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THE PATHWAY TO PERMANENT JOBS: A TIME EVENT ANALYSIS OF YOUNG ITALIAN WORKERS

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The pathway to permanent jobs: a time event analysis of young Italian workers.

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Abstract

The paper analyses the effect of fixed-term contracts on the probability of finding a permanent job in the Italian labour market. I estimate a continuous proportional hazard model with nonparametric smoothing splines for time varying continuous covariates. It will be shown that such a method excellently improves the model specification with regard to proportionality assumption. Results surprisingly suggest that the hazard rate of switching to permanent employment is higher for unskilled workers than skilled workers; while transition probability is not affected by gender differences *per se*, rather individual traits for females and males act differently on the baseline hazard. Results show that a period of temporary employment varying between two or three years is needed before obtaining a permanent jobs. Potential implications of the main findings are provided.

JEL classification: C14; J41; J42.
Keywords: fixed-term job; duration analysis; penalized likelihood; smoothing spline.

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1 Introduction

In the Mortenseen and Pissarides' model (1994), it has been shown that the presence of strict employment protections reduce both the inflow and the outflow into unemployment, but uncertainty exists about the overall effect on the unemployment rate (see the survey of Mortenseen and Pissarides, 1999). However, the high unemployment rate, recorded by several European countries in the last two decades, has been usually associated with the rigid employment protection system. By preventing firms from readily adjusting the employment to the aggregate demand fluctuations, employment protections may give rise to smaller movements and lower level of employment. Although both the empirical evidence and the theory do not provide a clear pattern (Bentolila and Bertola, 1990, chapter 10 in Boeri and Van Ours, 2008), increased flexibility of working time, making wage and labour costs more flexible by removing restrictions, reforming employment security provisions and unemployment benefit systems are some of the measures enacted by national governments in the eighties and nineties, in order to deal with the high unemployment rate. The main novelty has undoubtedly been the introduction of temporary employment contracts.

The fact that labour contracts of predetermined duration are not generally subject to firing costs might give to firms an incentive to open new vacancies and, consequently, might lead to an increase in the overall employment. However, as well described by Saint-Paul (2000, 2002, 2004) and some other scholars (Boeri and Garibaldi, 2007; Blanchard and Landier, 2002; Cahuc and Postel-Vinay; 2002), this can give rise to a segmented labour market, in which permanent workers benefit from job protections and higher wages, while temporary workers might suffer from high turnover, less training and lower wages. Inasmuch as the labour demand is mostly affected by the firing costs and as the permanent workers get retired one should expect that in the long-run all workers be hired with a fixed-term contract. However, it is hard to believe that this will happen firstly because firms always have reasons to convert short-term positions into long-term ones (e.g. in terms of the shirking model or the efficiency wage theory, the latter can be associated with a higher productivity, or firms have higher incentives to invest in firm-specific human capital), secondly, this seems not to hold in the real world. Indeed, in the last decades many European countries have shown an increasing share of temporary jobs in total employment while recording a roughly constant quota of permanent employment, and, furthermore, most of the new jobs created have been de facto temporary (amongst others see Guell and Petrongolo, 2007 for Spain; Boeri and Garibaldi, 2007 for Italy; Blanchard and Landier, 2002 for France). Thus, it is likely that the hiring decisions of the firms are influenced by the firing costs (but also the costs associated with the social contributions) but this seems to be relevant either for some type of jobs or for some determined period of the labour relationship. By considering the latter, some authors have argued that fixed-term jobs might lengthen the probationary period in order to better screen the worker's ability and if the match turns out to be quite productive the contract is then converted to permanent. Even in this case, one might argued that there is always an incentive for the firms to leave the job relationship as temporary, mainly because it is less onerous in terms of costs than a regular one, or to prefer to fire the worker while the firing cost is low, and take a chance with a new worker. The concern may therefore be that the result of the introduction of these types of contracts might involve fewer regular jobs and, consequently, more job instability. The point has to be clearly unravel empirically.

My purpose on this paper is to analyze the effect of fixed-term contracts on the probability of finding a permanent job, namely to test the the so-called stepping stone hypothesis. In doing so I will make use of the "time to events" approach. This is not the first attempt in the literature to test such an hypothesis, some other paper have already focused on it, relying on different econometric technique. Booth *e al.* (2002) use a discrete time proportional hazard model for the UK and show that the transition from fixed-term to permanent job differs for men and women. For men, being younger than 35 years of age has a positive impact on exit to permanent work. By using a discrete-time proportional hazard model, Guell and Petrongolo (2007) study the determinants and the timing of the conversion of temporary contract into permanent contract in Spain. They find that the conversion rates show a clear spike at the legal limit imposed by law and higher conversion rates in cases where workers have higher outside options. For Italy, Gagliarducci (2005) applies a multi-spell duration model, and find that the probability of moving from a temporary to a permanent position increases with the duration of the contract, but decreases with repeated temporary jobs and career interruptions. Ichino et al. (2008) focus on two specific Italian regions (Tuscany and Sicily) to assess the stepping-stone effect of temporary work agency job. By using propensity score-matching estimators, they firmly confirm such a hypothesis only for Tuscany. In addition by using a dynamic probit model, Picchio (2008) find that having a temporary contract in Italy increases the probability of having a permanent job 2 years later. However, when using a time to events approach and, in particular, a standard proportional hazard model (PHM) careful attention is demanded to the proportional hazards assumption; the effect of an independent variable on the hazard rate is assumed to be multiplicative and that proportionality is maintained over time. Furthermore, as it will be shown below, the non-linear nature of the covariates, especially for the time varying ones, might give rise to time-dependency of those and invalidating the proportional hazard assumption. A significant contribution of the paper is also to deal with such an issue, by taking into account nonlinear effect and, if instrumental, to allow for a more complex dependence of the log hazard on the covariate through some function.

To the best of my knowledge, the contributions on this topic for Italy lack in long and recent longitudinal data. I will use a long panel from 1998 to 2004 drawn from the WHIP dataset (Work Histories Italian Panel), which is a panel survey of individual work histories, based on INPS (Istituto Nazionale di Previdenza Sociale, Social Security Institute) administrative archives.

At least two features of my analysis set it apart from previous studies. First, I allow for nonlinearity of the time-varying covariates; and second, I pay careful attention to the proportional hazard assumption, something that it seems to be neglected in several empirical papers.

