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Abstract: This paper analyses the link between educational attainment and unemployment risk in a French-German comparison, based on a discrete time competing risks hazard rate model applied to comparable microdata sets. The unemployment risk is broken down into the risk of entering unemployment and the risk, once unemployed, of not getting reemployed. The paper examines the impact of education on both risk components. France faces a higher unemployment rate than West-Germany, due to a higher risk of entering unemployment whereas the risk, when unemployed, of not getting reemployed is lower than in Germany. The risk of entering unemployment is particularly high for French employees with poor education, but higher education graduates face a higher risk of getting unemployed in Germany than in France. Concerning the reemployment prospects of the unemployed, they are better in France than in West-Germany at all education levels, but particularly for the unemployed with a low education level. The effect of education on both risk components does not differ significantly across genders, all else equal.

JEL classification: I2; J6
Keywords: Education; unemployment; hazard rate model

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Non technical summary

This paper analyses the link between educational attainment and unemployment risk in France and Germany, two countries plagued with high unemployment rates. The aim pursued here is to compare the extent to which various educational outcomes offer a protection against the unemployment risk. A look at the literature reveals indeed that the empirical evidence on this topic is extremely scarce - particularly for France and Germany - and do not lead to conclusive results as to the empirical link between education and unemployment.

The starting point of the analysis is a broad comparison of the structure of unemployment on the basis of comparable microdata sets, the *Emploi* survey for France and the GSOEP for West Germany. Then, the unemployment risk is broken down into the risk of entering unemployment, on the one hand, and the risk, once unemployed, of not getting reemployed, on the other hand. The impact of educational attainment on both components is examined. The methodological framework applied for this analysis is a discrete time competing risks hazard rate model which makes use of the panel structure of the GSOEP and the *Emploi* data sets and of the availability of retrospective monthly data on the employment history of the respondents in both data sets.

The unemployment rate proves to be higher in France than in West Germany at all education levels, but particularly for basic vocational and intermediate qualifications. In both France and West Germany, women face a higher unemployment rate than men, but the gender unemployment gap is far more pronounced in France. The higher unemployment rate in France compared to Germany results from a higher risk of entering unemployment in France whereas the risk, when unemployed, of not getting reemployed is lower there than in Germany. The risk of entering unemployment is particularly high for French employees with poor education, but higher education graduates face a lower risk of getting unemployed in France than in Germany.

Concerning the reemployment prospects of the unemployed, they are better in France than in West-Germany at all education levels, but particularly for the unemployed with a low education level. The effect of education on both risk components does not differ significantly across genders. Nevertheless, because men and women differ in their characteristics and in the impact of other variables, their unemployment risk does differ. In both countries, women face a higher unemployment risk through the joined effect of a higher risk of entering and of not exiting unemployment, though the magnitude of the gender gap varies across education levels. The disadvantage of women regarding the reemployment prospects of the unemployed is larger in France, especially at lower education levels.

1 Introduction

The level of educational attainment is expected to be a strong determinant of the employability of individuals in so far as it constitutes an essential part of their human capital, i.e. of the skills employers can make use of. As previous studies show (e.g. Lauer, 2003), France and Germany appear to have very different education systems, in particular with respect to the degree of consideration of employment prospects, and the distribution of educational qualifications across the population also differs considerably. At the same time, both countries are confronted with a similar unemployment problem, the solution of which has invariably been at the top of the political agenda for the past few decades. The question therefore arises how the qualifications acquired in the French and German education systems are rewarded by the respective labour markets in terms of access to employment, or, to put it differently, what protection they offer against the unemployment risk in both countries.

Looking at the empirical evidence, it appears that while the link between education and wages has been extensively investigated, there is an undoubtable lack of research on the relationship between education and unemployment. This is particularly true for France and Germany, not to mention comparisons of these countries. Moreover, the few studies available for other countries do not come to conclusive results onto the nature of the empirical relationship between education and unemployment. The aim of the present paper is therefore to examine the link between educational attainment and unemployment risk in a French-German comparison. To be more specific, a dynamic view is adopted. The unemployment risk is broken down into the risk of entering unemployment, on the one hand, and the risk of not exiting unemployment, on the other hand. The impact of educational attainment on both components is examined on the basis of a discrete-time hazard rate model.

The structure of the paper is the following. First, section 2 looks at the empirical evidence available so far on the relationship between education and unemployment. Then, section 3 presents as a starting point a static overview of the link between education and unemployment in France and Germany. This descriptive analysis is based on microdata sets which makes it possible to compute the unemployment rate in a way as similar as possible. The article then moves on to an econometric analysis of the impact of education on the dynamics of unemployment on the basis of a hazard rate model. Section 4 proposes a rigorous formulation of the model that will be estimated. The estimations require an extensive preparation of the microdata, all the more since the French and the German data sets on which the analysis is based need to be put in comparable form first. The construction of the spell data and of the variables used for the analysis is explained in section 5. Finally, section 6 presents the results of the comparative analysis of the impact of education on the risk of entering unemployment, and section 7 of the analysis of the effect of education on the hazard of leaving unemployment. Section 8 concludes.

2 Empirical evidence available so far

While an immense literature is available on the wage structure by education, little research is devoted to the empirical relationship between education and unemployment. Among the rare studies, Nickell (1979) examines the impact of education on unemployment incidence, understood as the probability of being unemployed at a given time, then analyses the impact of education on the duration of unemployment based on a simplified version of a hazard rate model. Combining the information on the impact of education on the duration and on the incidence of unemployment enables him to derive education-specific probabilities of inflow into unemployment. The results show for Great-Britain that the level of education strongly influences the probability of becoming unemployed during working life, but rather weakly affects the expected duration of unemployment spells.

Jacob Mincer also explored this relationship for men (Mincer, 1991b) as well as for women (Mincer, 1991a), though with a different methodology. His analysis is based on the decomposition of the unemployment rate into different components: the probability of having separated from the previous job, the probability of experiencing unemployment when separated, the duration of unemployment for job separators and the labour force rate as well as the labour force participation rate (for women). He then explains the gross unemployment differentials between educational groups by differences in the various components and finally tries to identify the impact of education, net of other characteristics, on the components in a term by term multivariate analysis. He concludes that in the United States, educational unemployment differentials are far more attributable to the fact that the higher education reduces the incidence of unemployment than because it reduces the duration of unemployment.

More recently, Wolbers (2000) examined the effect of education on the mobility between employment and unemployment for the case of the Netherlands. The study applies a single risk discrete hazard rate model to assess on the one hand the impact of the education level on the probability that an employed individual enters employment, and on the other hand the effect of education on the probability to exit unemployment and getting re-employed. It appears that less educated have a greater chance of entering unemployment than the better educated, and they also have poorer prospects of exiting unemployment. However, the link is not linear. For instance, university graduates have a greater probability of encountering unemployment than individuals with higher vocational education, but there are hardly any differences in the unemployment exit rates of people with secondary and tertiary education.

