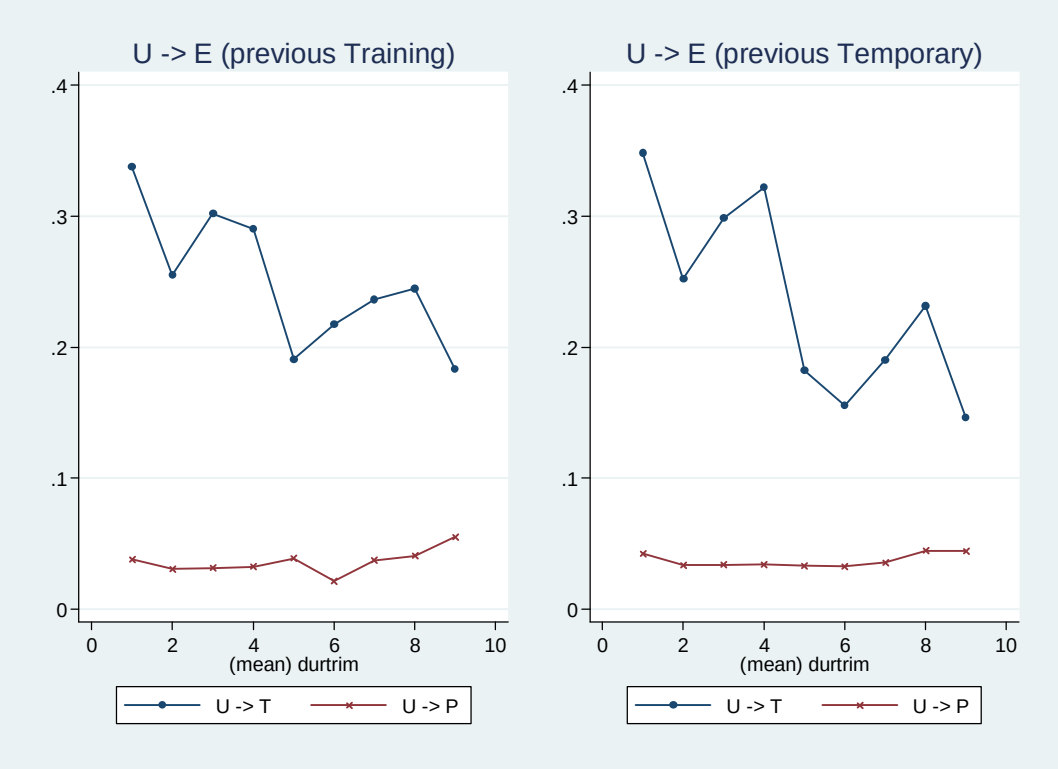
In contrast with what was observed in the employment exit rates for whose workers with a Training contract, the high peaks of transition to a new job (both to a Temporary, and specially to a Permanent one) disappear. So, it seems that to go through a period of unemployment implies a penalty in the professional career of workers in our sample, reflected in reduced and constant exit rates to a permanent job, around 5%. And we observe that this exit rates equal to those who have previously been employed through a Temporary contract (around 5%). Furthermore, we observe that the exit rate from unemployment to a Temporary job also equal among those who have just been employed through a Training Contract, and those who have just been employed under a Temporary one.

Therefore, the possibility of finding a permanent job, by having been employed under a Training contract, is lost when passing from this type of labour contract to unemployment. So, we clearly see that the effect of this type of contract occurs through direct transitions from employment (job-to-job).

Table 3 Predicted mean hazard. Exit from unemployment (main quarters)

	U => T		U => P	
	Training	Temporary	Training	Temporary
Quarter 1	33,74%	34,83%	3,80%	4,25%
Quarter 2	25,49%	25,19%	3,06%	3,35%
Quarter 4	29,03%	32,20%	3,23%	3,43%
Quarter 6	21,76%	15,56%	2,15%	3,25%
Quarter 8	24,46%	23,15%	4,07%	4,46%

Figure 6 Predicted mean hazard. Exit from unemployment



Previous work experience effect

In the unemployment equation, we have included a set of explanatory variables for analyzing the effect that the previous employment history has on the probability of leaving unemployment state. These variables include information on: 1) whether the worker

previously had one or more Training contracts; 2) the number of Temporary contracts the worker has had until the current unemployment spell; and 3) the number of unemployment episodes the worker has had until the current unemployment spell.

Our estimates show that previous experience in a Training contract increases the probability of leaving unemployment. For workers who have had only one episode of Training contract, the effect on the exit toward a Temporary job is practically the same in both groups of workers: 0.274 and 0.265 for treated and control workers, respectively. However, for treated workers the effect on the probability of finding a Permanent job is negative (although the associated coefficient is not statistically significant) while for workers in the control group, this effect is positive (0.349) and statistically significant.

Again, by analyzing the similarities in the unemployment exit rates of two groups of workers, our hypothesis, by which the potential treatment effect disappears once the Training contract ends (i.e. non-exactly stepping-stone effect), is gaining strength. Although these results must be interpreted with carefully, since, as we discussed above, in this section we are analyzing workers who didn't achieve a direct transition from the treatment —Training contract— to another job. Therefore, we may be observing a group of "bad" workers, i.e. a group of treated workers less productive that have failed in getting a matching with the employer while they was hired with a Training contract.

7. The importance of Unobserved Heterogeneity

In this section we want to show the importance of controlling for the presence of unobserved heterogeneity in our model. The following graphs show the predicted hazard rates from employment (Figures 7, 8 and 9) and unemployment (Figures 10 and 11), with and without unobserved heterogeneity. Table 4 show the estimated probabilities associated to each of four mass-point defined in the likelihood function of our econometric model. In this table we can see the nonparametrically estimated distribution of the unobserved heterogeneity components.

Table 4 Estimated unobserved heterogeneity distribution

	Coef. p_j	T-stat.	Percent. π_j [15]
$\pi_1 = P(\eta^U = \eta_1^U, \eta^E = \eta_1^E; \eta^{IS} = \eta_1^E)$	1.734	0.766	48.46%
$\pi_2 = P(\eta^U = \eta_1^U, \eta^E = \eta_2^E; \eta^{IS} = \eta_2^E)$	1.182	0.183	27.9%
$\pi_3 = P(\eta^U = \eta_2^U, \eta^E = \eta_1^E; \eta^{IS} = \eta_1^E)$	0.567	0.807	15.1%
$\pi_4 = P(\eta^U = \eta_2^U, \eta^E = \eta_2^E; \eta^{IS} = \eta_2^E)$	-	-	8.56%

As we can see in these Figures, we clearly distinguish four types of individuals, depending on the intensity and type of rotation between different labour market states. The largest group (those who represent 48.46%) is characterized by high reemployment

[15] These percentages are obtained using the mlogit formula to obtain the probability distribution of unobserved heterogeneity. Namely, $\pi_j = \frac{\exp(p_j)}{\sum_{j=1}^{3}\exp(p_j)}$, expressed in percentages. $\pi_4 = 1 - \sum_{j=1}^{3}\pi_j$

rates (via job-to-job), as well as high exit rates from unemployment: when they go into an unemployment episode, also experience a quick exit from this state to a new job. This is the group with the desired work behaviour, since most of them come directly from one job to another (via job-to-job), and once unemployed find a new job quickly. For these, *treatment* (having a Training contract) has a great effect on reemployment rates (via job-to-job) from the Training contract to another Temporary contract (the 27.48% of those who carry at least 8 quarters Training employees with leave to a Temporary contract, and this rate rises to 28.09% for those who exhaust *treatment*). This effect is even higher when we analyze reemployment rates (via job-to-job) from Training contract to a Permanent job: 33.75% of those holding a Training contract at least 8 quarters find a Permanent job, and 48.20% of workers who exhaust treatment do.

There is another group of workers, who represent 8.56% of sample. These workers experience high reemployment rates from *treatment*, therefore Training contract has a positive effect on their reemployment rates. But if they go from Training contract into an unemployment episode, the probability of find a new job is quite lower than for the previous group described earlier. Furthermore, we observe that once unemployed, the probability of finding a Permanent job is practically zero and it does not depend on the duration of unemployment spell.

In fact, as we can see in Figures 10 and 11, the predicted unemployment hazard rates estimated without unobserved heterogeneity mainly describe the behaviour of 36.46% of sample (as result of adding the percentages $\pi_2 = 27.9\%$ and $\pi_4 = 8.56\%$). Thus, if we had not considered the presence of unobserved heterogeneity in our model, we would have been unable to identify the remaining 63.54% of individuals whose work behaviour differs from the rest, and for whom the *treatment* seems to have no effect on reemployment rates. This would had implied a clear source of bias in our estimates.

8. A non exactly stepping-stone effect

In Section 6, we have seen that unemployment hazard rates of both treated and control workers tend to be very similar. This may can show that treated workers who don't achieve a direct transition —from the Training contract to another Temporary contract, or to a Permanent one— and therefore go into unemployment state, loose the higher opportunities of finding a Permanent job, provided by the Training contract. Thus, upon

at unemployment state, treated workers have almost the same probabilities of finding a new job (temporary or permanent) than workers in the control group. Figures 10 and 11 show the similarity of the probabilities of leaving unemployment among those who have just had a Training contract, and those who have been employed with a Temporary one

The main aim of this paper is to investigate whether the Training contract imply (or not) a stepping-stone effect on the prospect labour career of treated workers. To do this, we have include a set of explanatory variables in the employment equation that focus on information about the most recent past labour experience of workers. We define this set of variables only for the workers of control group (i.e. for workers who are currently employed under a Temporary contract). By doing this, we want to analyze if the potential treatment effects disappear when the treatment ends (i.e. when the Training contract finishes).