The paper is organized as follows: section2 briefly sketches the contents of the main reform on labour contracts legislation; section 3 discusses the data and provides some preliminary evidence of the duration of fixed-term job needed to get a long-term one; section 4 shows the econometrics strategy applied and discusses the importance of testing the proportional hazard assumption and the non-linearity of the covariates; sections 5 shows the empirical results and section 6 gives the main conclusions of the paper.

2 The institutional background

The European Employment Strategy, starting in the 1997 with the European Council summit, updated in several occasions (Lisbona 2000 and Barcellona 2002) set up the major guidelines for the employment policies of each state member. In particular, it highlighted the importance of improving the employability through reforms of the public and private employment services, and the necessity of introducing flexibility in the labour market through the introduction of new, non-permanent contractual forms. Along this direction, in the last decade, several reforms were enacted in Italian labour market. As far as flexibility is concerned, Italian legislations experienced three radical reform in 1997, 2001 and 2003. The first act toward liberalization of non-standard contracts has been the so-called "Treu law" (law 196/1997), which legalized and regulated the supply of temporary workers by authorized agencies. Temporary Work Agencies (TWA) are entitled to "hire" workers on a temporary basis and to supply their work to firms. This type of employment is banned in the following cases: i) replacement of workers on strike, ii) firms that experienced collective dismissals in the previous 12 months, and iii) jobs that require medical vigilance. The law lets the provision of further regulation to collective bargaining. In particular, collective bargaining have set that temporary workers cannot exceed 8-15% of standard employees and that firms cannot extend a contract more than four time for a maximum of 24 months.

In 2001 with the 368/2001 law, Italian legislation recognizes the legal nature of fixed-term contracts. Such an act completely reverses the previous institutional setting which banned any chance of putting a definite duration on labour contract except for some cases explicitly scheduled by law (e.g., seasonal jobs). Employer is now entitled to use fixed-term contract for technical and productive reasons and for substituting absent workers. Indeed, the law does not provide any restriction about their use.

Lastly, the 2003 reform (also know as "Biagi law") has represented the more extensive reform on labour contracts. It improves earlier short-term contracts and introduces new contractual forms to better meet the requirements of a changing labour market. The major innovations introduced by the reform pertain to the following aspects: public and private employment service, TWA contracts, new temporary contractual forms. Regarding the first aspect, the main change has concerned the public employment service, and, in particular, that the employment service is no longer provided solely by public institutions. Other private actors, accordingly enabled by the regions, can enter the market and provide services to the workers and employers in order to bridge the gap between labour demand and supply. The second aspect is not properly an innovation, as the "Treu law" has already introduced the TWA contracts. Rather the 30/2003 reform recognizes to the private agencies the possibility to supply work even on a permanent basis. Then, the last innovation concerns both the introduction of a range of new contractual forms and some legislative reshaping of existing temporary labour contracts. After the reform, any worker can be hired on a temporary basis without the requirement of a specific cause. This implies that for any job, employers can *de facto* freely choose between a long-term or a short-term contract.

3 The Data

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

For each of these people the main episodes of their working careers are observed. Furthermore, data concerning the firm in which the worker is employed is also available. The observed period goes from 1985 to 2004. Workers transitions can be studied by linking consecutive information on the same individuals, available for all cohorts selected since 1985. As the introduction of fixed-term contract in the Italian labour market is dated back to 1997 (196/1997 law which has introduced temporary work agencies), I do not consider individuals surveyed before 1997.[1]

Although I do not have information about when the first entry in the labour market occurs, I conjecture that people not surveyed two year before 1997 are engaged in education or have never been employed earlier;, while it is trivial for workers that enter the observational period after 1997. This allows me to end up with a sample of individuals that enter the labour market for the first time. I further select workers aged 14 to 35 at the beginning of the first spell and employed with a short-term contract, so that having a sample of individuals that enters the labour market for the first time and via short-term contract. Thus, there is only one initial state (FT) and this leaves me with 40327 working spells corresponding to 14318 individuals.

[1]Before 1997, fixed-term employment was allowed only for jobs that were temporary in their nature, as seasonal activities and for particular project, and thus all the preceding years are not of my concern See Elia, 2010, for a review of the main acts regulating fixed-term contracts in Italy.

The choice of restricting the sample to workers aged 14 to 35 relies on two main reasons. First, fixed-term contracts concern mainly new hires, so they reasonably apply to a greater extent to young cohorts (Boeri and Garibaldi, 2007), whereas older workers, who started their careers before the liberalization of fixed-term contracts are more likely to be employed with a long-term contract. Second, to reduce the risk of including people who might strictly prefers working on a fixed-term basis on their own accord.

Destination states are derived by considering the types of labour contracts and whether the workers is not employed. As a result I end up with six destination states: Same FT, if worker is still employed with the same fixed-term contract; New FT, if worker change for another FT contract; SE, if worker turns to be self-employed; LT, if he gets a long-term contract; Others, whether the worker is employed with a contract different from those mentioned so far, such as re-employment contract; and Non-employment state. The latter is used as a proxy of the unemployment state. This measure might be biased upward as it detects not only flows into unemployment but probably also individuals moving to public sector, underground economy or simply people who becomes inactive. Unfortunately, I am not able to disentangling this issue because there exists no way to have such an information from the WHIP dataset.

FT state is comprised by the following fixed-term contracts: i) CFL (Contratto di Formazione e Lavoro), which provides the worker with on-the-job-training; ii) Agency contract, the provider (agency) hires the workers and supply their work to the firms; iii) Apprenticeship, similar to CFL but designed for workers aged 15 to 24, or 15 to 26 in deprived area; iv) parasubordinate (*co.co.co (pro)*, Collaborazione Coordinata e Continuativa (a Progetto)), although they are ranked as self-employed from a fiscal viewpoint, it is not unrealistic to consider them as parasubordinate employed; indeed, it has been shown that most of fixed-term contracts is of this type, in particular for young workers and women, and that tasks and duties involved are not so different from the ones of subordinates (see Berton *et al.*, 2005); v) Others, which consists of re-employment contract, designed to long-term unemployed workers, and unranked contracts.

In order to give a flavour of labour market transitions in our sample, Table (1) shows raw transition rates into five labour market states in the first 8 semesters of the panel. It is worth pointing out that as WHIP does not allow to keep track of the firm where the workers is employed in, I am not able to distinguish whether there has been a contractual renewal in the same firm.