Kettunen (1997) explored the link between education and the duration of unemployment on the basis of a Weibull duration model with discrete mixing distribution for Finland. Education is found to have a strong effect on the duration of unemployment. Up to a certain level, a higher level of education increases the hazard of exiting unemployment, but beyond the bachelor's degree, the re-employment probability decreases again, and unemployed individuals with a master's or doctor's degree have the lowest probability of re-employment.

For France and Germany, however, only a few studies are specifically targeted at analysing the relationship between education and unemployment. Brauns, Gangl and Scherer (1999), for instance, analyses the educational stratification of unemployment in early labour market career and its institutional embodiment by comparing the situation in the United Kingdom, France and Germany. The analysis does not aim at explaining the dynamics of unemployment but rather consists in estimating from a static point of view the impact of educational achievement on the unemployment risk in the transition period from education to work. Based on simple logit estimates, the analysis concludes that Germany is characterised by a fairly smooth access to initial employment for vocationally qualified graduates, while extensive job search is confined to the least qualified. Once initial employment has been found, education plays a negligible role for the risk of unemployment, which is more tied to the characteristics of the position occupied. In contrast, in France and the United Kingdom, access to first employment is more difficult and the role of educational achievement is found to be less pronounced. However, educational achievement seems to conserve a more important role than in Germany with respect to securing employment. Joutard and Ruggiero (2000) estimate a structural model of unemployment duration with a discrete time Weibull specification, in which the job seekers may anticipate the possible recurrence of unemployment spells. Their analysis focuses on the role of qualification and gender regarding unemployment duration. They find out that in France, the highest degree obtained plays an all the more important role since the occupational position is of high level. Moreover, the level of education attained turns out to be a more discriminating factor for women than for men.

The other studies available for France or Germany generally have an other focus of interest than education. These studies do not refer explicitly to education, but education generally appears, among others, as an explanatory factor for unemployment. Most articles examine the duration of unemployment, i.e. the probability of exiting unemployment rather than the probability of entering unemployment. A general analysis of the determinants of unemployment duration is for instance provided by Wurzel (1993) or Hunt (1999) for Germany and Bonnal and Fougère (1990) or Cases and Lollivier (1994) for France. However, most papers focus on one particular aspect of unemployment duration. The impact of unemployment benefits, for instance, has been analysed by Steiner (1997) or Plassmann (2002) for Germany and by Florens, Gérard-Varet and Werquin (1989) or Dormont, Fougère and Prieto (2001) for France. Other studies focus on youth unemployment or the transition from school to work (e.g. Zimmermann, 2000, Franz and Zimmermann, 2001 for Germany; Fougère, Kramarz and Magnac, 2000, D'Addio, 1998 for France), on the impact of business cycle (e.g. van den Berg and van der Klaauw, 2001) or on more technical issues like the distinction between state dependence and individual heterogeneity (e.g. Steiner, 1997; Magnac, 1998); or the impact of measurement error

(Magnac and Visser, 1999).

Thus, this paper aims at complementing the empirical literature in three ways. First, it provides some evidence onto the empirical relationship between education and unemployment, which, as has just been observed, is particularly scarce for France as well as for Germany. Second, it does not only examine the duration of unemployment, but also entry into unemployment, an aspect which has been particularly neglected in the literature. Finally, it adopts a comparative perspective, drawing on the fact that if the gross unemployment rates in France and Germany are often compared in public discourse, there is to my knowledge no detailed comparative study on this subject until now.

3 Stylised facts

3.1 Data and definition of the variables

The data used for the analyses is drawn from the German Socio-Economic Panel (GSOEP) for Germany and from the *Emploi* survey for France. In both data sets, the respondents are requested to report their labour market status in each month of the year preceding the interview month[1]. This monthly information makes it possible to retrace the labour market history of the respondents. In the GSOEP, the individuals are re-interviewed each year since 1984 and leave the sample only because of attrition, but in the *Emploi* survey, the retrospective information is only collected from the 1990 wave onwards. Moreover, because the *Emploi* survey is a rotating panel in which one third of the sample is renewed each year, we can track the employment status of an individual for at most three consecutive years, i.e. for a maximum of 37 consecutive months. Therefore, the subsequent empirical analyses will basically rely on the data drawn from the latest three waves available, i.e. 1998, 1999 and 2000, and covers, broadly speaking, the period 1997 to 1999. To illustrate developments over time, however, the descriptive analysis - which does not need the longitudinal structure of the data set - will extend to the period between January 1991 and December 1999. The German sample is restricted to West-German residents. Moreover, the observation samples of both countries only includes nationals or individuals born in the country and aged between 25 and 55. The age restriction

1 The interview takes place in March every year - except in 1990, where the households were interviewed in January - and the retrospective information refers to the 12 months immediately preceding the interview month. Consequently, the data for February 1990 is missing and there is double information for March, since each wave yields information for March of the previous year until March of the current year. Because there might be some recall errors (see Magnac and Visser, 1999), the information of the current year is retained for March in case it does not coincide with the retrospective information drawn from the next wave. In the GSOEP, the month of the interview might vary across individuals and across waves, even though the bulk of the interviews take place at the beginning of the year. The retrospective information on employment status does not depend on the interview month since it refers to the calendar year preceding the year of the interview.

aims to limit the problems related to retirement, on the one hand, and those related to the fact that too young individuals may not have finished their education yet, on the other hand.

Table 1: Typology of educational attainment

	Highest degree obtained
Level 1	**No vocational qualification**
10	No degree
11	Lower secondary education
12	Intermediate secondary education
Level 2	**Basic vocational qualification**
20	No or lower secondary education + basic vocational degree
21	Intermediate secondary education + basic vocational degree
Level 3	**Intermediate qualification**
30	Intermediate vocational degree
31	Vocational maturity certificate
32	General maturity certificate
33	General maturity certificate + vocational degree
Level 4	**Tertiary level qualification**
40	Lower tertiary education
41	Upper tertiary education

For the analysis, three labour market states are distinguished: employment, unemployment and non-employment[2]. For Germany (GSOEP), the monthly employment state comprises the categories full-time employment, part-time employment, short-time employment or training at work. For France (*Emploi*), it comprises permanent employment, fixed-term employment or training at work. The unemployment state is based on the declarations of the respondents. In the GSOEP data, the unemployment state refers to unemployment registration at the Federal Labour Office, whereas in the French data, a respondent may assign himself to unemployment even if he is not registered as unemployed. Thus, the concept of unemployment differs somewhat in the French and German data, but this difference is likely to affect the height of unemployment more than its structure or the impact of education on it, which is the main outcome of interest in the context of the present analysis. The non-employment state is the remaining category and includes retirement, maternity leave, education, military service, housewife and other non-specified states out of the labour force. The unemployment rate is defined as the proportion of the labour

2 In the *Emploi* data, the respondents indicate a unique labour force state for each month. This is not the case in the GSOEP, where individuals may report more than one single labour market state per month. In case of multiple answers, it was decided to choose which labour force state applies for one specific month according to the priority: unemployment, employment, non-employment.

force (i.e. employed plus unemployed persons) which is unemployed.