This set of variables includes: 1) A dummy variable that takes value one if the temporary worker comes just from an unemployment spell; 2) A dummy variable that takes value one if the temporary worker comes just from a Training contract with a duration between one and three quarters; 3) A dummy variable that takes value one if the temporary worker comes just from a Training contract with a duration between four and six quarters; and 4) A dummy variable that takes value one if the temporary worker comes just from a Training contract with a duration between 7 and 12 quarters.
By analyzing the estimated coefficients associated to these variables, we highlight the following results: Firstly, temporary workers who come from an unemployment spell have a higher probability of go back to unemployment state (the associated coefficient is 0.168 and is statistically significant), and have a lower probability of exiting directly to another job, both to a Temporary contract (-0.038), and to a Permanent job (-0.0763). Secondly, temporary workers who come from a Training contract have a lower probability of exiting both to an unemployment spell, and to another job.

As Table A8 shows, as duration of previous Training contract increases, the probability of exiting to unemployment decreases, what may reflects that duration of the treatment affects substantially to transitions from temporary employment to unemployment. Furthermore, the probability of finding a temporary job is significantly affected by the

duration of treatment. Again, we find that coefficients associated —to the exit toward a temporary job— become more negative as the duration of treatment increases. This is a striking result since we would expect the opposite sign for these last coefficients (i.e. that the probability of finding a new job was positively correlated with the duration of treatment).

Figure 7 Employment hazard rates (E => U) , without and with unobserved heterogeneity (by type of individual)

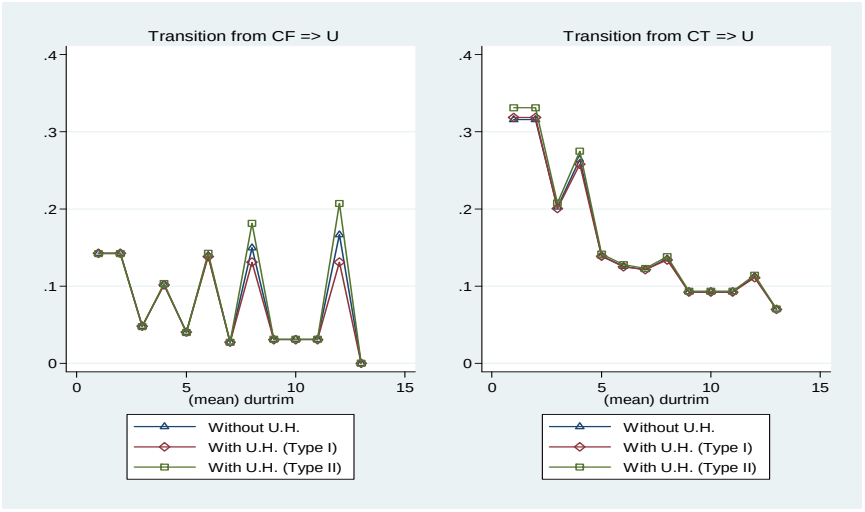


Figure 8 Employment hazard rates (E => T) , without and with unobserved heterogeneity (by type of individual)

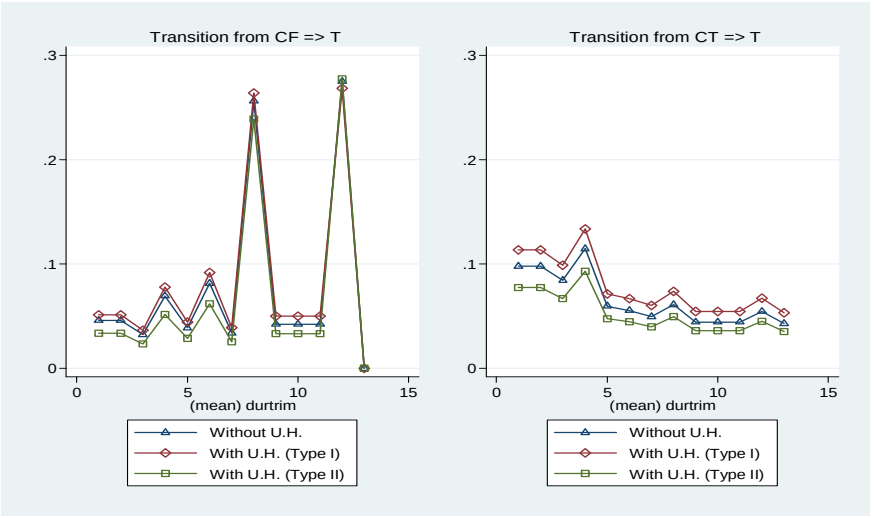


Figure 9 Employment hazard rates (E => P) , without and with unobserved heterogeneity (by type of individual)

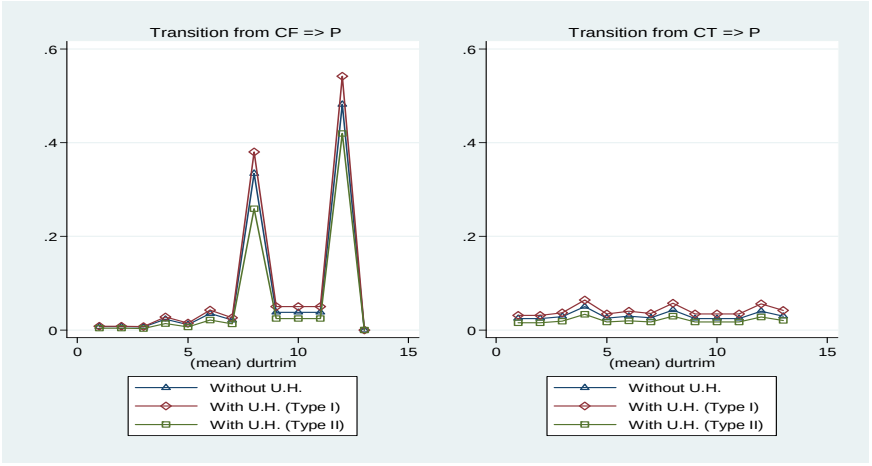


Figure 10 Unemployment hazard rates (U => T) , without and with unobserved heterogeneity (by type of individual)

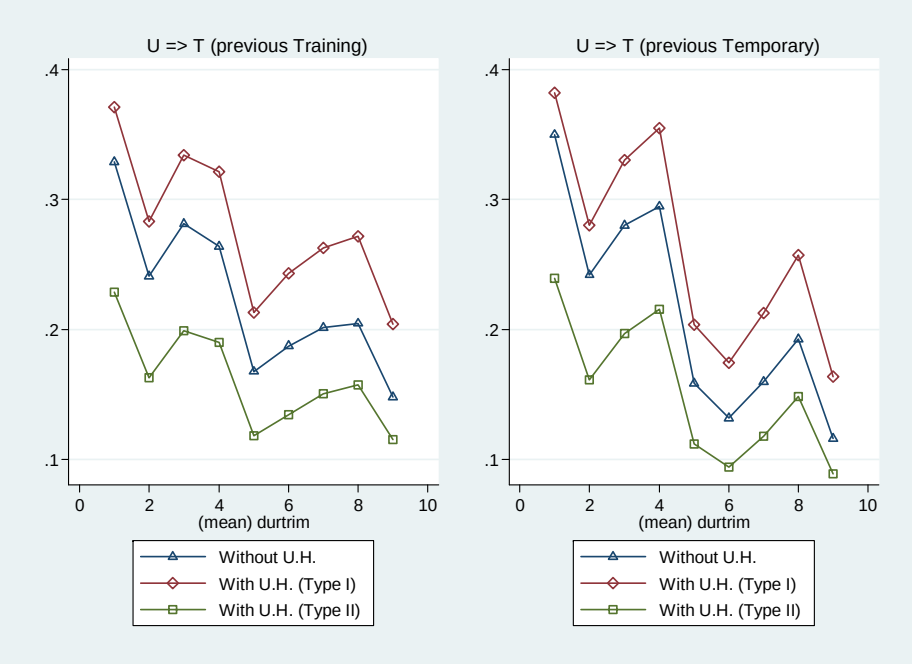
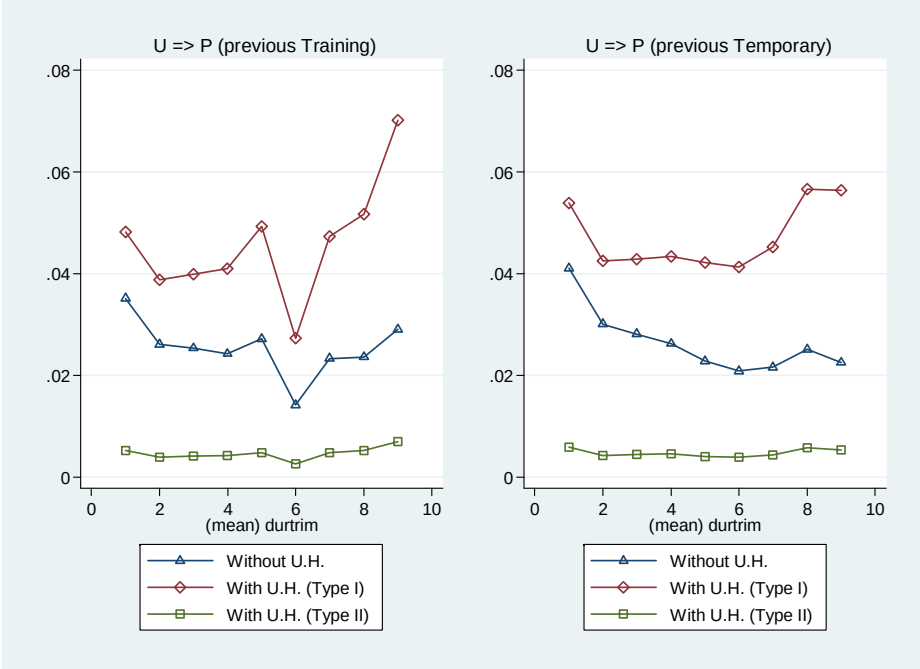


Figure 11 Unemployment hazard rates (U => P) , without and with unobserved heterogeneity (by type of individual)



9. Estimation by educational levels

In this section we investigate whether the educational level (differences) achieved by workers in our sample may have a significance influence on the treatment effect. Therefore, we have split our sample according to three educational levels, and we have estimated the econometric model in each of these three subsamples.