– table 1 about here –

Table (1) displays that a significant share of workers is still employed with a fixed-term contract in the period under scrutiny. The highest figures are registered in the first three semesters, going from 20 to 25%, then state dependence decreases as the time goes by. More interestingly, table (1) shows strong state dependence in the long-run: for duration greater than 48 months about 50% of workers are still enduring in the fixed term state. However, some caution is required when interpreting this strong state dependence, because it may be the result of a self-selection process, namely, some workers might strictly prefer working on a fixed-term basis on their own accord.

Transition to long-term employment is increasing with time, showing a spike at the 7th semester of employment. It seems to confirm the stepping-stone hypothesis of temporary contracts at least when considering durations up until 48 months. Afterwards, the figures dramatically declines.

Exit to non-employment records the highest values in the first year then is decreasing over time, meaning that fixed-term employment is extremely volatile at the onset of the working career. Lastly, transitions to self-employment state are negligible.

To give a better understanding of how the type of fixed-term contract affects transitions to permanent jobs, table (2) depicts long-term job conversion rates by duration and type of contract for the period 1997-2004. Training contract shows an inverted U-shaped conversion rate; more than half of the workers who starts the working career with such a contract obtains a long-term job at the 4th semester, then the figure dramatically declines. Temporary work agency contract experiences the highest conversion rate in the first six months, then it strongly drops in the next semesters. By contrast, the long-term job conversion rate for whom is employed with an apprenticeship contract display an increasing trend over time. In addition, it shows a clear spike at 43-48 months which is consistent with the legal duration of such a contract of 4 years. Further, be employed as a parasubordinate for long span seems to lower probability of getting a permanent job. Such a contract may gather both people who self-select in fixed-term jobs and para-subordinate workers who in principle prefer a long-term job, therefore lower conversion rates at longer duration may be driven by the former. However, I think the self-selection issue only marginally affects that figures, mainly because the restriction made about the sample (workers younger than 35 years old) should largely reduce the risk of considering workers who strictly prefer to be temporary for the entire life; job prospects generally evolves in that age profile, thus it seems more likely that most of parasubordinates are involuntary employed with such a contract.

– table 2 about here –

Explanatory variables included in the regressions showed further on are mainly individual characteristics such as gender, age, birth cohort and a dummy indicating whether individuals are filling more than one job; job characteristics such as industrial sectors, type of fixed-term contract held before exiting to permanent employment, a dummy denoting whether workers are employed with a part-time work schedule and a dummy indicating skilled job. I do not use the educational levels, because missing in WHIP, but information on the type of job filled by the workers, thus, skilled workers are those who fill a managerial and clerical occupation, and unskilled workers anyone else; labour market characteristics such as the local unemployment rate and the individual daily wage; they should grasp the effect of local labour market, and as proxies for outside options and productivity. The local unemployment rate is the time-varying rate according to the four conventional macro-areas, namely, North-West, North-East, Centre and South. Summary statistics of pooled sample covariates are reported in Table (3). Average age of the sample is about 23 years; less than half of the sample consist of female workers; part-timers are less than 10% of the whole sample; only a negligible share of workers have more than one jobs, while 17% of workers fill skilled positions. Looking at the type of short-term contract, it emerges that the main form of fixed-term employment is represented by the apprenticeship contract (control group), followed by parasubordinate and training contract; while the temporary work agency contract covers the lowest share. Regarding the industrial sector the sample shows an high percentage of workers employed in the services and less in construction. On average the unemployment rate equals 6.75% and the log of daily wage is very low, suggesting that fixed-term jobs on average pay low salary. Lastly, the cohort dummies show an evenly distribution of individuals in three decades considered (the omitted category is made up of people born between 1965 and 1972).

– table 3 about here –

4 The econometric model

The model used in this empirical investigation is a continuous time duration model. More precisely, I make use of a proportional hazard model as pioneered by Cox (1972, 1975). The main advantage of the Cox model is that the relationship between covariates and the hazard rate can be estimates without having to make any assumptions whatsoever about the nature and shape of the baseline hazard rate. As fixed-term contract can terminate in several states not only in long-term employment, I need to consider a competing risks model which distinguish exits to the following states: long-term, new fixed-term, self employment or non-employment. A commonly applied approach to the competing risks problem assumes that there are $k = \{1, 2, ..., r\}$ specific destination states and that there is assumed to exist a latent failure time associated with each outcome. For k outcomes only the shortest duration time is actually observed $T_k = \min\{T_1, T_2, ..., T_R\} = T_c$, where T_c is the duration time associated with the observed event, while the remaining event are latent. Assuming that different destination states depend on different sets of parameters (as in Narendranathan and Stewart, 1993) and considering that my concern is about conversion into long-term employment, I can consider LT state as the terminal state, while treating durations finishing for other reasons as randomly censored at time of exit.

Hence, the hazard rate of the transition into permanent employment for he ith individual is

$$h_i(t) \quad = \quad h_0(t) \exp(x_i'(t)\beta) \tag{1}$$

where $h_0(t)$ is the baseline hazard function, $x_i'(t)$ is a vector of time-invariant and time-varying explanatory variables and β is a vector of unknown coefficients.

An estimate for the parameters of interest, β, can be found maximizing the partial likelihood

$$L_i = \prod_{i=1}^{N} \left[\frac{\exp(x_i'(t)\beta)}{\sum_{j \in R(t_i)} \exp(x_j'(t)\beta)} \right]^{\delta_i} \tag{2}$$

where $R(t_i)$ is the set of spells at risk at time t_i, and δ_i is the censoring indicator such that it equals 1 if i fails and 0 if the observation is right-censored. An estimate of the baseline hazard can be recovered after estimation of β. To deal with ties within event times, that is, when more than one failure at a given time occurs and they could not theoretically be the same, I make use of the Efron (1977) approximation to likelihood function. The vector of controls x_i' includes individual and job-related covariates as well as characteristics of the local labour market. In order to take into account unobservable individual effect in the exit from fixed-term job, the model can be extended by conditioning on a random disturbance u_i. The term would capture the effect of individual heterogeneity such as ability, preferences and so forth. As result, the hazard rate of the transition out of fixed-term job can be written as