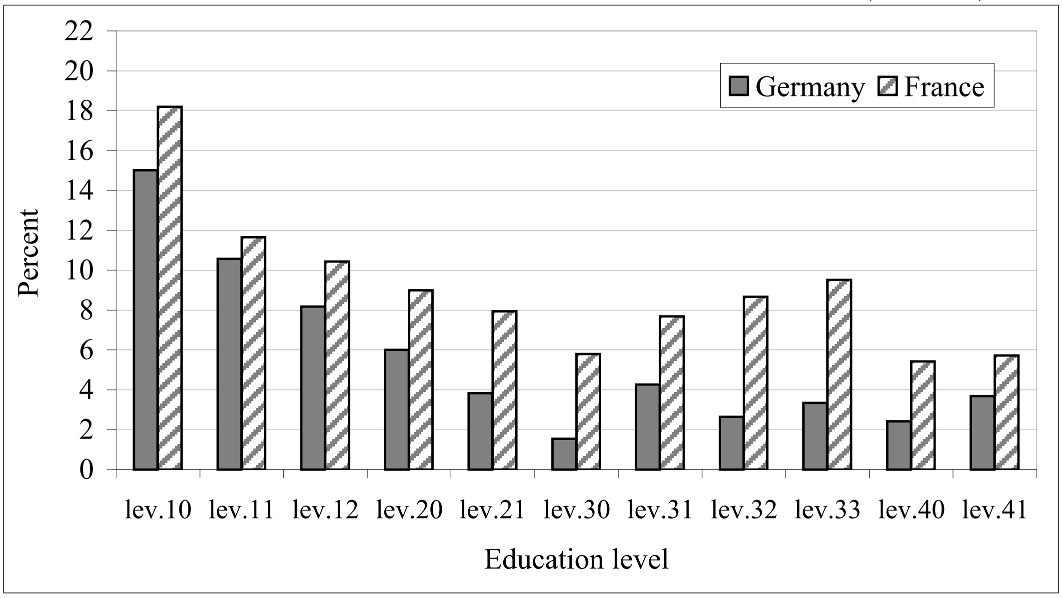
Both data sets contain comparable information on completed degrees in general, vocational and higher education. This information can be combined to define a comparable variable for educational attainment based on the highest degree obtained, such as established in Lauer (2001) and reported in table 1.

3.2 The distribution of unemployment

3.2.1 Structure and developments over time

Figures 1 presents the distribution of unemployment by education for the time period 1997 to 1999 in France and Germany (pooled samples).

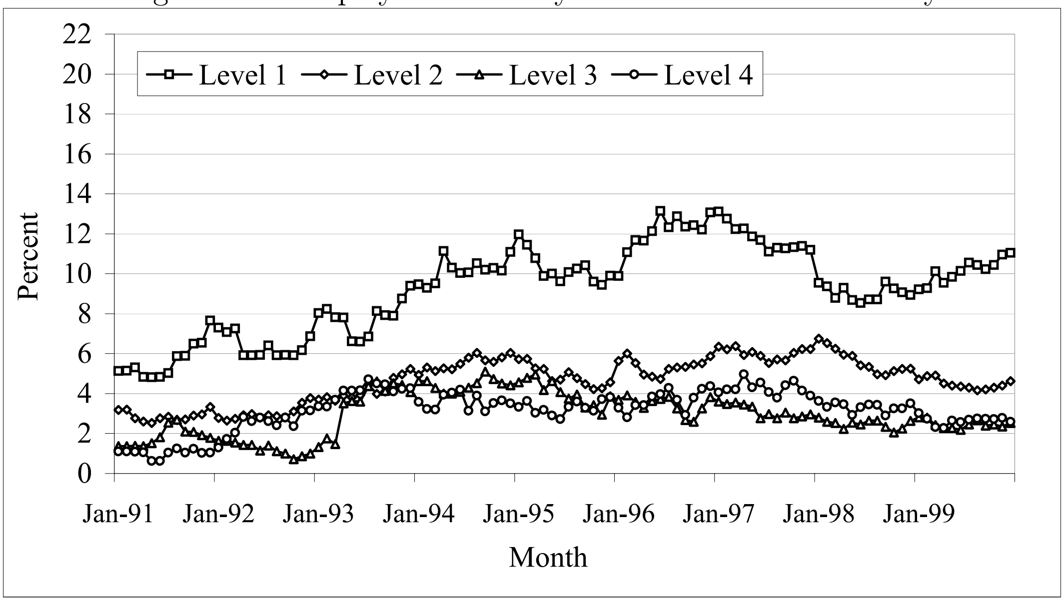
Figure 1: Unemployment rate by detailed education level (1997-99)



Comparing the figures with the official statistics, the unemployment rates reported here appear quite low, especially for Germany. This has also been remarked by Schmidt (1999), who ran an in-depth analysis of monthly labour market stocks and flows on the basis of the GSOEP retrospective monthly data. One reason for the low German figures here is that the sample of observation West German natives, whereas foreigners typically have higher unemployment rates. The same holds for France. Moreover, the sample only covers individuals aged 25 to 55 and not the whole labour force. This undoubtedly drives the unemployment rates down for France, since young people have comparatively higher unemployment rates. A further reason lies in the definition of unemployment used here, which includes in the denominator the self-employed and the military personnel. Finally, the employment state is self-reported and as such not exempt from reporting errors or recall biases.

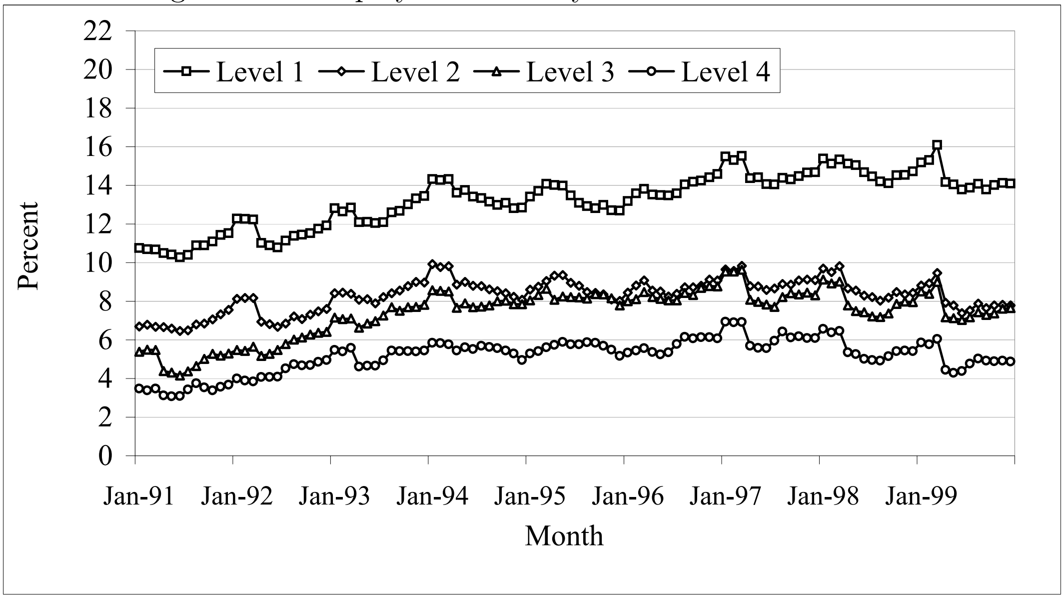
The unemployment rate appears to be higher in France than in Germany at all education levels, but particularly for basic vocational and intermediate qualifications (level 2 and 3). Generally speaking, the unemployment rate tends to get lower as the level of education gets higher. However, the pattern exhibits some non-linearities. In both countries, the unemployment rate is by far highest for those individuals without any degree at all (level 10), i.e. neither a school nor a vocational degree. Having at least a school degree, even below the maturity level, already reduces considerably the unemployment risk. Having completed basic vocational education (typically an apprenticeship in Germany) protects further from unemployment in Germany, while it only slightly reduces the unemployment risk in France. The unemployment rate is higher in France than in Germany at all education levels, but it seems that the gap is largest for intermediate qualifications (from level 21 to level 33), while it is smaller for low and high qualification levels.