We define the following three educational levels: 1) Low education (this subsample consists of workers with incomplete primary education); 2) Mid education (this subsample consists of workers with complete primary education and workers with the first stage of secondary education); and 3) vocational training and bachelor degree (this subsample consists of workers with a vocational training degree and workers with a bachelor degree).

Tables 5 and 6 show, for the main quarters of the spell, the predicted employment and unemployment hazard rates, respectively; and Figures 12 and 17 plot theses hazard rates evaluated in the sample mean. [16]As we can see in Table 5, employment hazard rates show important differences by educational levels. The results show that treated workers with mid education and workers with a vocational or bachelor degree have a much lower probability of exiting to unemployment; have a lightly high probability of exiting to another Temporary contract; and have a much higher probability of finding a Permanent job.

The differences are striking. With respect to the transitions from the Training contract to unemployment, in quarter 6 this probability for workers with a vocational or bachelor degree is 8.5% (10.95% in quarter 8); for workers with mid education is 14.1% (16.56% in quarter 8); and for workers without education is 17.21% (16.24% in quarter 8).

If we focus on transitions from the Training contract to a Permanent job, we see that for example in quarter 8, the probability of finding a Permanent job for workers with a vocational or bachelor degree is 33% (50.21% in quarter 12); for workers with mid education is 34.22% (52.85% in quarter 12); and for workers without education is 28.63% (43.63% in quarter 12).

[16] All these estimation results are available upon request.

Table 5 Predicted mean hazard, by educational level. Exit from employment (main quarters)

	Without Education		*Low Education*		*Vocational training or bachelor degree*	
E => U	**Training**	**Temporary**	**Training**	**Temporary**	**Training**	**Temporary**
Quarter 1	13,80%	31,84%	13,59%	30,92%	12,85%	33,87%
Quarter 4	10,96%	26,77%	10,44%	26,42%	7,86%	26,62%
Quarter 6	17,21%	14,29%	14,10%	12,21%	8,50%	11,54%
Quarter 8	16,24%	13,21%	16,56%	12,56%	10,95%	14,79%
Quarter 12	19,93%	13,10%	13,00%	11,20%	13,51%	7,85%
	Without Education		*Low Education*		*Vocational training or bachelor degree*	
E => T	**Training**	**Temporary**	**Training**	**Temporary**	**Training**	**Temporary**
Quarter 1	3,66%	9,42%	4,98%	10,47%	4,69%	10,26%
Quarter 4	6,04%	11,51%	7,28%	12,63%	5,80%	11,13%
Quarter 6	7,26%	5,73%	7,98%	6,26%	7,66%	5,61%
Quarter 8	25,52%	6,16%	25,62%	7,01%	23,53%	6,66%
Quarter 12	26,87%	6,66%	29,25%	6,88%	26,62%	5,08%
	Without Education		*Low Education*		*Vocational training or bachelor degree*	
E => P	**Training**	**Temporary**	**Training**	**Temporary**	**Training**	**Temporary**
Quarter 1	0,54%	2,06%	0,78%	2,66%	0,89%	3,28%
Quarter 4	1,70%	4,61%	2,57%	5,27%	2,14%	6,02%
Quarter 6	2,86%	2,48%	3,41%	3,43%	3,37%	3,91%
Quarter 8	28,63%	3,87%	34,22%	4,60%	33,00%	6,14%
Quarter 12	43,63%	3,60%	52,82%	4,29%	50,21%	7,01%

Table 6 Predicted mean hazard, by educational level. Exit from unemployment (main quarters)

	Without Education		*Low Education*		*Vocational training or bachelor degree*	
U => T	**Training**	**Temporary**	**Training**	**Temporary**	**Training**	**Temporary**
Quarter 1	33,10%	34,24%	35,18%	36,49%	34,55%	33,16%
Quarter 2	26,20%	25,69%	26,92%	27,09%	24,48%	23,38%
Quarter 4	24,54%	25,96%	26,35%	29,04%	45,10%	42,06%
Quarter 6	22,05%	14,85%	22,54%	17,72%	24,10%	15,09%
Quarter 8	20,38%	19,59%	20,92%	20,88%	42,13%	29,81%
	Without Education		*Low Education*		*Vocational training or bachelor degree*	
U => P	**Training**	**Temporary**	**Training**	**Temporary**	**Training**	**Temporary**
Quarter 1	2,71%	3,30%	3,49%	4,55%	4,81%	5,05%
Quarter 2	1,96%	2,80%	3,00%	3,78%	4,18%	3,84%
Quarter 4	3,41%	2,24%	2,02%	3,17%	4,49%	5,58%
Quarter 6	1,64%	1,92%	1,89%	4,34%	3,35%	4,34%
Quarter 8	3,60%	2,59%	3,97%	5,20%	4,27%	6,68%