$$h_{ik}(t) = h_{0k}(t) \exp(x_{ik}'(t)\beta_k) u_i \tag{3}$$

The unobserved heterogeneity parameter u_i for individuals i is assumed to be a realization of the gamma distribution, $f_U(u_i) = \frac{u^{1/\theta - 1} \exp(\frac{-u}{\theta})}{\theta^{1/\theta} \Gamma(\frac{1}{\theta})}$. I will estimate model (3) via penalized likelihood as shown in Therneau and Grambsch (2000). So the penalized partial likelihood is given by

$$L_i = \log \prod_{i=1}^{N} \left[\frac{\exp(x_i'(t)\beta) u_i}{\sum_{j \in R(t_i)} \exp(x_j'(t)\beta) u_j} \right]^{\delta_i} + \sum_{i=1}^{N} \log f_U(u_i) \tag{4}$$

where the last term is the penalty on the log scale in the case of the gamma density. This extended model thus contains one more parameter, θ, the variance of the random disturbance, describing the heterogeneity between individuals. For fixed values of the heterogeneity parameter θ, maximization of the penalized partial likelihood leads to the parameter estimates β.

Non-linearity of the covariates and the proportional hazard assumption

The assumption that the log hazard depends on the covariate in a linear way might be not true when investigating transition in different labour market state. It is therefore important to test the linearity assumption and, if instrumental, to allow for a more complex dependence of the log hazard on the covariate through some function. Furthermore, as a key assumption of the proportional hazard model is that the effect of an independent variable on the hazard rate is assumed to be multiplicative and that proportionality is maintained over time, the non-linear nature of the covariates, especially for the time varying ones, might give rise to time-dependency of those and invalidating the proportional hazard assumption. This can seriously affect any conclusions drawn by the model. The customary diagnostic of the proportional hazard assumption is a residual based-test and it can be carried out as in Grembsch and Therneau (1994). Whether a covariate fails the test, in order to remove the time-dependency, it is common to interact the covariate with some function of time and see if the assumption holds. A secondary, but not less important, feature of this test is that might detect several misspecification other than nonproportionality (Therneau and Grambsch 2000). If the model omit or incorrectly specifies the functional form of a covariate, the test may show significant result of nonproportionality. Thus, testing for nonlinear functional form is an important step to improve model specification. The nonlinearity can be tested by simply using a quadratic, a cubic, or a log function of the covariates of interest. While this is the simplest way to allow for nonlinearity it can be quite restrictive, mainly because we do not have a priori knowledge about the true functional form. One more flexible approach is to use a nonparametric method such as smoothing spline. Splines are piecewise polynomial function that are constrained to join at control points in the data. With respect to polynomials, they yield a better approximation to the data by recovering a local fit. Splines fits can be easily combined with the model in 1 as follow:

$$h_{ik}(t) = h_{0k}(t)\exp(g\{x'_{ik}(t)\}\beta_k) \tag{5}$$

where the function $g(.)$ stands for smoothing spline. Parameters estimates can be recovered by maximizing the following penalized partial likelihood

$$L_i = \log \prod_{i=1}^{N} \left[\frac{\exp(x'_i(t)\beta)u_i}{\sum_{j\in R(t_i)} \exp(x'_j(t)\beta)u_j} \right]^{\delta_i} - \lambda \int [g''(z)]^2 dz \tag{6}$$

wherein λ is the smoothing parameter for the penalty imposed. The level of splines' smoothness is selected by using the corrected Akaike's Information Criterion as in Hurvich *et al.*, 1998. Once the smoothing parameter λ is selected, the parameter estimates are retrieved maximizing 6 (see Therneau and Grambsch, 2000 for the computational issues).

In this paper I use smoothing splines to estimate the following time varying covariates: age of the subject, the log of daily wage and the log of local unemployment rate. The nonlinearity can be tested using a Wald or a likelihood test. It will be shown that allowing for non linearity of the time-varying covariates excellently improves the model specification with regard to proportionality assumption.

5 Results

Overall sample

The first set of estimates for the determinants of worker transitions from fixed-term to long-term employment are reported in table 4. I provide two specifications of the model as outlined in the previous section. The second column differ from the first over allowing for unobserved heterogeneity. Indeed, the model in the second column takes into account unobservable individual effect in the exit from fixed-term employment, by estimating an extra gamma-distributed disturbance term. The aim of the estimates in table 4 is mainly that of detecting whether the presence of the random parameter, θ, is crucial for the modeling of the hazard rate of transition to long-term jobs. Although the magnitude is modest, the estimates of the disturbance term is significant with a p-value of 0.044, indicating that some residual heterogeneity is not taken entirely into account by the covariates. However, the effect of all the regressors in the model with unobserved heterogeneity is quite unchanged with respect to the model of the first column and log-likelihood value suggests that the disturbance term only marginally improve the model fit. These facts allay concerns about the importance of allowing for individual unobserved heterogeneity. As a consequence, and in order to avoid unneeded overparametrization, I will rely on a model without the θ parameter in the following.

– table 4 about here –

In table 5 I report the first column of table 4 and the penalized partial maximum likelihood estimates of the model (5), in which the continuous time-varying covariates, such as age, log of daily wage and log of local unemployment rate are fitted with splines.

Before moving to the discussion of the results, it is worth pointing out the improvement of the model in terms of proportionality assumption when allowing for nonlinearity of the continuous covariates. Table 6 shows the results of the proportionality test carrying out both for each regressor and jointly. It tests the null hypothesis of proportional hazard. Therefore, we need not to reject the null. By looking at table 6 one can see how impressive is the improvement. When I impose a linear effect for age, wage and unemployment rates, the test reports strong evidence of nonproportional hazard for most of the covariates. On the contrary, once spline fit is applied to the three continuous covariates in the analysis, only few of them now require corrections for time-varying effects.[2] Although the unemployment rate does not already show statistically significant sign of nonproportionality, I apply the spline fit also for it because of the overall improvement achieved by the model. Besides, the model in column 1 of table 5 hides some important misspecifications. Fig. 1 displays the effect and the 95% pointwise confidence bands of the time varying covariates on the hazard

[2]For the variables with spline fit, the Grambsch and Therneau tests calculates a test statistic and p-value for each knot placement. In the tables, the average p-value across the spline fits is reported.

rate of getting a permanent job. On the y-axis the hazard ratio is reported, while on the x-axis the covariates along with their densities are shown. The nonlinear effect of age, daily wage and unemployment rate on the hazard rate is apparent, and well hidden by the log linear assumption in the model of column 1. In addition, a likelihood ratio test, not shown here, encourages such a choice. Regarding age, the hazard rate of getting a permanent job is increasing at early stage, decreasing between 18-22 years old and constant afterwards. This finding would suggest that, for workers older than 22, age is not a key determinant of attaining a long-term job, something that model with linear effect fails to catch.