Figure 2: Unemployment rate by education level - Germany



Figures 2 and 3 depict the developments in the unemployment rate by education level, relying on the one-digit level of the educational scale (see table 1). In both countries, the developments in the unemployment rate of workers with no vocational qualification (level 1) differ from the other educational groups. The unemployment rate of poorly qualified individuals has increased at a faster rate than that of workers with a least a basic vocational education throughout the 1990s. This divergence phenomenon was particularly pronounced in Germany until 1997, but then, the overall decreasing trend in unemployment benefitted more the least qualified so that the rates converged again. However, since the end of 1998, unemployment progressed faster for the least qualified again. In France, the increase in the unemployment rate of the least qualified was regular over the period, whereas it has diminished slightly and in a quite parallel way for the better qualified groups since 1997. Overall, university graduates (level 4) face the lowest unemployment rate over the whole period in France, it is in particular lower than level 3 individuals. In Germany, level 3 qualifications offer a good protection against unemployment, just as good - if not

Figure 3: Unemployment rate by education level - France



better - than university education.

3.2.2 Gender differences

Figure 4 and 5 report the average monthly unemployment rate for German and French men and women in the respective observation samples. As can be seen, women face a higher unemployment risk than men, but the gender gap is significantly larger in France than in Germany[3]. Moreover, the gender gap has remained constant over the 1990s in France, whereas there seems to be a convergence in the unemployment rates of German men and women. The time developments differ somewhat in France and Germany. In Germany, there is a sharp increase in the unemployment rates of both males and females in the first half of the 1990s. Then, the unemployment went back for women and stagnated for men. In France, the developments were smoother over the period: the increase in the unemployment rate was more moderate at the beginning of the decade, unemployment remained stable in the middle of the decade and it only decreased slightly at the end of the decade.

Looking at figures 6 and 7, it appears that gender differences are much more marked in France than in Germany at all education levels. In Germany, however, men with no degree at all (level 10) are more heavily penalised than women, and at certain education levels, there is only a small difference (level 11, level 20, level 30 and level 31). The education levels for which women are most disadvantaged are the *Realschule* level (with or without a basic vocational education) and the *Fachhochschule* level (level 40). In France, women face a higher unemployment risk than men, whatever their education level. However, here also, the gender gap is

3 Remember from chapter 3 that, by contrast, gender differences in educational attainment - in favour of men - proved more marked in Germany than in France.

Figure 4: Unemployment rate by gender - Germany

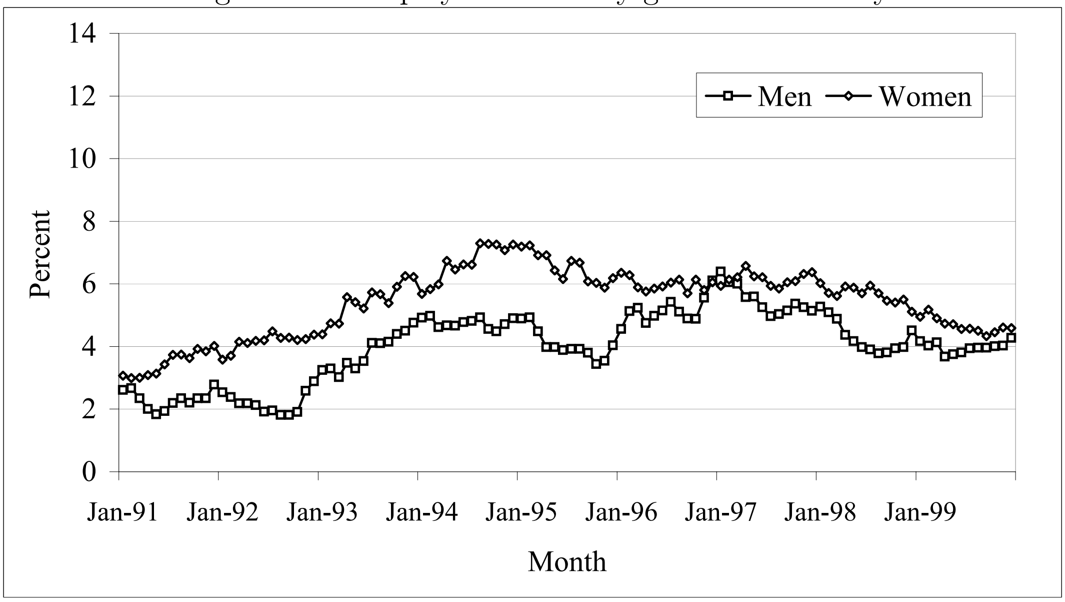
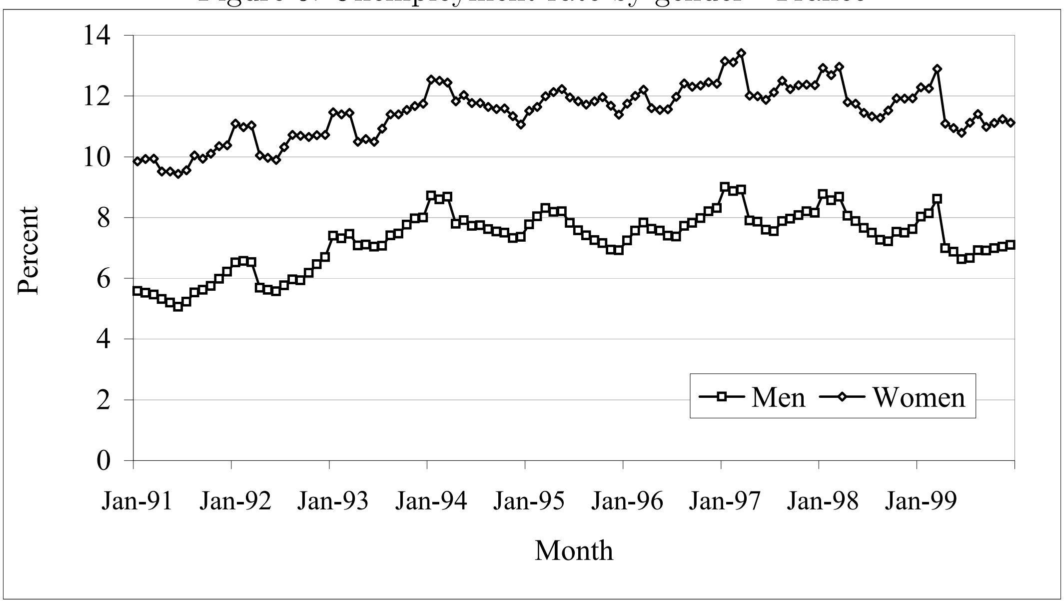


Figure 5: Unemployment rate by gender - France



more or less pronounced depending on the education level. It is lowest at the higher education level, but also among holders of an advanced vocational qualification (level 30). However, it is particularly large at the basic vocational level (level 2) and below as well as among holders of the vocational maturity certificates (level 31) or of the general maturity certificate assorted with some vocational qualification.