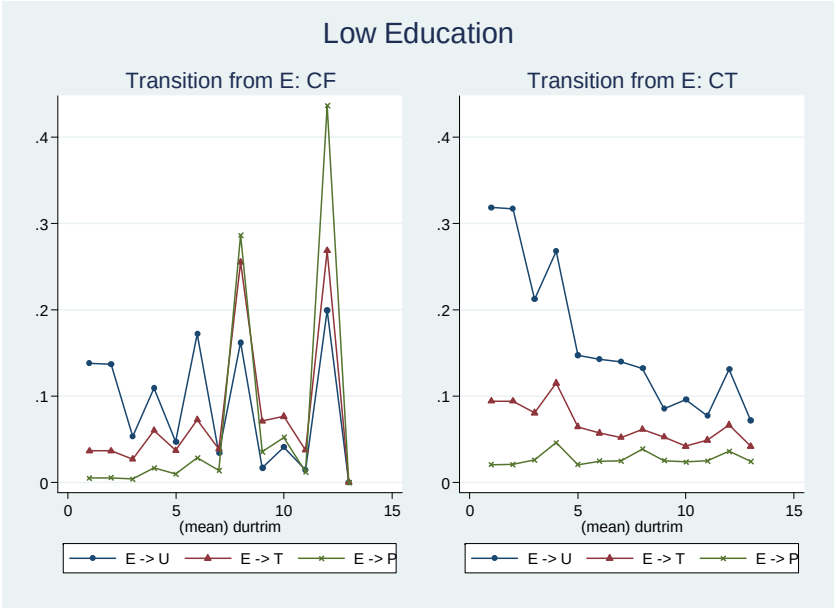


Figure 12 Exit from employment. Low education

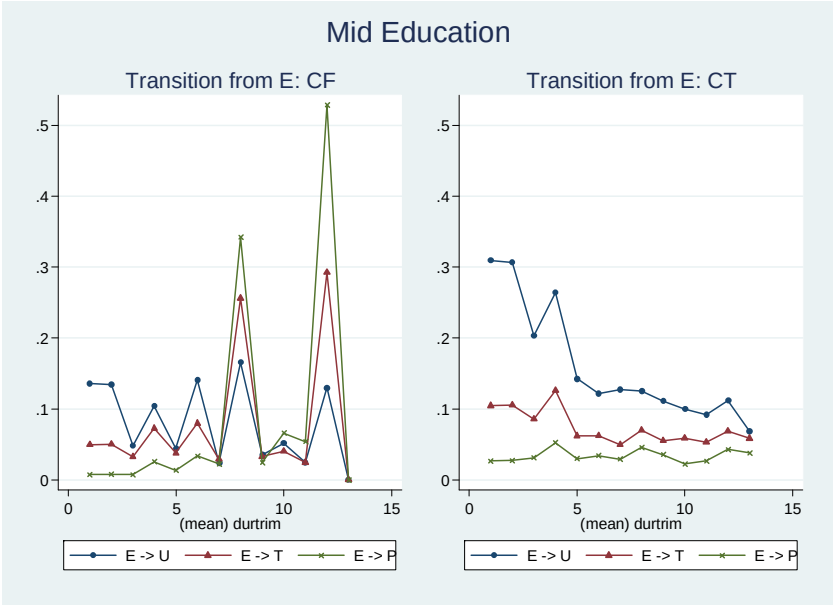


Figure 13 Exit from employment. Mid education

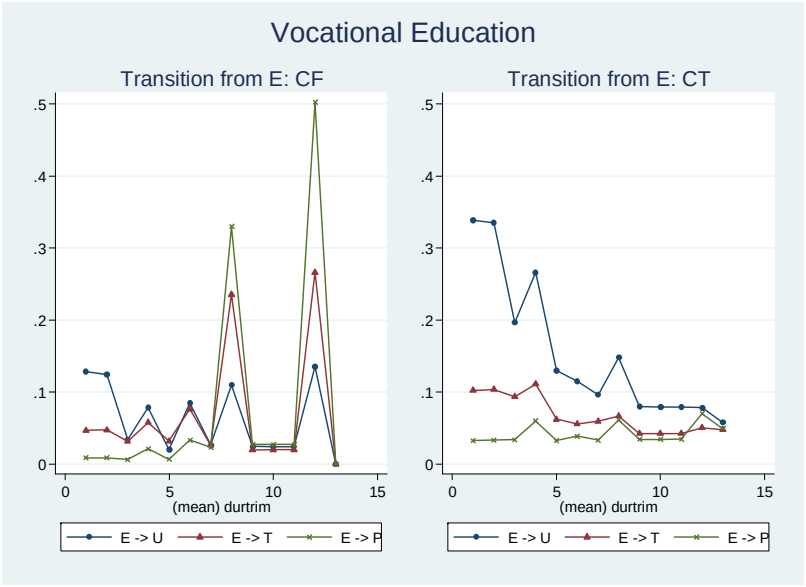


Figure 14 Exit from employment. Vocational and bachelor degree

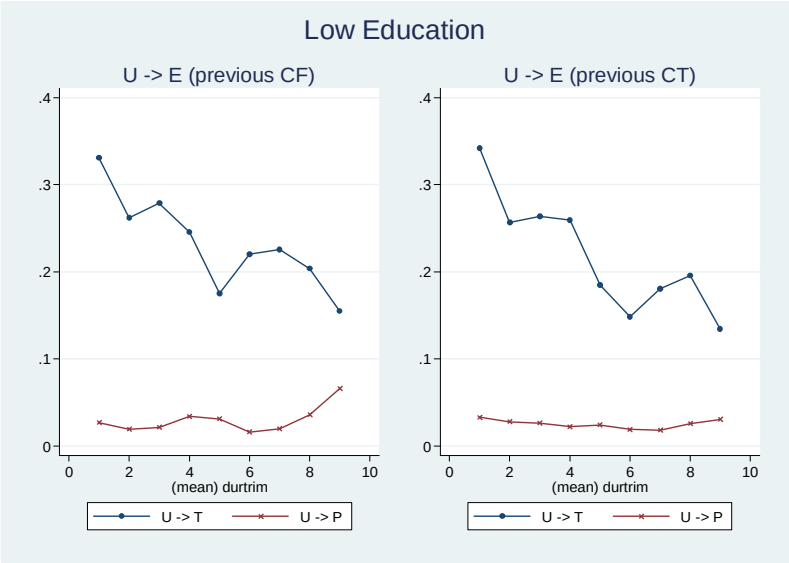


Figure 15 Exit from unemployment. Low education

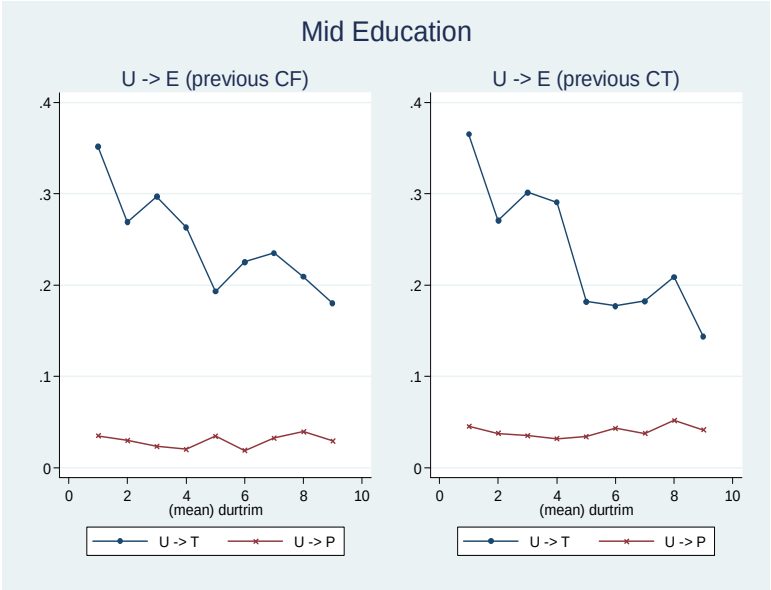


Figure 16 Exit from unemployment. Mid education

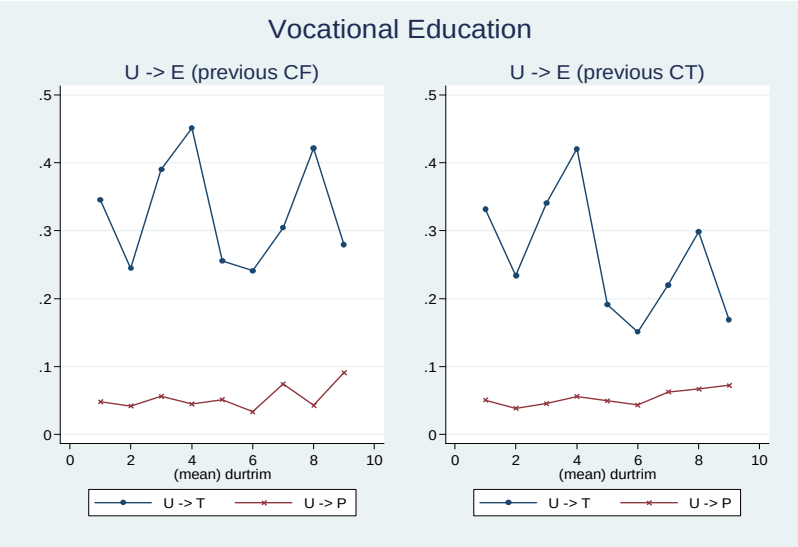


Figure 17 Exit from unemployment. Vocational and bachelor degree

10. Concluding Remarks

Training contracts have become a major form of active labour market policy to reduce the unemployment incidence of low educated young workers and to enhance their chances of entering into a regular work. If training contracts are not a stepping stone, then the problem becomes evident because there is a proportion of the population that, given they low educational attainment level, will have strong difficulties to have a stable labour market career. Available evidence about whether these contracts are a stepping stone to a permanent employment are not common since the empirical literature has mostly focused on the role of temporary contracts of any kind as a device to favour future regular employment. However, training contracts are not the typical temporary contract since benefited workers may acquire formal education and training during the life of the contract. Hence, they deserve special attention.

For testing the stepping-stone hypothesis, we analyse a sample of low educated young employees (16-30 years old) for the period 2000-2012, obtained from Spanish administrative Social Security records, and apply a mixed proportional hazards rate model with multiple states –employment and unemployment– facing multiple competing risks, and controlling for the presence of unobserved heterogeneity.

The results obtained show that 30% of young people hired at least for two years under this contract find a permanent job immediately after the training contract (without any unemployment period in between). This rate increases almost to 50% for those who complete the full duration of the contract, which shows the importance of the *treatment* duration on the job-to-job rate for those hired under this type of contract. Hence, it seems that in Spain, some firms make use of this type of contract as a signalling device—once trained and qualified, these employees are reintroduced into their production process.

However, it is not clear the presence of a stepping-stone effect, since the treatment effect is reflected in the reemployment rates (directly from the Training contract to another Temporary contract, and especially, to a Permanent job), but this effect seems to disappear once treatment has ended (i.e. once the Training contract has concluded). That is, if throughout the duration of the Training contract the worker fails, and hence, he does not get a new job before the end of contract; once the treatment is finished, and he goes into an unemployment episode, the probability of finding a job will be practically the same for anyone who has not previously

received the treatment. Therefore, according to the results obtained, we can argue that Training contract has a positive effect on employment rates immediately after receiving the treatment, but we cannot conclude that Training contract involve a stepping-stone effect in working career of individuals treated.

References

Abbring, Jaap H. and Gerard J. Van den Berg, (2003): "The nonparametric identification of treatment effects in duration models", *Econometrica*, Vol. 71, No. 5, 1491-1517.

García-Pérez, J.I. and Muñoz-Bullón, F. (2011): "Transitions into Permanent Employment in Spain: An Empirical Analysis for Young Workers", *The British Journal of Industrial Relations*, Vol 49(1), pp. 103-143.

Gould, W., Pitblado, J. and Sribney, W. (2006), *Maximum Likelihood Estimation with Stata*, Third Edition, Stata Press.

Heckman, J. J. and Singer, B. (1984): "A Method for Minimizing the Impact of the Distributional Assumptions in Econometric Models for Duration Data", *Econometrica*, Vol. 52, pp. 271–320.

Heckman, J.J. and B.E. Honoré (1989): "The identifiability of the competing risk models", *Biometrika*, 76, 325-330.

Honoré, B.E. (1993): "Identification results for duration models with multiple spells", *Review of Economic Studies*, 60, 241-246.

Kaplan, E.L. and Meier, P. (1958): "Nonparametric estimation from incomplete observations", Journal of the American Statistical Association, 53, pp. 457-481.

Lancaster, T. (1990), *The econometric analysis of transition data*, Cambridge University Press, Cambridge.

Marloes de Graaf-Zijl, Gerard J. van den Berg, Arjan Heyma (2011): "Stepping stones for the unemployed: the effect of temporary jobs on the duration until (regular) work", *Journal of Population Economics*, 24:107–139.

Rebollo, Yolanda (2011): "Landing a permanent contract in Spain: Do job interruptions and employer diversification matter?", *The Manchester School*, Vol. 79, No. 6, pp. 1197-1236.

Van den Berg, G.J. (1999): "Duration models: specification, identification and multiple durations", in J.J. Heckman and E. Leamer (eds.), Handbook of Econometrics, Volume V, North-Holland, Amsterdam.

Wooldridge, J. (2005): "Simple solutions to the initial conditions problem for dynamic, nonlinear panel data models with unobserved heterogeneity", Journal of Applied Econometrics 20(1): 39-54.

Results Appendix

Table A1 Predicted mean hazard. Exit from employment

	CF -mean hazard-			CT -mean hazard-		
Duration of spell (in quarters)	E => U	E => T	E => P	E => U	E => T	E => P
1	14,26%	4,50%	0,71%	32,31%	10,05%	2,59%
2	14,26%	4,50%	0,71%	32,31%	10,05%	2,59%
3	4,80%	3,17%	0,63%	20,33%	8,71%	3,07%
4	10,24%	6,85%	2,31%	26,42%	11,87%	5,31%
5	4,04%	3,86%	1,19%	13,98%	6,28%	2,80%
6	14,01%	8,11%	3,51%	12,63%	5,87%	3,28%
7	2,77%	3,39%	2,16%	12,21%	5,29%	2,90%
8	14,95%	25,48%	33,60%	13,57%	6,51%	4,75%
9	3,10%	4,41%	4,12%	9,28%	4,78%	2,83%
10	3,10%	4,41%	4,12%	9,28%	4,78%	2,83%
11	3,10%	4,41%	4,12%	9,28%	4,78%	2,83%
12	15,87%	27,17%	49,69%	11,23%	5,91%	4,61%
13	0,00%	0,00%	0,00%	7,02%	4,68%	3,44%

Table A2 Predicted mean hazard. Exit from unemployment

	CF -mean hazard-		CT -mean hazard-	
Duration of spell (in quarters)	U => T	U => P	U => T	U => P
1	33,74%	3,80%	34,83%	4,25%
2	25,49%	3,06%	25,19%	3,35%
3	30,21%	3,15%	29,87%	3,38%
4	29,03%	3,23%	32,20%	3,43%
5	19,08%	3,87%	18,22%	3,32%
6	21,76%	2,15%	15,56%	3,25%
7	23,64%	3,73%	19,03%	3,56%
8	24,46%	4,07%	23,15%	4,46%
9	18,31%	5,53%	14,60%	4,43%