The effect of the daily wage on the hazard rate is approximately decreasing. However, at lower wages the effect on the hazard rate seems to be increasing, suggesting that workers residing in the bottom tail of the distribution have a higher probability of getting a permanent job. This could be the result of higher effort of searching for more stable job exerted by people who, probably unable to improve their wage, focus more on the searching a better work opportunity. Whereas, at the top end of the distribution of wages the effect turn to be constant and approximately unimportant for getting a long-term job, showing a hazard ratio equals one. However it is worth noting that the effect at the two tails has to be taken with caution because of the wide confidence bands.

With regard to the unemployment rate, unfortunately, the shape of the spline fit is not so clear. It suggests a rough decreasing effect on the hazard, something that already has been detected when we allow for a linear effect only. The fuzziness is probably due to very few values of such a variable which make difficult to end up with a smoother curve.[3]

The effect of the other covariates on the conversion rates are quite standard and in line with the corresponding literature (see D'addio and Rosholm, 2005 for EU states, Gagliarducci, 2005 for Italy and Guell and Petrongolo, 2007 for Spain). Gender has the expected effect on the probability of obtaining a long-term job, showing the conventional discrimination of females even in this case. By holding concurrent jobs reduces the hazard of getting a long-term job, while being part-timers raises it. The hazard is also increasing irrespective of the fixed-term contract previously held, the control group is mostly comprised of apprenticeship contracts. The highest hazard is shown by the temporary work agency contracts, confirming the figures shown in table 2. Industry dummies show that services exhibit the highest positive hazard rate of getting a permanent job and manufacturing the lowest with respect to the control group (energy and public utilities sector). Further, the dummies for younger cohorts detect a negative effect on the conversion rates with respect to the older one, even tough only the cohort '81-'89 is statistically significant. This is probably the consequence of the recent reforms of the Italian labour market concerning fixed-term employment.

– table 5 and 6 about here –

[3] The unemployment rate in the analysis varies according to years and 4 macro areas.

– figure 1 about here –

Besides these expected results, what is interesting to highlight is the effect of the qualification on the hazard rate: skilled workers exhibit an overall lower probability with respect to unskilled workers. This finding is surprising and contrasting with the results found so far in the literature (Booth *et al.*, 2002, D'Addio and Rosholm, 2005, Gagliarducci, 2005, Guell and Petrongolo, 2007). One would expect that unskilled, rather than skilled workers, being generally in a weaker bargaining position should experience higher turnover and, as a consequence lower conversion rates. On the contrary, I think that such a finding would suggest a different underlying mechanism. Skilled workers generally occupy more productive job positions which demand substantial individual ability. As firms are concerned with distinguishing workers along the degree of ability, they probably tend to perform a more intense screening process with such matches. This, in turn, yields longer probation period and, thus, longer temporary employment for skilled workers. Whereas, for unskilled matches the individual ability could matter a little (or, to some extent, not at all). Such job positions usually entail routine and repetitive tasks and, consequently, firms might not be interested in workers' skills. Thus, no screening is carried out and higher conversion rates for unskilled workers are detected.

The estimated survival function (baseline hazard) and the confidence bands corresponding to model in the second column of table 5 are depicted in fig 2. It shows the probability of surviving in temporary employment over the entire analysis period. After 2 years of employment, the probability of remaining in temporary employment is still high. Only after 3 years the probability drops to less than half. This pattern suggests that on average individuals have to undergo a long period of fixed-term employment in order to obtain a permanent contract.

– figure 2 about here –

Female/male sample

In order to investigate whether different population groups have different duration patterns, I also carry out separate regressions for women and men.

Table 7 presents results for female and male subgroups.Ttable 8 also reports the comparison between the original model and the model with spline with respect to the proportional hazard assumption and the spline fits are reported. Even for these subgroups, it is clear the model improvement, after allowing for the nonlinear effect of the time varying continuous variables.

All regression coefficients broadly affect in the same direction the transition rates to long-term job. However, some differences among gender can be highlighted. Being concurrently occupied in more than one jobs is more detrimental to obtaining a permanent job for men than for women. In the same fashion, skilled men have lower probability to end up with a conversion. The contract and the industry dummies detect a positive effect, but stronger for women than for men (even tough two of the three industry dummies are only slightly significant). Gender differences is also detected for younger cohort: belonging to the '81-'89 cohort has an overall negative effect on the probability of exiting to permanent employment and stronger for males. Results in table 7, then, suggest that the impact of some individual characteristics of women on the baseline hazard is on average stronger than that of males. Such finding might be the result of two main facts. Firstly, women mostly occupy less productive matches which, in line with the above discussion, should give rise to earlier conversion. Secondly, by taking into account the low female employment rate in the Italian labour market, it is likely that women, who have entered the labour market (which discriminates against them), exhibit on average higher ability than those that are out of employment and, therefore, they remarkably deserve a long-term job. As a result, the larger effect of the covariates might be magnified by these selection processes.

– table 7 and 8 about here –

Finally, by looking at the shape of the spline fits (figures 3), the overall pattern shows very negligible differences for both women and men. Furthermore, the effect of age, wage and the unemployment rate on the hazard of getting a permanent job resembles those shown for the overall sample.

Fig. 4 reports the estimated survivor function for both female and male sample. The two functions differ of an negligible amount, showing that women on average have a slightly lower probability of getting a long-term job with respect to men, a result already highlighted in the table 5. This finding contrasts with the general claim that would see some gender discrimination even in time pattern of conversion rates. Rather, the analysis seems to indicate that significant differences can emerge by the contribution of some individual traits on the baseline hazard.