Figure 6: Unemployment rate by detailed education level and gender (1997-99) - Germany

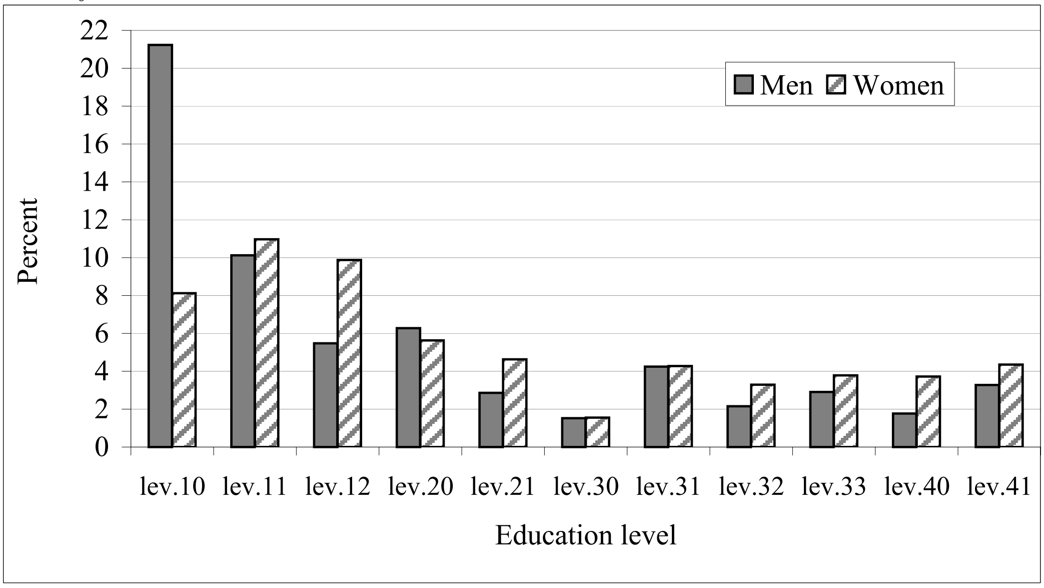
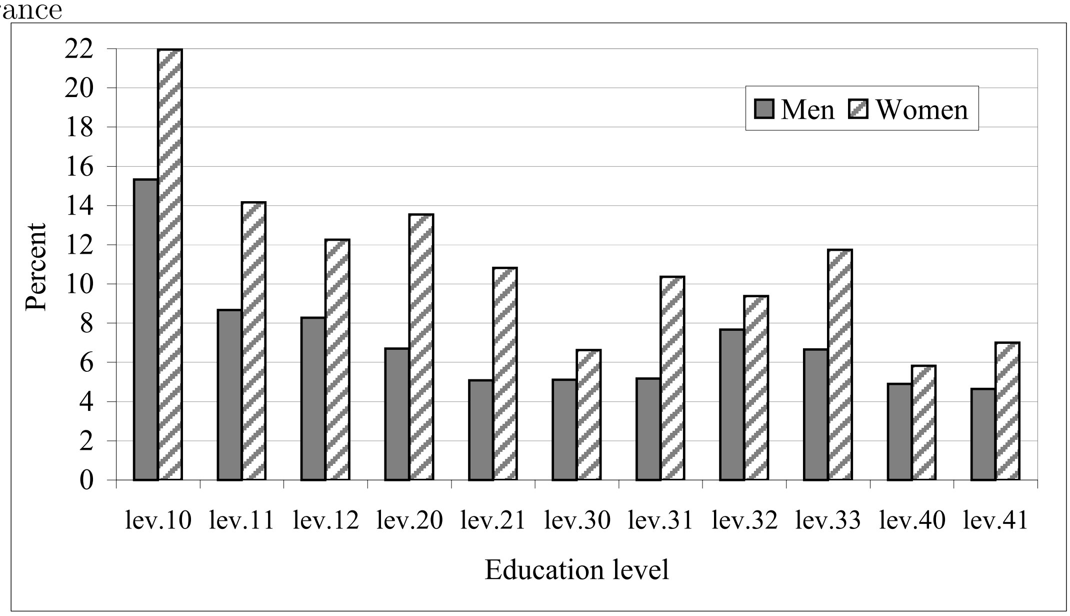


Figure 7: Unemployment rate by detailed education level and gender (1997-99) - France



4 The modelling framework

The analysis of the stock of unemployed at a given point in time provides a snapshot of the labour market situation at this point. However, it may be useful to have a look at the dynamics of unemployment, the flows into and out of unemployment, instead of just looking at the stock of unemployment. The subsequent microeconometric analysis aims at examining the way the level of education an individual possesses affects his probability to enter unemployment, if he has a job, or to exit unemployment, if he is unemployed.

The modelling framework chosen for the analysis is a discrete time competing risks hazard rate model. The basic idea of the hazard rate models (see among others Kalbfleisch and Prentice, 1980, Lancaster, 1990, Petersen, 1995 and Jenkins, 1995) is that instead of focussing on the duration spent in a state, one divides this duration into a certain number of time intervals and looks for each time interval whether the state the person was in is left or not. Here, it seems a priori adequate to adopt a so-called competing risks formulation, i.e. to distinguish between different possible destination states, because the factors influencing the transition into one specific state might differ from those affecting the transition to another state[4]. A discrete time model has been chosen because the data is available in discrete time time intervals (monthly data). Petersen (1995) and Jenkins (1995), among others, propose a discrete time formulation for single risk models which has the practical advantage of being estimable in the end as a logit model. For competing risks models, however, discrete time modelling is extremely seldom. Allison (1982) and more recently Petersen (1995) postulate that the discrete time competing risks case can be estimated as a multinomial logit model, by extension of the single risk case, but do not formalise this assumption. Recent studies (e.g. Zimmermann, 2000, Steiner, 2001 or Reize, 2002) run multinomial logit estimations without, again, formally deriving the likelihood function corresponding to a multinomial logit model. This paper proposes a formal presentation of the competing risks model in a discrete time framework and shows how the relatively simple multinomial logit estimation which has been applied in the recent literature can be rationalised from an econometrical point of view.