Table A3 Predicted hazard, by type of individual. Exit from employment

	CF -Type I-			CT -Type I-			CF -Type II-			CT -Type II-		
Duration of spell (in quarters)	E => U	E => T	E => P	E => U	E => T	E => P	E => U	E => T	E => P	E => U	E => T	E => P
1	14,27%	5,15%	0,87%	31,84%	11,38%	3,15%	14,24%	3,36%	0,43%	33,13%	7,74%	1,61%
2	14,27%	5,15%	0,87%	31,84%	11,38%	3,15%	14,24%	3,36%	0,43%	33,13%	7,74%	1,61%
3	4,82%	3,64%	0,77%	20,08%	9,88%	3,74%	4,77%	2,35%	0,37%	20,76%	6,68%	1,90%
4	10,17%	7,80%	2,82%	25,80%	13,35%	6,43%	10,35%	5,19%	1,41%	27,51%	9,30%	3,36%
5	4,04%	4,43%	1,47%	13,88%	7,15%	3,43%	4,02%	2,88%	0,72%	14,15%	4,77%	1,72%
6	13,85%	9,20%	4,28%	12,53%	6,68%	4,01%	14,29%	6,21%	2,17%	12,79%	4,46%	2,01%
7	2,77%	3,88%	2,65%	12,14%	6,03%	3,55%	2,77%	2,54%	1,30%	12,32%	4,00%	1,77%
8	13,11%	26,39%	38,04%	13,41%	7,38%	5,79%	18,16%	23,90%	25,87%	13,86%	4,99%	2,94%
9	3,09%	5,02%	5,04%	9,24%	5,46%	3,47%	3,14%	3,34%	2,51%	9,35%	3,61%	1,72%
10	3,09%	5,02%	5,04%	9,24%	5,46%	3,47%	3,14%	3,34%	2,51%	9,35%	3,61%	1,72%
11	3,09%	5,02%	5,04%	9,24%	5,46%	3,47%	3,14%	3,34%	2,51%	9,35%	3,61%	1,72%
12	13,10%	26,85%	54,13%	11,12%	6,72%	5,62%	20,69%	27,72%	41,97%	11,44%	4,52%	2,84%
13	0,00%	0,00%	0,00%	6,99%	5,33%	4,21%	0,00%	0,00%	0,00%	7,09%	3,54%	2,10%

Table A4 Predicted hazard, by type of individual. Exit from unemployment

	CF -Type I-		CT -Type I-		CF -Type II-		CT -Type II-	
Duration of spell (in quarters)	U => T	U => P	U => T	U => P	U => T	U => P	U => T	U => P
1	37,10%	4,82%	38,20%	5,38%	22,89%	0,53%	23,93%	0,60%
2	28,33%	3,89%	28,00%	4,26%	16,30%	0,40%	16,14%	0,43%
3	33,40%	3,99%	33,02%	4,28%	19,89%	0,42%	19,69%	0,45%
4	32,14%	4,10%	35,50%	4,34%	19,00%	0,43%	21,54%	0,47%
5	21,32%	4,92%	20,40%	4,22%	11,86%	0,48%	11,19%	0,41%
6	24,32%	2,73%	17,46%	4,14%	13,46%	0,27%	9,40%	0,39%
7	26,29%	4,74%	21,27%	4,53%	15,06%	0,48%	11,78%	0,44%
8	27,17%	5,17%	25,72%	5,66%	15,73%	0,53%	14,84%	0,58%
9	20,40%	7,02%	16,37%	5,64%	11,54%	0,70%	8,90%	0,54%

Figure A5 Predicted mean hazard, by type of individual. Exit from employment

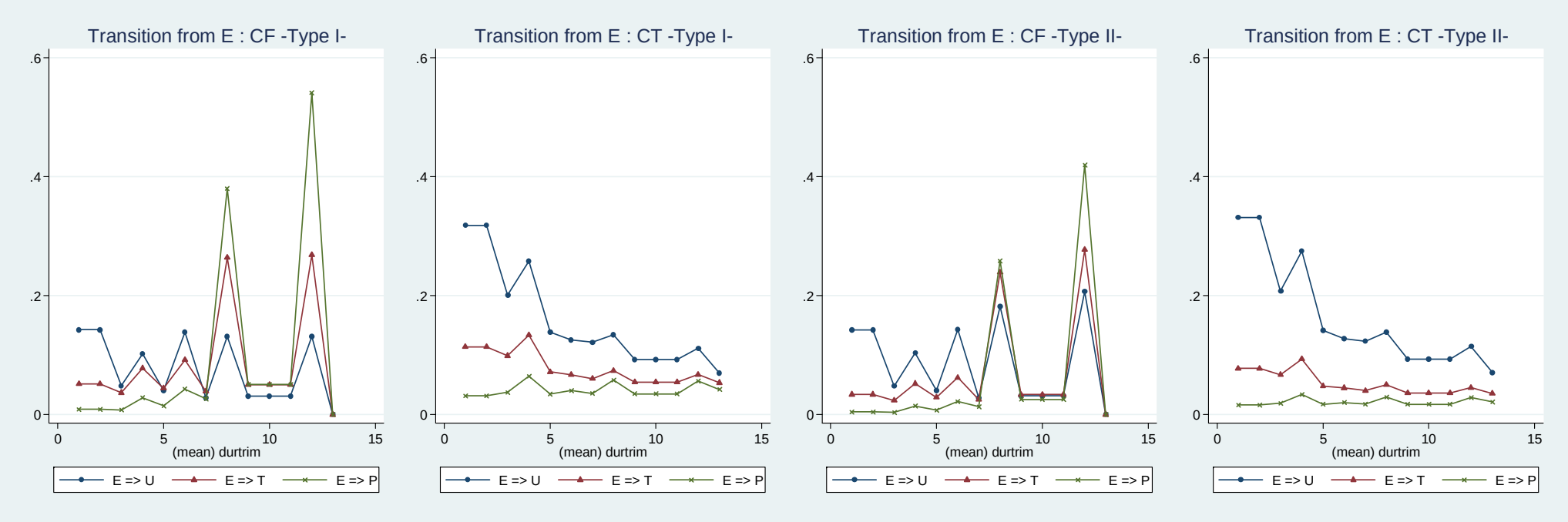


Figure A6 Predicted mean hazard, by type of individual. Exit from unemployment

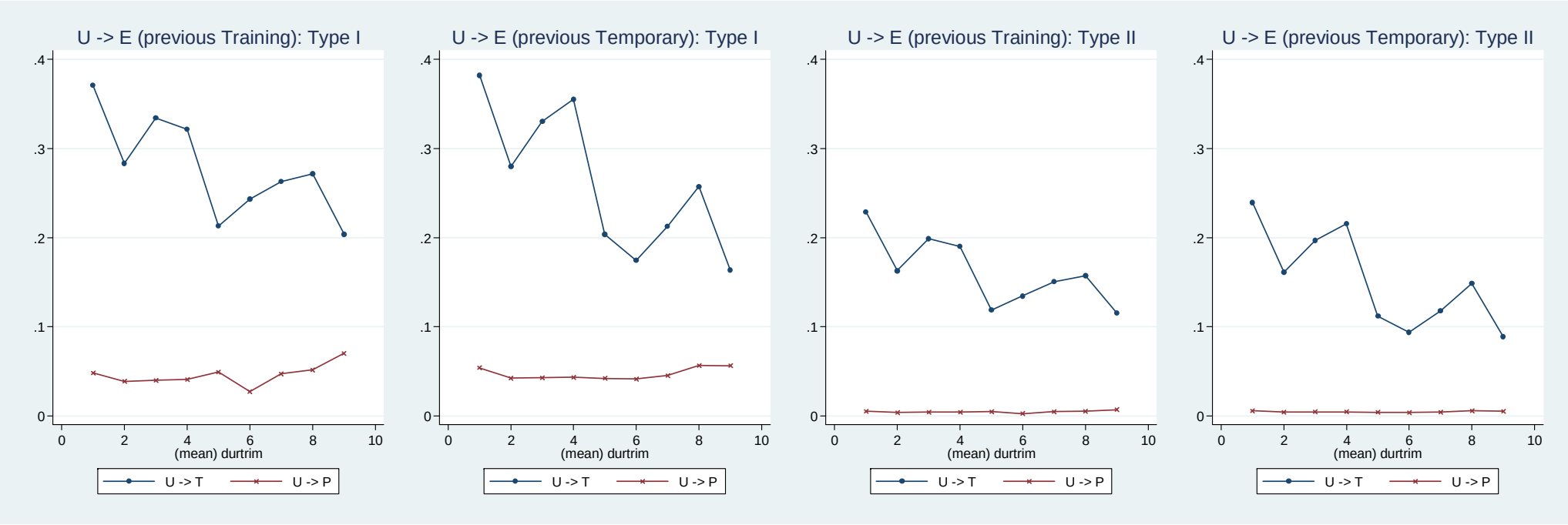


Table A7 Initial conditions

	Training	Permanent
Personal characteristics (dummies)		
Female (=1)	0.330***	-0.143***
Age 20-23	-0.864***	0.280***
Age 24-30	-2.576***	0.470***
Economic Immigrant	-0.682***	0.351***
Firm characteristics (dummies)		
Public firm	2.390***	-3.469***
Firm size without info.	2.890***	-0.241***
Firm size small (1-2 workers)	2.535***	0.223***
Economic sector (dummies)		
Industry or Construction sectors	1.063***	0.0836*
Commercial or Hospitality sectors	0.783***	0.654***
Regional dummies		
Andalucia	1.038***	-0.743***
Aragon	0.0346	-0.258**
Asturias	1.524***	-0.497***
Baleares	0.0446	-0.685***
Canarias	-0.0795	-0.306***
Cantabria	0.809***	-0.933***
Castilla La Mancha	0.550***	-0.275***
Castilla Leon	0.413***	-0.460***
Valencia	0.428***	-0.325***
Extremadura	1.284***	-0.499***
Galicia	1.512***	-0.590***
Madrid	0.756***	0.0994*
Murcia	0.643***	0.0421
Navarra	0.373***	-0.470***
Pais Vasco	0.464***	-0.409***
Observations	49,484	