– figure 2 about here –

6 Final remarks

The purpose of such an empirical investigation has been twofold. On one hand, it attempted to shed light on the duration pattern of fixed-term contract and, in particular, on the determinants of their conversion into permanent contracts. On the other hand, it wanted to draw attention to model specification, when using a proportional hazard model. To carry out the empirical analysis I have selected a sample of individuals who enter the labour market via fixed-term employment over the period 1997-2004, and followed until they obtained a permanent contract. When using a time to events approach and, in particular, a standard proportional hazard model careful attention is demanded to the proportional hazards assumption, something that it seems to be neglected in several empirical papers. The effort here has been to pay seriously attention to model specification, in particular, to allow for nonlinear effect of time varying covariates. It has been proposed to use nonparametric spline fits for time varying covariates in order to address such issue. It has been shown that, once allowed for nonlinearity, only few of the regressors require corrections for time-varying effects.

Results mainly suggests that the highest conversion rates are shown at very long durations. After 2 years of employment, the probability of remaining in temporary employment is still high, and it drops to less than half only after about 3 years of temporary employment. Results have shown that unskilled workers generally exhibit higher conversion rates than skilled ones. I argue that this finding might be the result of different screening practices. As firms are concerned with distinguishing workers along the degree of ability, they probably tend to perform a more intense screening process with the more productive job positions, such as the skilled ones. This yields longer probation period and, thus, longer temporary employment for skilled workers. Whereas, for unskilled matches the individual ability could matter a little (or, to some extent, not at all). Indeed, such job positions usually require routine and repetitive tasks and, consequently, firms might not be interested in workers' skills. Thus, no screening is carried out and higher conversion rates for unskilled workers are detected.

Gender discrimination does not seem to affect the transition probability too much. Rather, individual traits are much more important. It has been shown even a larger influence of some covariates for females than males. I argue that such a finding might depend on two main facts. On one hand, women mostly occupy less productive matches which should give rise to earlier conversions. On the other hand, by taking the low female employment rate in the Italian labour market into consideration, it is likely that women, who have entered the labour market (which discriminates against them), exhibit on average higher ability than those that are out of employment and, therefore, they remarkably deserve a long-term job.

Furthermore, the process of easing restrictions on the use of temporary contract, which have experienced Italy and other European countries in the last two decade, seems to affect mostly the youngest cohorts of workers, in terms of both incidence and lower chances of exiting into permanent employment.

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Table 1: The duration distribution of fixed-term contract by state of exit.

Months	Long-Term	Same FT	New FT	Self-employed	Others	Non-employed	No. of spells
<6	16.37	61.16	8.45	0.32	1.43	12.28	15421
7-12	14.51	68.89	7.47	0.29	1.25	6.60	7621
13-18	17.38	69.38	6.28	0.28	1.43	5.24	5304
19-24	20.59	68.30	4.57	0.22	2.32	3.99	4133
25-30	16.78	72.73	4.81	0.11	1.52	4.05	2765
31-36	21.20	69.79	3.62	0.15	0.89	4.36	2019
37-42	21.42	73.56	2.39	0.08	0.58	1.98	1214
43-48	22.06	71.52	2.79	0.12	0.48	3.03	825
>48	22.05	73.76	1.46	0.20	0.29	2.24	1025

Transition rates are computed according to the distribution of individuals across labour market states in each semester.

Table 2: Long-term conversion rates by duration and type of contract, and mean durations by type of contract, 1997-2004. Source: WHIP.

Duration (months)	Training contract	TWA contract	Apprenticeship contract	Freelance	Others*
<=6	16.64	23.65	38.87	19.97	0.87
7-12	38.34	13.65	31.46	13.83	2.71
13-18	50.76	4.77	33.84	8.03	2.61
19-24	59.34	2.94	28.91	4.47	4.35
25-30	25.43	3.66	61.21	3.23	6.46
31-36	17.06	2.57	62.15	3.97	14.25
37-42	8.85	2.31	76.92	2.31	9.62
43-48	7.14	2.20	85.16	2.20	3.30
>48	27.52	18.04	39.64	6.90	7.90
All durations	29.50	14.29	40.90	10.50	4.81
Mean durations in days	393	148	508	197	634

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

Table 3: Mean and standard deviation of sample covariates.*

	Mean	(Std. Dev.)	No. of spells
Age	22.813	(4.661)	40327
Female	0.444	(0.497)	40327
Part-time	0.079	(0.270)	40327
Concurrent job	0.017	(0.132)	40327
Skilled Worker	0.170	(0.375)	40327
Training contract	0.148	(0.355)	40327
TWA contract	0.083	(0.276)	40327
Freelance contract	0.166	(0.372)	40327
Construction	0.106	(0.308)	40327
Manufacturing	0.270	(0.456)	40327
Services	0.387	(0.487)	40327
log local unemployment rate	1.911	(0.537)	40327
log daily wage	2.876	(1.060)	40327
Cohort '73-'80	0.467	(0.500)	40327
Cohort '81-'89	0.387	(0.490)	40327

* All variables refer to the pooled sample. *Concurrent job* indicates whether individuals have occupied in more than one job. *Skilled workers* are those who fill a managerial or clerical occupation.

Table 4: Maximum likelihood estimates of the transition from fixed-term to long-term employment with and without unobserved heterogeneity.

Variables	**Coefficients**	**(Std. Err.)**[†]	**Coefficients**	**(Std. Err.)**
Age	-0.044* * *	(0.005)	-0.048* * *	(0.005)
Female	-0.151* * *	(0.027)	-0.170* * *	(0.026)
Part-time	0.555* * *	(0.046)	0.572* * *	(0.046)
Concurrent Job	-0.642* * *	(0.181)	-0.660* * *	(0.163)
Skilled	-0.155* * *	(0.034)	-0.150* * *	(0.034)
log daily wage	-0.466* * *	(0.030)	-0.517* * *	(0.014)
Training contract	1.093* * *	(0.038)	1.130* * *	(0.036)
TWA contract	1.716* * *	(0.052)	1.804* * *	(0.046)
Freelance contract	0.744* * *	(0.095)	0.782* * *	(0.091)
Construction	0.634* * *	(0.087)	0.661* * *	(0.090)
Manufacturing	0.626* * *	(0.081)	0.657* * *	(0.083)
Services	0.786* * *	(0.081)	0.830* * *	(0.083)
log local unemployment rate	-0.097* * *	(0.023)	-0.094* * *	(0.024)
Cohort '73-'80	-0.344* * *	(0.046)	-0.361**	(0.050)
Cohort '81-'89	-0.814* * *	(0.068)	-0.870* * *	(0.071)
θ (p-value)			0.113**	(0.044)
log-likelihood	-58008.31		-57997.4	
No of observations		40319		
No of subjects		14317		

[†] Clustered standard errors in parentheses.