4.1 Formal presentation of the model: basic concepts

Let us assume that T_{ij}^s describes the time that individual i, $i \in \{1...N\}$, spent in the sth, $s \in \{1...S_i\}$, spell of state type j, $j \in \{1...\Omega\}$, before transition to another state or censoring[5] occurs. T_{ij}^s is a discrete random variable taking positive integer values[6]. Now assume that T_{ij}^s may be partitioned into a discrete number of intervals I_t, $t \in \{1...T_{ij}^s\}$. If transition or censoring occurs in interval I_t, then, by definition, $t = T_{ij}^s$. If it has not yet occurred in interval I_t, i.e. if the individual survives in that state until the end of interval I_t, then $T_{ij}^s > t$.

The destination-specific hazard rate h_{ijk}^s is the probability that individual i leaves his sth spell of state type j for state k, $k(\neq j) \in \{1...\Omega\}$, during interval I_t, given that the spell j lasted until the beginning of interval I_t, and given a vector of covariates

4 The hypothesis that the different exit states might be combined will be tested formally (see sections 6.1 and 7.1).

5 Censoring refers here to right-censoring. It is assumed that the start date of the spell is known.

6 T_{ij}^s is only observed for individuals who experience state j at least one interval and can therefore not be zero.

$x_{ijk}(t)$[7] and some unobserved factors ε_{ij}[8]:

$$h^s_{ijk}(t|x_{ijk}(t),\varepsilon_{ij}) = Pr(T^s_{ij} = t, \delta^s_{ijk} = 1|T^s_{ij} \geq t, x_{ijk}(t), \varepsilon_{ij}) \tag{1}$$

where

$$\delta^s_{ijk} = \begin{cases} 1 & \text{if the } s\text{th spell of individual } i \text{ in state } j \text{ ends in state } k \\ 0 & \text{otherwise (spell is censored or ends in another state than } k) \end{cases}$$

In each time interval, only one state may be observed (the original state j or one of the other k states). Since the different exit states are mutually exclusive, the overall probability H^s_{ij} of ending the sth spell of state type j for any other state in interval I_t, conditional on the fact that the spell j lasted until the beginning of interval I_t, can be expressed as the sum of the transitions from j to each specific other state:

$$H^s_{ij}(t|x_{ij}(t),\varepsilon_{ij}) = Pr(T^s_{ij} = t|T^s_{ij} \geq t, x_{ij}(t), \varepsilon_{ij}) = \sum_{k \neq j}^{\Omega} h^s_{ijk}(t|x_{ijk}(t),\varepsilon_{ij}) \tag{2}$$

A contrario, the probability that individual i does *not* leave his sth spell in state j in time interval I_t, conditional on the fact that the spell j lasted until the beginning of interval I_t is given by:

$$1 - H^s_{ij}(t|x_{ij}(t),\varepsilon_{ij}) = Pr(T^s_{ij} > t|T^s_{ij} \geq t, x_{ij}(t), \varepsilon_{ij}) \tag{3}$$

Consequently, the unconditional probability that an individual i who was in his sth spell of state j remains in this state until the end of interval I_t (i.e. that he "survives" interval I_t) can be expressed by the so-called survivor function S^s_{ij}:

$$S^s_{ij}(t|x_{ij}(t),\varepsilon_{ij}) = Pr(T^s_{ij} > t|x_{ij}(t),\varepsilon_{ij}) = \prod_{z=1}^{t}(1 - H^s_{ij}(z|x_{ij}(t),\varepsilon_{ij})) \tag{4}$$

Finally, the unconditional probability p^s_{ijk} that individual i leaves his original state j into state k exactly in interval I_t can be expressed by the probability that he survives time interval I_{t-1} and that he leaves state j in interval I_t, given he had survived until I_{t-1}:

$$\begin{aligned} p^s_{ijk}(t|x_{ijk}(t),\varepsilon_{ij}) &= Pr(T^s_{ij} = t, k|x_{ijk}(t),\varepsilon_{ij}) \\ &= h^s_{ijk}(t|x_{ijk}(t),\varepsilon_{ij}) \;\; S^s_{ij}(t-1|x_{ij}(t-1),\varepsilon_{ij}) \\ &= h^s_{ijk}(t|x_{ijk}(t),\varepsilon_{ij}) \prod_{z=1}^{t-1}(1 - H^s_{ij}(z|x_{ij}(z),\varepsilon_{ij})) \end{aligned} \tag{5}$$

Thus, the probability that spell number s of type j is complete and ends in state k is given by $p^s_{ijk}(T^s_{ij})$, and the probability that it is censored is given by $S^s_{ij}(T^s_{ij})$.

7 The vector of explanatory variables may vary according to the origin state j, but also according to the destination state k.

8 The unobserved individual factors affect the decision to exit the original state for choosing another state.

Assuming that all spell observations, conditional on the explanatory variables and the unobserved factors, are independent and that censoring is random, the sample likelihood function for the original state j may be written as follows[9]:

$$\mathcal{L}_j = \prod_{i=1}^{N} \prod_{s=1}^{S_i} \left[\prod_{k \neq j}^{\Omega} p_{ijk}^s(T_{ij}^s) \right]^{\delta_{ijk}^s} S_{ij}^s(T_{ij}^s))^{\gamma_{ij}^s} \tag{6}$$

where δ_{ijk}^s is defined as above and

$$\gamma_{ij}^s = \begin{cases} 1 & \text{if the } s\text{th spell of individual } i \text{ in state } j \text{ is censored} \\ 0 & \text{otherwise (spell ends in any state } k(\neq j) \in \{1...\Omega\}) \end{cases}$$

Note that:

$$\gamma_{ij}^s + \sum_{k \neq j}^{\Omega} \delta_{ijk}^s = 1 \tag{7}$$

The first term of $\mathcal{L}_j$ corresponds to the contribution of the completed spells, the second term represents the contribution of the censored spells. Using equations (4) and (5), the likelihood function may be rewritten as:

$$\begin{aligned} \mathcal{L}_j &= \prod_{i=1}^{N} \prod_{s=1}^{S_i} \left[\prod_{k \neq j}^{\Omega} \left[h_{ijk}^s(T_{ij}^s) \prod_{t=1}^{T_{ij}^s - 1} (1 - H_{ij}^s(t)) \right]^{\delta_{ijk}^s} \right] \left[\prod_{t=1}^{T_{ij}^s} (1 - H_{ij}^s(t) \right]^{\gamma_{ij}^s} \\ &= \prod_{i=1}^{N} \prod_{s=1}^{S_i} \left[\prod_{k \neq j}^{\Omega} h_{ijk}^s(T_{ij}^s) \right]^{\delta_{ijk}^s} \left[\prod_{t=1}^{T_{ij}^s - 1} (1 - H_{ij}^s(t)) \right]^{\sum_{k \neq j}^{\Omega} \delta_{ijk}^s} \left[\prod_{t=1}^{T_{ij}^s} (1 - H_{ij}^s(t) \right]^{\gamma_{ij}^s} \\ &= \prod_{i=1}^{N} \prod_{s=1}^{S_i} \frac{\prod_{k \neq j}^{\Omega} h_{ijk}^s(T_{ij}^s)^{\delta_{ijk}^s}}{(1 - H_{ij}^s(T_{ij}^s))^{\sum_{k \neq j}^{\Omega} \delta_{ijk}^s}} \left[\prod_{t=1}^{T_{ij}^s} (1 - H_{ij}^s)(t) \right]^{\gamma_{ij}^s + \sum_{k \neq j}^{\Omega} \delta_{ijk}^s} \end{aligned}$$