Table A8 Exit from employment

Worker currently employed under a Training contract				Worker currently employed under a Temporary contract					
	E => U	E => T	E => P		E => U	E => T	E => P		
Baseline hazard				***Baseline hazard***					
Quarter 3	-1.215***	-0.476***	-0.250**	Quarter 3	-0.673***	-0.353***	-0.0395	η_1^U	-0.786***
Quarter 4	-0.332***	0.422***	1.184***	Quarter 4	-0.225***	0.145***	0.699***		(0.0209)
Quarter 5	-1.383***	-0.273***	0.402***	Quarter 5	-1.172***	-0.806***	-0.257***	η_2^U	-1.546***
Quarter 6	0.0625	0.672***	1.687***	Quarter 6	-1.291***	-0.891***	-0.118**		(0.0365)
Quarter 7	-1.767***	-0.411***	0.985***	Quarter 7	-1.342***	-1.013***	-0.258***	η_1^E	-0.113***
Quarter 8	1.182***	2.900***	5.045***	Quarter 8	-1.179***	-0.747***	0.295***		(0.0230)
Quarters 9-11	-1.617***	-0.111	1.671***	Quarters 9-11	-1.659***	-1.157***	-0.326***	η_2^E	-0.143***
Quarter 12	2.516***	4.252***	6.732***	Quarter 12	-1.408***	-0.883***	0.224**		(0.0308)
				Quarter 13	-1.959***	-1.199***	-0.153	k^{UP}	3.282***
Current spell				***Current spell***					(0.113)
Training contract (=1)	-1.597***	-1.659***	-2.471***	Part time job (=1)	-0.00211	0.0823***	0.000104	k^{ET}	15.06***
Past labour experience				***Past labour experience***					(2.811)
Previous Training contract/s (=1)	-0.0145	0.542***	0.730***	Previous Training contract/s (=1)	-0.178***	0.114***	0.0468	k^{EP}	24.53***
Previous Temporary contracts (number)	-0.101***	0.202***	0.151***	Previous Temporary contracts (number)	-0.0391***	0.134***	0.0191**		(4.596)
Previous unemployment spells (number)	0.189***	-0.0312	-0.0632	Previous unemployment spells (number)	0.0864***	-0.0676***	-0.0330***	k^F	29.44***
				Comes from an unemployment spell (=1)	0.168***	-0.0380***	-0.0763***		(5.555)
				Comes from a Training contract (1-3 quarters) (=1)	-0.382***	-0.188***	-0.282***	k^P	16.08***
				Comes from a Training contract (4-6 quarters) (=1)	-0.502***	-0.231***	-0.0831		(2.784)
				Comes from a Training contract (7-12 quarters) (=1)	-0.815***	-0.527***	-0.0218	p_1	1.734**
Personal characteristics				***Personal characteristics***					(0.766)
Female (=1)	0.168***	-0.0591	-0.000228	Female (=1)	0.119***	-0.0102	0.0971***	p_2	1.182***
Current Age - 16	-0.169***	-0.0497**	0.0860***	Current Age - 16	-0.172***	-0.0179***	0.0621***		(0.183)

(Current Age - 16)^2	0.00627***	-0.00243	-0.0121***	(Current Age - 16)^2	0.00696***	-0.000458	-0.00416***	p_3	0.567
Economic Immigrant	-0.0168	0.155	0.276**	Economic Immigrant	-0.00213	0.239***	-0.0539		(0.807)
Low Education (=1)	-0.0140	0.0181	0.0858	Low Education (=1)	0.0230**	0.0438***	0.143***		
Vocational Training (Low degree) (=1)	0.144***	0.151**	0.292***	Vocational Training (Low degree) (=1)	0.0593***	0.0584**	0.294***		
Vocational Training (High degree) (=1)	0.415***	0.245***	0.335***	Vocational Training (High degree) (=1)	0.200***	0.0687***	0.309***		
Bachelor Degree (=1)	0.501***	-0.0302	0.278**	Bachelor Degree (=1)	0.279***	0.0622***	0.267***		
Economic cycle				***Economic cycle***					
Quarterly employment growth rate (Q.e.g.r.)	-0.00764**	0.0706***	0.0772***	Quarterly employment growth rate (Q.e.g.r.)	0.00594***	0.0789***	0.0793***		
Other control dummies				***Other control dummies***					
Industry or Construction sectors	0.501***	0.614***	0.600***	Industry or Construction sectors	0.0911***	-0.0490***	-0.203***		
Commercial or Hospitality sectors	0.701***	0.650***	0.968***	Commercial or Hospitality sectors	0.254***	0.0788***	0.384***		
Firm size without info.	0.578***	0.742***	1.161***	Firm size without info.	0.259***	0.413***	0.0812***		
Firm size small (1-2 workers)	-0.570***	-0.312***	0.334***	Firm size small (1-2 workers)	0.150***	0.0298	0.0366		
Regional dummies				***Regional dummies***					
Andalucia	0.0487	-0.0520	-0.986***	Andalucia	-0.140***	-0.192***	-0.743***		
Aragon	0.139	0.0329	7.64e-05	Aragon	-0.126***	-0.101**	-0.201***		
Asturias	0.129*	0.0747	-0.483***	Asturias	-0.203***	-0.289***	-0.584***		
Baleares	0.217**	0.168	0.316*	Baleares	0.0699***	-0.122***	-0.541***		
Canarias	0.245***	-0.0495	-0.554***	Canarias	-0.0529**	-0.128***	-0.574***		
Cantabria	0.308***	0.0321	-0.830***	Cantabria	-0.153***	-0.108**	-0.503***		
Castilla La Mancha	-0.126**	0.00990	-0.370***	Castilla La Mancha	-0.130***	-0.126***	-0.294***		
Castilla Leon	0.133**	0.0807	-0.229**	Castilla Leon	-0.135***	-0.187***	-0.395***		
Valencia	-0.0654	-0.130*	-0.522***	Valencia	-0.0812***	-0.0859***	-0.307***		
Extremadura	-0.00296	-0.153	-0.896***	Extremadura	-0.212***	-0.483***	-1.026***		
Galicia	0.217***	0.182***	-0.600***	Galicia	-0.251***	-0.220***	-0.578***		
Madrid	0.149***	-0.0545	-0.0584	Madrid	-0.156***	-0.0670***	-0.210***		
Murcia	-0.166**	-0.162*	-0.616***	Murcia	-0.172***	-0.199***	-0.320***		
Navarra	0.144	0.103	-0.332	Navarra	-0.141***	-0.103*	-0.361***		
Pais Vasco	0.179**	0.0813	-0.00776	Pais Vasco	-0.175***	-0.121***	-0.520***		
Observations	716,138								
Log-likelihood	-612263								

Table A9 Exit from unemployment

Unemployed worker has just been employed under a Training contract			Unemployed worker has just been employed under a Temporary contract				
	U => T	U => P		U => T	U => P		
Baseline hazard			***Baseline hazard***				
Quarter 2	-0.424***	-0.369***	Quarter 2	-0.494***	-0.418***	η_1^U	-0.786***
Quarter 3	-0.180***	-0.263**	Quarter 3	-0.252***	-0.334***		(0.0209)
Quarter 4	-0.237***	-0.254*	Quarter 4	-0.138***	-0.279***	η_2^U	-1.546***
Quarter 5	-0.793***	-0.217	Quarter 5	-0.918***	-0.535***		(0.0365)
Quarter 6	-0.650***	-0.795***	Quarter 6	-1.112***	-0.593***	η_1^E	-0.113***
Quarter 7	-0.516***	-0.189	Quarter 7	-0.860***	-0.447***		(0.0230)
Quarter 8	-0.464***	-0.0830	Quarter 8	-0.591***	-0.146	η_2^E	-0.143***
Quarter 9	-0.821***	0.153	Quarter 9	-1.172***	-0.278**		(0.0308)
Current spell			***Current spell***			k^{UP}	3.282***
Unemployment benefits (U.B.)	-1.350***	-1.782***	Unemployment benefits (U.B.)	-0.801***	-0.717***		(0.113)
Past labour experience			***Past labour experience***			k^{ET}	15.06***
One just previous Training contract (=1)	0.274***	-0.185	One previous Training contract (=1)	0.265***	0.349***		(2.811)
Two or more previous Training contract/s (=1)	0.374***	0.465***	Two or more previous Training contract/s (=1)	0.356***	0.390***	k^{EP}	24.53***
Previous Temporary contracts (number)	0.305***	0.322***	Previous Temporary contracts (number)	0.128***	0.0624***		(4.596)
Previous unemployment spells (number)	-0.186***	-0.277***	Previous unemployment spells (number)	-0.0909***	-0.120***	k^F	29.44***
			Part time job (=1)	-0.105***	-0.0137		(5.555)
Personal characteristics			***Personal characteristics***			k^P	16.08***
Female (=1)	-0.0655**	0.0126	Female (=1)	-0.0343***	-0.0361		(2.784)
Current Age - 16	0.0974***	0.372***	Current Age - 16	0.108***	0.242***	p_1	1.734**
(Current Age - 16)^2	-0.00726***	-0.0241***	(Current Age - 16)^2	-0.00587***	-0.0115***		(0.766)
Economic Immigrant	0.146	0.394**	Economic Immigrant	0.288***	0.224***	p_2	1.182***
Low Education (=1)	-0.0112	0.0694	Low Education (=1)	0.0748***	0.146***		(0.183)
Vocational Training	-0.234***	0.0787	Vocational Training	0.0569***	0.237***	p_3	0.567