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

Table 5: Maximum likelihood estimates of the transition from fixed-term to long-term employment with and without splines fits for age, log of wage and log of unemployment rate.

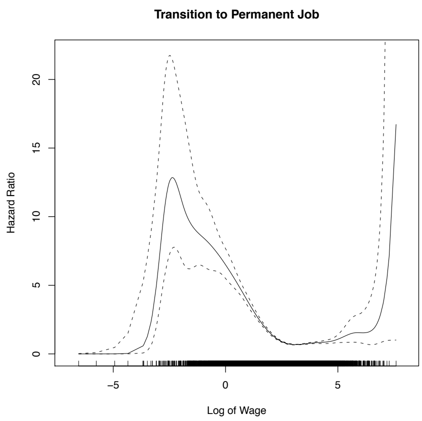
	Original model		Spline model	
Variables	Coefficients	(Std. Err.)[†]	Coefficients	(Std. Err.)[†]
Age	-0.044* * *	(0.005)	-* * *	*<0.001*
Female	-0.151* * *	(0.027)	-0.135* * *	(0.026)
Part-time	0.555* * *	(0.046)	0.584* * *	(0.043)
Concurrent Job	-0.642* * *	(0.181)	-0.751* * *	(0.188)
Skilled	-0.155* * *	(0.034)	-0.200* * *	(0.033)
log daily wage	-0.466* * *	(0.030)	-* * *	*<0.001*
Training contract	1.093* * *	(0.038)	0.940* * *	(0.036)
TWA contract	1.716* * *	(0.052)	1.587* * *	(0.052)
Freelance contract	0.744* * *	(0.095)	0.610* * *	(0.097)
Construction	0.634* * *	(0.087)	0.667* * *	(0.088)
Manufacturing	0.626* * *	(0.081)	0.645* * *	(0.081)
Services	0.786* * *	(0.081)	0.808* * *	(0.081)
log local unemployment rate	-0.097* * *	(0.023)	-* * *	*<0.001*
Cohort '73-'80	-0.344* * *	(0.046)	-0.051	(0.054)
Cohort '81-'89	-0.814* * *	(0.068)	-0.372* * *	(0.076)
log-likelihood	-58008.31		-57603.26	
No of observations		40319		
No of subjects		14317		

[†] Clustered standard errors in parentheses.

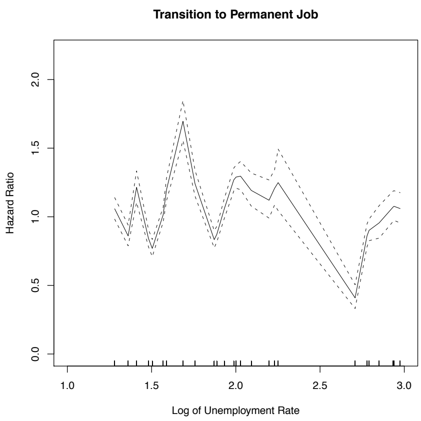
* * * Significant at 1%, ** Significant at 5%. p-value in *italics*.

Figure 1: Spline fits for age, daily wage and unemployment rate.

(a) Spline fits for age



(b) Spline fits for log of daily wage



(c) Spline fits for log of local unemployment rate

Figure 2: Estimated survival function for the transition to fixed-term to long-term job.

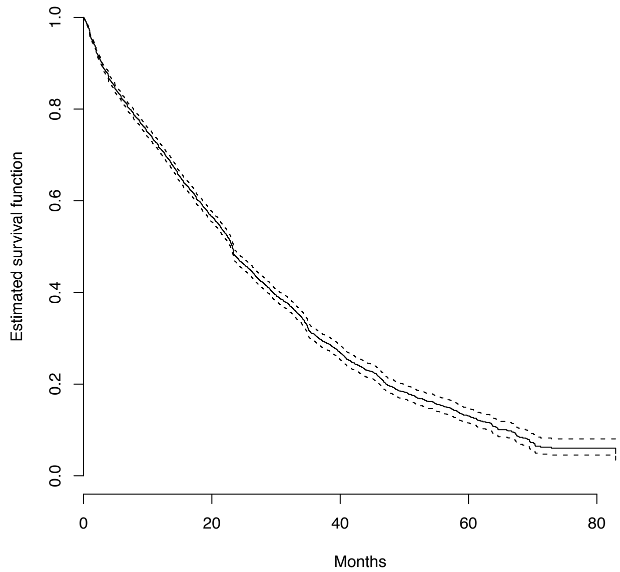


Table 6: Testing the proportional hazard assumption.

Variables	original model	model with splines
Age	0.008	**0.527**
Female	0.009	**0.134**
Part-time	<0.001	**0.055**
Concurrent Job	0.008	0.025
Skilled	<0.001	0.009
log daily wage	<0.001	**0.382**
Training contract	<0.001	**0.080**
TWA contract	<0.001	<0.001
Freelance contract	<0.001	0.006
Construction	0.016	**0.046**
Manufacturing	<0.001	0.008
Services	0.007	**0.105**
log local unemployment rate	**0.697**	**0.120**
Cohort ’73-’80	**0.424**	**0.109**
Cohort ’81-’89	0.007	**0.135**
Global test	<0.001	<0.001

For the variables with spline fits, the Grambsch and Therneau tests calculates a test statistic and p-value for each knot placement. I report the average p-value across the spline fit.

Table 7: Maximum likelihood estimates of the transition from fixed-term to long-term employment, female and male sample.