Using equation (7), one obtains:

$$\mathcal{L}_j = \prod_{i=1}^{N} \prod_{s=1}^{S_i} \frac{\prod_{k \neq j}^{\Omega} h_{ijk}^s(T_{ij}^s)^{\delta_{ijk}^s}}{(1 - H_{ij}^s(T_{ij}^s))^{1 - \gamma_{ij}^s}} \prod_{t=1}^{T_{ij}^s} (1 - H_{ij}^s)(t) \tag{8}$$

This likelihood is too complicated to be maximised directly, but, extending the method proposed by Jenkins (1995) for binary models to the multinomial case, one

9 The conditioning on $x_{ijk}(t)$ and ε_{ij} has been dropped temporarily to simplify notation.

can derive an easier estimation method. The trick consists in defining new indicator variables which depend on the censoring indicators in the following way:

$$y^s_{ijkt} = \begin{cases} 1 & \text{if } \delta^s_{ijk} = 1 \text{ and } t = T^s_{ij} \\ 0 & \text{otherwise } (\gamma^s_{ij} = 1 \text{ or } \delta^s_{ijk} = 0 \text{ or } \delta^s_{ijk} = 1 \text{ and } t \neq T^s_{ij}) \end{cases}$$

$$z^s_{ijt} = \begin{cases} 1 & \text{if } \gamma^s_{ij} = 0 \text{ and } t = T^s_{ij} \\ 0 & \text{otherwise } (\gamma^s_{ij} = 1 \text{ or } t \neq T^s_{ij}) \end{cases}$$

where $t \in \{1...T^s_{ij}\}$.

One has:

$$z^s_{ijt} = \sum_{k\neq j}^{\Omega} y^s_{ijkt}$$

To put it in words, for people staying in state j in all time intervals observed (censored observations), y^s_{ijkt} is zero for all intervals. For people making the transition to any k, y^s_{ijkt} is zero for all intervals except the interval of transition (the last one), when it is equal to 1. z^s_{ijt} is zero if the spell is censored and if it is not censored, it is zero for all intervals except the last one when transition occurs.

Using these indicator variables, the likelihood may be rewritten as:

$$\begin{aligned}\mathcal{L}_j &= \prod_{i=1}^{N}\prod_{s=1}^{S_i}\left[\prod_{t=1}^{T^s_{ij}} \frac{\prod_{k\neq j}^{\Omega} h^s_{ijk}(t)^{y^s_{ijk}}}{(1-H^s_{ij}(t))^{z^s_{ij}}}\right]\left[\prod_{t=1}^{T^s_{ij}}(1-H^s_{ij}(t))\right] \\ &= \prod_{i=1}^{N}\prod_{s=1}^{S_i}\prod_{t=1}^{T^s_{ij}}\prod_{k\neq j}^{\Omega} h^s_{ijk}(t)^{y^s_{ijk}}(1-H^s_{ij}(t))^{1-z^s_{ij}}\end{aligned}$$

To put it differently:

$$\mathcal{L}_j = \prod_{i=1}^{N}\prod_{s=1}^{S_i}\prod_{k\neq j}^{\Omega}\prod_{t=1}^{T^s_{ij}} h^s_{ijk}(t)^{y^s_{ijk}}(1-\sum_{k\neq j}^{\Omega} h^s_{ijk}(t))^{1-\sum_{k\neq j}^{\Omega} y^s_{ijk}} \tag{9}$$

Thus, after this transformation, the likelihood function boils down to a standard multinomial likelihood function where the y^s_{ijt} is the dependent variable and the censored observations enter the likelihood function as an additional category. In practical terms, one needs to rearrange the data so that the spell month (if the month is the time unit for intervals) is the unit of analysis instead of the spell and construct the indicator variables such as described above. For equation (9) to be estimable empirically, one needs to operate further choices.

4.2 Further specification choices

Functional form of the hazard function

The hazard rate is assumed to have a multinomial logit form, with censoring as the base category:

$$h^s_{ijk}(t|x_{ijk}(t), \varepsilon_{ij}) = \frac{exp\left[\alpha_{jk}(t) + \beta'_{jk}x_{ijk}(t) + \varepsilon_{ij}\right]}{1 + \sum\limits_{\ell \neq j}^{\Omega} exp\left[\alpha_{j\ell}(t) + \beta'_{j\ell}x_{ij\ell}(t) + \varepsilon_{ij}\right]} \tag{10}$$

The multinomial logit form, however, is an adequate specification only if the so-called Independence of Irrelevant Alternatives (IIA) assumption is fulfilled, i.e. if the odds ratio for a subset of alternatives is independent of the remaining alternatives. This follows from the initial assumption required for modelling the decision problem as in (10) that the disturbances are uncorrelated between the states. The validity of the IIA assumption will be tested by means of two tests: the Hausman test (Hausman and McFadden, 1984) and the Small Hsiao test (Small and Hsiao, 1985). Further Wald tests (Judge, Hill, Griffiths and Lee, 1985) will be run to test whether some of the outcome categories should be combined, i.e. whether the parameter estimates differ significantly across outcome categories.

Functional form of the baseline hazard

In equation (10), $\alpha_{jk}(t)$ is the so-called baseline hazard function, which describes the pattern of duration dependence, i.e. the way the hazard rate depends on process time. Here, a semi-parametric specification has been chosen: the baseline hazard function is assumed to be piecewise constant, i.e. constant within fixed time spans. This allows for a flexible pattern of duration dependence and avoids misspecification biases, while it increases efficiency by permitting to aggregate process time units where the duration effect is found to be constant or the number observations too small.

Specification of unobserved heterogeneity

It remains to specify the unobserved heterogeneity ε_{ij}. A common procedure is to impose a specific distribution on ε_{ij}, for instance a normal, a log-normal or a gamma distribution. Heckman and Singer, 1984 have sharply criticised such a parametric approach, arguing that functional form assumption for unobserved heterogeneity might seriously affect the parameter estimates, and the economics provide little guidance for choosing one specific distribution rather than another. For this reason, unobserved heterogeneity will be specified non-parametrically using the mass point approach. Thus, one assumes a discrete probability distribution for ε_{ij}, i.e. one assumes that ε_{ij} may be partitioned into a limited number M of mass points or location parameters ε_{mj}, $m \in \{1...M\}$, with a given probability $Pr(\varepsilon_{mj})$. The mass points and their probabilities have the following properties:

$$\sum_{m=1}^{M} Pr(\varepsilon_{mj}) = 1 \tag{11}$$

$$\sum_{m=1}^{M} Pr(\varepsilon_{mj})\varepsilon_{mj} = 0 \tag{12}$$

$$E(\varepsilon_{mj}x_{ijk}(t)) = 0 \tag{13}$$

Hence, the likelihood function (9) may be rewritten as:

$$\mathcal{L}_j = \sum_{m=1}^{M} Pr(\varepsilon_{mj}) \left[\prod_{i=1}^{N} \prod_{s=1}^{S_i} \prod_{k \neq j}^{\Omega} \prod_{t=1}^{T_{ij}^s} h_{ijk}^s(t|x_{ijk}, \varepsilon_{mj})^{y_{ijkt}^s} \; (1 - H_{ij}^s(t|x_{ij}, \varepsilon_{mj}))^{1-z_{ijt}^s} \right] \tag{14}$$