(Low degree) (=1)			(Low degree) (=1)			
Vocational Training (High degree) (=1)	-0.341***	-0.242*	Vocational Training (High degree) (=1)	-0.0752***	-0.0774*	(0.807)
Bachelor Degree (=1)	-0.431***	-0.295**	Bachelor Degree (=1)	-0.128***	-0.115***	
Economic cycle			***Economic cycle***			
Quarterly employment growth rate (Q.e.g.r.)	0.0284***	0.00958	Quarterly employment growth rate (Q.e.g.r.)	0.0326***	0.0385***	
(Q.e.g.r.) x ln(dur. unemployment)	-0.0169***	-0.0112	(Q.e.g.r.) x ln(dur. unemployment)	-0.00949***	-0.0131***	
2004-2007 period (=1)	0.0965**	0.371***	2004-2007 period (=1)	0.194***	0.254***	
2008-2012 period (=1)	-0.329***	-0.363**	2008-2012 period (=1)	-0.139***	-0.291***	
Other control dummies			***Other control dummies***			
Industry or Construction sectors	0.0475	-0.157	Industry or Construction sectors	0.119***	0.0486	
Commercial or Hospitality sectors	-0.0715	-3.94e-05	Commercial or Hospitality sectors	-0.0233	0.284***	
Firm size without info.	-0.115***	0.0475	Firm size without info.	-0.0216	-0.0930***	
Firm size small (1-2 workers)	0.114**	0.297**	Firm size small (1-2 workers)	-0.00518	0.0651	
Regional dummies			***Regional dummies***			
Andalucia	-0.124**	-1.160***	Andalucia	-0.0385**	-0.900***	
Aragon	-0.0141	-0.437	Aragon	-0.000235	-0.367***	
Asturias	-0.158	-0.536***	Asturias	-0.0986**	-0.848***	
Baleares	0.0454	-0.652**	Baleares	0.0589*	-0.303***	
Canarias	-0.298***	-0.573***	Canarias	-0.0598**	-0.474***	
Cantabria	0.111	-1.016***	Cantabria	0.0913*	-0.507***	
Castilla La Mancha	0.0619	-0.517***	Castilla La Mancha	0.0148	-0.590***	
Castilla Leon	-0.146*	-1.028***	Castilla Leon	-0.0160	-0.477***	
Valencia	0.000971	-0.484***	Valencia	0.0121	-0.336***	
Extremadura	-0.0579	-0.765***	Extremadura	-0.170***	-0.875***	
Galicia	-0.0351	-0.798***	Galicia	0.0406	-0.678***	
Madrid	0.123*	0.00184	Madrid	0.108***	-0.0187	
Murcia	-0.0543	-0.311	Murcia	-0.0785**	-0.376***	
Navarra	-0.109	-0.164	Navarra	0.140***	-0.495***	
Pais Vasco	-0.115	-0.837***	Pais Vasco	0.127***	-0.545***	
Observations	716,138					
Log-likelihood	-612263					

Technical Appendix

General form of first derivatives composing gradient vector:

1. Exits from unemployment state

$$\frac{\partial \log L}{\partial \beta^{UD_U}} = \sum_{i=1}^{N} \frac{1}{L_i} \left(\sum_{j=1,2,3,4} \left[pr_j \left(e^{\sum_{t=1}^{T_i} \log l_{it}^j} \right) \left(\sum_{t=1}^{T_i} \frac{\partial \log l_{it}^j}{\partial \left(x_{it}^{UD_U} \beta^{UD_U} + k^{UD_U} \eta_{u_j}^U \right)} \frac{\partial \left(x_{it}^{UD_U} \beta^{UD_U} + k^{UD_U} \eta_{u_j}^U \right)}{\partial \beta^{UD_U}} \right) \right] \right)$$

With $u_j = \begin{cases} 1 \, if \;\; j = 1,2 \\ 2 \, if \;\; j = 3,4 \end{cases}$

Where D_U contains two specific destinations from unemployment state: a temporary employment (T), and a permanent job (P). Thus, $D_U = \{T, P\}$. Therefore, we estimate two different parameter vectors specific to each exit from unemployment state: β^{UT} and β^{UP}.

$\frac{\partial \log L}{\partial \beta^{UD_U}}$ is a $k_u x 1$ vector, where k_u : number of covariates include in equation of unemployment exits.

2. Exits from employment state

$$\frac{\partial \log L}{\partial \beta^{ED_E}} = \sum_{i=1}^{N} \frac{1}{L_i} \left(\sum_{j=1,2,3,4} \left[pr_j \left(e^{\sum_{t=1}^{T_i} \log l_{it}^j} \right) \left(\sum_{t=1}^{T_i} \frac{\partial \log l_{it}^j}{\partial \left(x_{it}^{ED_E} \beta^{ED_E} + k^{ED_E} \eta_{e_j}^E \right)} \frac{\partial \left(x_{it}^{ED_E} \beta^{ED_E} + k^{ED_E} \eta_{e_j}^E \right)}{\partial \beta^{ED_E}} \right) \right] \right)$$

With $e_j = \begin{cases} 1 \, if \;\; j = 1,3 \\ 2 \, if \;\; j = 2,4 \end{cases}$

Where D_E contains three specific destinations from employment state: an unemployment spell (U), a temporary employment (T), and a permanent job (P). Thus, $D_E = \{U, T, P\}$. Therefore, we estimate three different parameter vectors specific to each exit from employment state: β^{EU}, β^{ET} and β^{EP}.

$\frac{\partial \log L}{\partial \beta^{UD_E}}$ is a $k_E x 1$ vector, where k_E : number of covariates include in equation of employment exits.

3. Unobserved heterogeneity components affecting unemployment exits

$$\frac{\partial \log L}{\partial \eta_1^U} = \sum_{i=1}^{N} \frac{1}{L_i} \left(\sum_{j=1,2} pr_j \left(e^{\sum_{t=1}^{T_i} \log l_{it}^j} \right) \left(\sum_{t=1}^{T_i} \frac{\partial \log l_{it}^j}{\partial \eta_1^U} \right) \right)$$

$$\frac{\partial \log L}{\partial \eta_2^U} = \sum_{i=1}^{N} \frac{1}{L_i} \left(\sum_{j=3,4} pr_j \left(e^{\sum_{t=1}^{T_i} \log l_{it}^j} \right) \left(\sum_{t=1}^{T_i} \frac{\partial \log l_{it}^j}{\partial \eta_2^U} \right) \right)$$

$$\frac{\partial \log L}{\partial k^{UD_U}} = \sum_{i=1}^{N} \frac{1}{L_i} \left(\sum_{j=1,2,3,4} \left[pr_j \left(e^{\sum_{t=1}^{T_i} \log l_{it}^j} \right) \left(\sum_{t=1}^{T_i} \frac{\partial \log l_{it}^j}{\partial \left(x_{it}^{UD_U} \beta^{UD_U} + k^{UD_U} \eta_{u_j}^U \right)} \frac{\partial \left(x_{it}^{UD_U} \beta^{UD_U} + k^{UD_U} \eta_{u_j}^U \right)}{\partial k^{UD_U}} \right) \right] \right)$$

With $u_j = \begin{cases} 1 \, if \;\; j = 1,2 \\ 2 \, if \;\; j = 3,4 \end{cases}$

With $D_U = \{P\}$, since $k^{UT} = 1$.

$\frac{\partial \log L}{\partial \eta_1^U}$, $\frac{\partial \log L}{\partial \eta_2^U}$ and $\frac{\partial \log L}{\partial k^{UD_U}}$ are scalars.

4. Unobserved heterogeneity components affecting employment exits

$$\frac{\partial \log L}{\partial \eta_1^E} = \sum_{i=1}^{N} \frac{1}{L_i} \left(\sum_{j=1,3} pr_j \left(e^{\sum_{t=1}^{T_i} \log l_{it}^j} \right) \left(\sum_{t=1}^{T_i} \frac{\partial \log l_{it}^j}{\partial \eta_1^E} \right) \right)$$

$$\frac{\partial \log L}{\partial \eta_2^E} = \sum_{i=1}^{N} \frac{1}{L_i} \left(\sum_{j=2,4} pr_j \left(e^{\sum_{t=1}^{T_i} \log l_{it}^j} \right) \left(\sum_{t=1}^{T_i} \frac{\partial \log l_{it}^j}{\partial \eta_2^E} \right) \right)$$

$$\frac{\partial \log L}{\partial k^{ED_E}} = \sum_{i=1}^{N} \frac{1}{L_i} \left(\sum_{J=1,2,3,4} \left[pr_j \left(e^{\sum_{t=1}^{T_i} \log l_{it}^j} \right) \left(\sum_{t=1}^{T_i} \frac{\partial \log l_{it}^j}{\partial \left(x_{it}^{ED_E} \beta^{ED_E} + k^{ED_E} \eta_{e_j}^E \right)} \frac{\partial \left(x_{it}^{ED_E} \beta^{ED_E} + k^{ED_E} \eta_{e_j}^E \right)}{\partial k^{ED_E}} \right) \right] \right)$$

With $e_j = \begin{cases} 1 \, if \;\; j = 1,3 \\ 2 \, if \;\; j = 2,4 \end{cases}$

With $D_E = \{T, P\}$, since $k^{EU} = 1$.

$\frac{\partial \log L}{\partial \eta_1^E}$, $\frac{\partial \log L}{\partial \eta_2^E}$ and $\frac{\partial \log L}{\partial k^{ED_E}}$ are scalars.

5. Probabilities associated to mass points

$$\frac{\partial \log L}{\partial p_m} = \sum_{i=1}^{N} \frac{1}{L_i} \left(\sum_{j=1,2,3,4} \left[\left(e^{\sum_{t=1}^{T_i} \log l_{it}^j} \right) \left(\frac{\partial pr_j}{\partial p_m} \right) \right] \right) \qquad \text{where } m = 1,2,3$$

$$pr_m = \frac{e^{p_m}}{1 + \sum_{m=1,2,3} e^{p_m}} \qquad \text{and} \qquad pr_4 = \frac{1}{1 + \sum_{m=1,2,3} e^{p_m}} = 1 - pr_1 - pr_2 - pr_3$$

General form of second derivatives composing Hessian matrix:

1. Exits form unemployment state with exits form unemployment state

$$\frac{\partial^2 \log L}{\partial \beta^{UD_U} \partial \beta^{UD_U}} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \beta^{UD_U} \partial \beta^{UD_U}} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial \beta^{UD_U}} \frac{\partial L_i}{\partial \beta^{UD_U}}$$

Where D_U contains two specific destinations from unemployment state: a temporary employment (T), and a permanent job (P). Thus, $D_U = \{T, P\}$.