	Female		Male	
Variables	Coefficients	(Std. Err.)†	Coefficients	(Std. Err.)†
Age	-***	*<0.001*	-***	*<0.001*
Part-time	0.573***	(0.059)	0.591***	(0.075)
Concurrent Jobs	-0.437	(0.236)	-1.084***	(0.230)
Skilled	-0.200***	(0.056)	-0.264***	(0.048)
log daily wage	-***	*<0.001*	-***	*<0.001*
Training contract	1.081***	(0.065)	0.843***	(0.050)
TWA contract	1.681***	(0.079)	1.536***	(0.062)
Freelance contract	0.854***	(0.121)	0.280	(0.148)
Construction	0.818***	(0.178)	0.280*	(0.140)
Manufacturing	0.834***	(0.107)	0.262*	(0.134)
Services	1.054***	(0.106)	0.384***	(0.134)
log local unemployment rate	-***	*<0.001*	-***	*<0.001*
Cohort '73-'80	0.040	(0.092)	-0.140**	(0.077)
Cohort '81-'89	-0.254**	(0.126)	-0.471***	(0.105)
log-likelihood	-20898.56		-31943.66	
No of observations	17915		22404	
No of subjects	6348		7969	

† Clustered standard errors in parentheses.

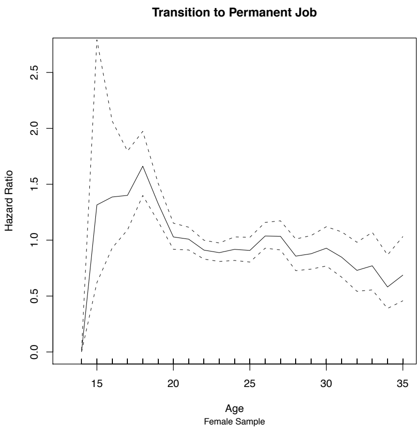
*** Significant at 1%, ** Significant at 5%, * Significant at 10%. p-value in *italics*.

Table 8: Testing the proportional hazard assumption.

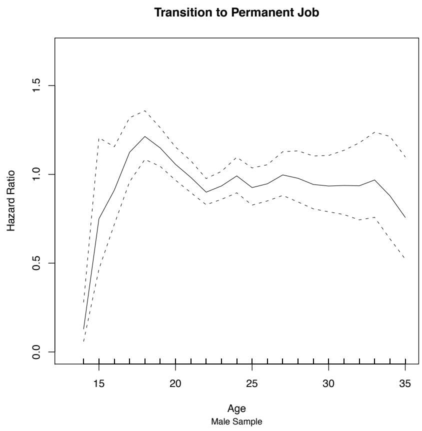
	Female		Male	
Variables	original model	spline model	original model	spline model
Age	**0.103**	**0.686**	**0.074**	**0.269**
Part-time	**0.614**	**0.162**	<0.001	**0.216**
Concurrent Job	**0.061**	**0.194**	0.034	**0.357**
Skilled	<0.001	0.026	<0.001	0.036
log daily wage	<0.001	**0.804**	<0.001	**0.386**
Training contract	<0.001	**0.631**	<0.001	**0.167**
TWA contract	<0.001	<0.001	<0.001	<0.001
Freelance contract	<0.001	0.005	0.008	**0.330**
Construction	0.033	**0.223**	0.003	**0.063**
Manufacturing	**0.093**	**0.333**	<0.001	0.020
Services	0.040	**0.481**	0.010	**0.138**
log local unemployment rate	<0.001	0.002	**0.066**	**0.235**
Cohort '73-'80	**0.903**	**0.085**	**0.200**	**0.703**
Cohort '81-'89	**0.914**	**0.570**	<0.001	**0.235**
Global test	<0.001	<0.001	<0.001	<0.001

For the variables with spline fits, the Grambsch and Therneau tests calculates a test statistic and p-value for each knot placement. I report the average p-value across the spline fits.

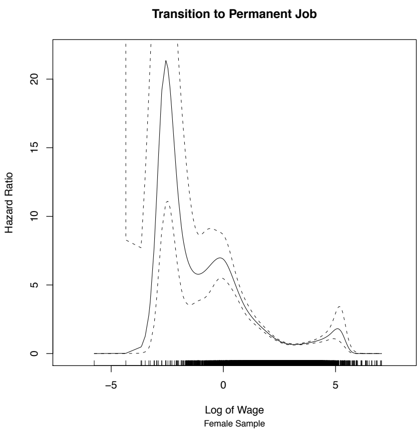
Figure 3: Spline fits for age, log of daily wage and log of local unemployment rate. Female and male sample.



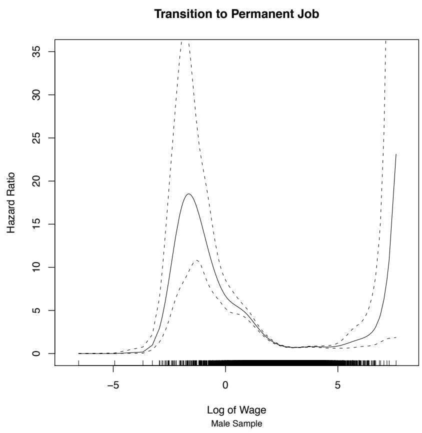
(a) Age, female sample



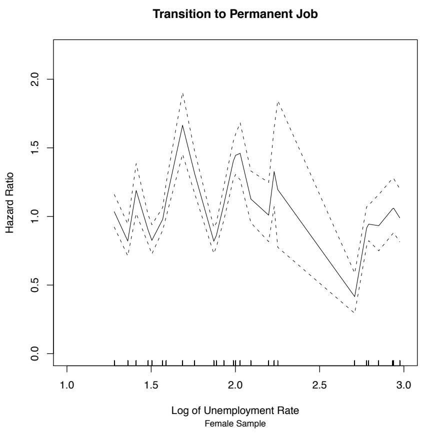
(b) Age, male sample



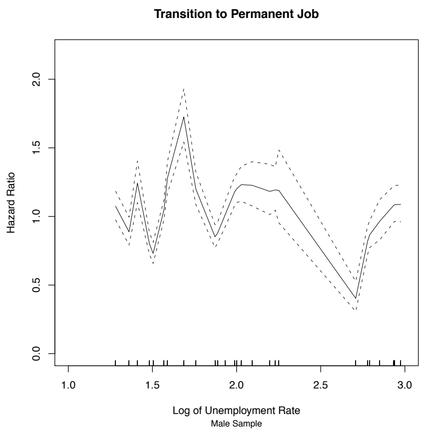
(c) Log of daily wage, female sample



(d) Log of daily wage, male sample



(e) Log of unemployment rate, female sample



(f) Log of unemployment rate, male sample

Figure 4: Estimated survival function for the transition to fixed-term to long-term job, females and males sample.