$\frac{\partial^2 \log L}{\partial \beta^{UD_U} \partial \beta^{UD_U}}$ is a $k_u x k_u$ matrix, where k_u : number of covariates include in equation of unemployment exits.

2. Exits from employment state with exits from employment state

$$\frac{\partial^2 \log L}{\partial \beta^{ED_E} \partial \beta^{ED_E}} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \beta^{ED_E} \partial \beta^{ED_E}} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial \beta^{ED_E}} \frac{\partial L_i}{\partial \beta^{ED_E}}$$

Where D_E contains three specific destinations from employment state: an unemployment spell (U), a temporary employment (T), and a permanent job (P). Thus, $D_E = \{U, T, P\}$.

$\frac{\partial^2 \log L}{\partial \beta^{ED_E} \partial \beta^{ED_E}}$ is a $k_e x k_e$ matrix, where k_e : number of covariates include in equation of employment exits.

3. Exits from unemployment state with exits from employment state

$$\frac{\partial^2 \log L}{\partial \beta^{UD_U} \partial \beta^{ED_E}} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \beta^{UD_U} \partial \beta^{ED_E}} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial \beta^{ED_E}} \frac{\partial L_i}{\partial \beta^{UD_U}}$$

With $D_U = \{T, P\}$ and $D_E = \{U, T, P\}$.

$\frac{\partial^2 \log L}{\partial \beta^{UD_U} \partial \beta^{ED_E}}$ is a $k_u x k_e$ matrix, where k_u : number of covariates include in equation of unemployment exits, and k_e : number of covariates include in equation of employment exits.

4. Exits from unemployment with unobserved heterogeneity components affecting unemployment exits

$$\frac{\partial^2 \log L}{\partial \beta^{UD_U} \partial \eta_1^U} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \beta^{UD_U} \partial \eta_1^U} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial \eta_1^U} \frac{\partial L_i}{\partial \beta^{UD_U}} \qquad \text{With } D_U = \{T, P\}.$$

$$\frac{\partial^2 \log L}{\partial \beta^{UD_U} \partial \eta_2^U} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \beta^{UD_U} \partial \eta_2^U} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial \eta_2^U} \frac{\partial L_i}{\partial \beta^{UD_U}} \qquad \text{With } D_U = \{T, P\}.$$

$$\frac{\partial^2 \log L}{\partial \beta^{UD_U} \partial k^{UP}} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \beta^{UD_U} \partial k^{UP}} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial k^{UP}} \frac{\partial L_i}{\partial \beta^{UD_U}} \qquad \text{With } D_U = \{T, P\}.$$

$\frac{\partial^2 \log L}{\partial \beta^{UD_U} \partial \eta_1^U}$, $\frac{\partial^2 \log L}{\partial \beta^{UD_U} \partial \eta_2^U}$, $\frac{\partial^2 \log L}{\partial \beta^{UD_U} \partial k^{UP}}$ are $k_u x1$ vectors, where k_u : number of covariates include in equation of unemployment exits.

5. Exits from employment with unobserved heterogeneity components affecting employment exits

$$\frac{\partial^2 \log L}{\partial \beta^{ED_E} \partial \eta_e^E} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \beta^{ED_E} \partial \eta_e^E} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial \eta_e^E} \frac{\partial L_i}{\partial \beta^{ED_E}} \text{ With } e = \{1,2\} \text{ and } D_E = \{U, T, P\}.$$

$$\frac{\partial^2 \log L}{\partial \beta^{ED_E} \partial k^{ED_E}} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \beta^{ED_E} \partial k^{ED_E}} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial k^{ED_E}} \frac{\partial L_i}{\partial \beta^{ED_E}}$$

Where destination for k^E's parameters are only $D_E = \{T, P\}$ since $k^{EU} = 1$.

$\frac{\partial^2 \log L}{\partial \beta^{ED_E} \partial \eta_e^E}$ and $\frac{\partial^2 \log L}{\partial \beta^{ED_E} \partial k^{ED_E}}$ are $k_e x1$ vectors, where k_e : number of covariates include in equation of employment exits.

6. Exits from employment with unobserved heterogeneity components affecting unemployment exits

$$\frac{\partial^2 \log L}{\partial \beta^{ED_E} \partial \eta_u^U} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \beta^{ED_E} \partial \eta_u^U} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial \eta_u^U} \frac{\partial L_i}{\partial \beta^{ED_E}}$$

$$\frac{\partial^2 \log L}{\partial \beta^{ED_E} \partial k^{UP}} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \beta^{ED_E} \partial k^{UP}} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial k^{UP}} \frac{\partial L_i}{\partial \beta^{ED_E}}$$

With $u = \{1,2\}$ and $D_E = \{U, T, P\}$.

$\frac{\partial^2 \log L}{\partial \beta^{ED_E} \partial \eta_u^U}$ and $\frac{\partial^2 \log L}{\partial \beta^{ED_E} \partial k^{UP}}$ are $k_e x1$ vectors, where k_e : number of covariates include in equation of employment exits.

7. Exits from unemployment with unobserved heterogeneity components affecting employment exits

$$\frac{\partial^2 \log L}{\partial \beta^{UD_U} \partial \eta_e^E} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \beta^{UD_U} \partial \eta_e^E} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial \eta_e^E} \frac{\partial L_i}{\partial \beta^{UD_U}} \text{ With } e = \{1,2\} \text{ and } D_U = \{T, P\}.$$

$$\frac{\partial^2 \log L}{\partial \beta^{UD_U} \partial k^{ED_E}} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \beta^{UD_U} \partial k^{ED_E}} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial k^{ED_E}} \frac{\partial L_i}{\partial \beta^{UD_U}}$$

Where $D_U = \{T, P\}$, and destinations for k^E's parameters are only $D_E = \{T, P\}$ since $k^{EU} = 1$.

$\frac{\partial^2 \log L}{\partial \beta^{UD_U} \partial \eta_e^E}$ and $\frac{\partial^2 \log L}{\partial \beta^{UD_U} \partial k^{ED_E}}$ are $k_u x1$ vectors, where k_u : number of covariates include in equation of unemployment exits.

8. Unobserved heterogeneity components affecting unemployment exits

$$\frac{\partial^2 \log L}{\partial^2 \eta_u^U} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial^2 \eta_u^U} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial \eta_u^U} \frac{\partial L_i}{\partial \eta_u^U} \qquad \text{With } u = \{1,2\}.$$

$$\frac{\partial^2 \log L}{\partial \eta_1^U \partial \eta_2^U} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \eta_1^U \partial \eta_2^U} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial \eta_2^U} \frac{\partial L_i}{\partial \eta_1^U}$$

$$\frac{\partial^2 \log L_i}{\partial \eta_u^U \partial k^{UP}} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \eta_u^U \partial k^{UP}} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial k^{UP}} \frac{\partial L_i}{\partial \eta_u^U} \qquad \text{With } u = \{1,2\}$$

$\frac{\partial^2 \log L}{\partial^2 \eta_u^U}$, $\frac{\partial^2 \log L}{\partial \eta_1^U \partial \eta_2^U}$ and $\frac{\partial^2 \log L}{\partial \eta_u^U \partial k^{UP}}$ are scalars.

9. Unobserved heterogeneity components affecting employment exits

$$\frac{\partial^2 \log L}{\partial^2 \eta_e^E} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial^2 \eta_e^E} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial \eta_e^E} \frac{\partial L_i}{\partial \eta_e^E} \qquad \text{With } e = \{1,2\}.$$

$$\frac{\partial^2 \log L}{\partial \eta_1^E \partial \eta_2^E} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \eta_1^E \partial \eta_2^E} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial \eta_2^E} \frac{\partial L_i}{\partial \eta_1^E}$$

$$\frac{\partial^2 \log L_i}{\partial \eta_e^E \partial k^{ED_E}} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \eta_e^E \partial k^{ED_E}} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial k^{ED_E}} \frac{\partial L_i}{\partial \eta_e^E}$$

With $e = \{1,2\}$, and destinations for k^E's parameters are only $D_E = \{T, P\}$ since $k^{EU} = 1$.

$\frac{\partial^2 \log L}{\partial^2 \eta_e^E}$, $\frac{\partial^2 \log L}{\partial \eta_1^E \partial \eta_2^E}$ and $\frac{\partial^2 \log L}{\partial \eta_e^E \partial k^{ED_E}}$ are scalars.

10. U. h. components affecting unemployment exits with u.h. components affecting employment exits

$$\frac{\partial^2 \log L}{\partial \eta_u^U \partial \eta_e^E} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \eta_u^U \partial \eta_e^E} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial \eta_e^E} \frac{\partial L_i}{\partial \eta_u^U} \qquad \text{With } u = \{1,2\} \text{ and } e = \{1,2\}.$$

$$\frac{\partial^2 \log L}{\partial \eta_1^U \partial k^{ED_E}} = \sum_{i=1}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \eta_1^U \partial k^{ED_E}} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial k^{ED_E}} \frac{\partial L_i}{\partial \eta_1^U} \qquad \text{With } D_E = \{T, P\}, \text{ since } k^{EU} = 1.$$

$\frac{\partial^2 \log L}{\partial \eta_u^U \partial \eta_e^E}$ and $\frac{\partial^2 \log L}{\partial \eta_1^U \partial k^{ED_E}}$ are scalars.

11. U. h. components affecting employment exits with u.h. components affecting unemployment exits

$$\frac{\partial^2 \log L_i}{\partial \eta_1^E \partial k^{U,P}} = \sum_{i=}^{N} \frac{1}{L_i} \frac{\partial^2 L_i}{\partial \eta_1^E \partial k^{U,P}} - \sum_{i=1}^{N} \frac{1}{L_i^2} \frac{\partial L_i}{\partial k^{U,P}} \frac{\partial L_i}{\partial \eta_1^E}$$

$\frac{\partial^2 \log L_i}{\partial \eta_1^E \partial k^{U,P}}$ is a scalar.