The number of mass points is determined by the approach of Baker and Melino (2000) based on a comparison of information criteria computed from the estimation results of models with a different number of mass points. The number of mass points is incremented until the addition of a further mass point stops improving the model, i.e. stops decreasing the value of the information criteria. The information criteria have the general form:

$$IC = ln\mathcal{L}_j^* - cp \tag{15}$$

where $\mathcal{L}_j^*$ is the value of the log-likelihood function obtained after maximisation, p is the number of parameters estimated and c a penalty function. In order to see whether the number of mass points found as optimal is robust towards the choice of the penalty function, three alternative information criteria are used here, with different functions c as penalty for additional parameters, IC_A (Akaike Information Criterion), IC_B (Baysian Information Criterion) and IC_H (Hannan-Quinn Information Criterion):

$$\begin{aligned} &\text{For } IC_A, \quad c = 1 \\ &\text{For } IC_B, \quad c = ln(O)/2 \\ &\text{For } IC_H, \quad c = ln(ln(O)) \end{aligned} \tag{16}$$

where O is the number of observations.

5 Data and variables

In the following analysis, three employment states are distinguished, i.e. $\Omega = 3$. State 1 corresponds to employment, state 2 corresponds to unemployment and state 3 to non-employment such as defined in section 3.1. The time intervals are of equal length and consist of months. The analysis concentrates on two aspects: the impact of education on the hazard $h_{i12}^s(t)$ of exiting employment for entering unemployment (section 6) and the impact of education on the hazard $h_{i21}^s(t)$ of exiting unemployment for employment (section 7).

5.1 Construction of the spell data

The first step is to construct the appropriate spell data. The data on the employment history is brought into person-month format and the variables necessary to the implementation of the model are constructed, in particular the spell identifiers, the censoring indicators and the hazard rates. Table 2 provides a summary of the composition of the sample.

Table 2: Sample composition

Spells of:	**Employment**		**Unemployment**	
	Germany	**France**	**Germany**	**France**
Total sample				
Numb. spells	5,579	18,175	2,053	4,888
complete	495 (8.9%)	2,044 (11.3%)	1,541 (75.1%)	2,406 (49.2%)
right-censored	931 (16.7%)	1,964 (10.8%)	286 (13.9%)	974 (19.9%)
left-censored	759 (13.6%)	1,694 (9.3%)	207 (10.1%)	1,117 (24.1%)
left-right censored	3,394 (60.8%)	12,473 (68.6%)	19 (0.93%)	331 (6.8%)
Sample of analysis				
Numb. observations	136,948	490,848	15,089	23,112
Numb. spells	4,791	15,734	1,827	3,380
complete	252 (5.3%)	660 (4.2%)	1,541 (84.4%)	2,406 (71.2%)
right-censored	649 (13.6%)	1,944 (12.4%)	286 (15.6%)	974 (28.8%)
left-censored	582 (12.1%)	935 (5.9%)		
left-right censored	3,308 (69.0%)	12,195 (77.5%)		
Not right-censored spells ending in				
employment			1,308 (84.9%)	2,248 (93.4%)
unemployment	342 (41.0%)	1,109 (69.5%)		
non-employment	492 (59.0%)	486 (30.5%)	233 (15.1%)	156 (6.6%)
Numb. individuals	4,498	15,000	1,198	2,157
with 1 spell	4,220 (93.8%)	14,303 (95.3%)	812 (67.7%)	1,430 (66.3%)
with 2 spells	263 (5.9%)	660 (4.4%)	245 (20.5%)	416 (19.3%)
with 3 spells	15 (0.3%)	37 (0.3%)	90 (7.5%)	188 (8.7%)
with 4 spells			27 (2.3%)	77 (3.4%)
with 5 spells			11 (0.9%)	35 (1.6%)
with 6 spells			4 (0.3%)	7 (0.3%)
with 7 spells			5 (0.4%)	3 (0.1%)
with 8 spells			3 (0.2%)	1 (0.0%)
with 9 spells			1 (0.1%)	
Numb. months	37	37	107	36

For the analysis of entry into unemployment, the focus is on the transition from employment to unemployment. Therefore, one needs to identify employment spells. As mentioned previously, the *Emploi* data is a rotating panel and the individuals are interviewed only three consecutive years, after which they leave the panel. I select those individuals interviewed for the first time in 1998 and use the information drawn from the two subsequent waves (1999 and 2000) to reconstitute their employment history over a period of 37 months (from March 1997 to March 2000). In order to make things comparable, the same restrictions have been adopted for the German sample, even though a longer panel would be available. Thus, for the German sample, the employment history is reconstituted over 37 months from December 1996 to December 1999.

Left-censored spells are problematic to handle. It is common practice to exclude them from the sample (see among others Steiner, 2001, Reize, 2002), especially when duration dependence - for which one needs to know the start date of the spell - is to be examined. This is the option chosen for the analysis of the duration of unemployment, since the process time, i.e. the time already spent in unemployment at the month of observation is known to be an essential explanatory factor of the hazard rate out of unemployment (duration dependence). However, it would be problematic for the analysis of entry into unemployment to exclude left-censored spells, first because the proportion of left-censored spells is quite large, secondly because keeping only not left-censored employment spells would boil down to selecting a very specific sample, with a high proportion of labour market entrants or career breakers. Therefore, it was decided to keep the left-censored spells in the sample for the analysis of entry into unemployment. It implies that it is assumed to be no duration dependence in the hazard rate out of employment (Jenkins, 1995). In the present context, this should be a minor problem in so far as the focus of the analysis is not on employment duration dependence and that the censoring status appears as a control variable in the regression.

Furthermore, the information on employment characteristics is not available from the monthly calendar data but only from the yearly interviews. This means that this information is only available if the individual was employed in the month of the interview. To make it possible to use this information, only those employment spells extending over the interview month have been retained for the analysis.

For the analysis of the reemployment prospects of the unemployed, one needs to identify unemployment spells. Because there are much fewer unemployment spells than employment spells and because the size of the German sample is much smaller than that of the French sample, it proved not to be feasible to reduce the observation period of individuals in the German sample to only 37 months like for the analysis of employment spells, due to an insufficient number of observations at the monthly level. Therefore, for Germany, the analysis uses information from the waves 1992 to 2000 and thus covers a total of 108 months (From January 1991 to December 1999).

Given the selection procedure and the definition of the samples, the statements made in the subsequent analyses cannot be considered as applicable for the whole population in France and Germany, but they give useful insights into the factors affecting unemployment dynamics and highlight in particular the role played by education.

5.2 Explanatory variables

Most explanatory variables are taken from the yearly interviews and have been merged with the monthly data on employment history. As a rule, the information drawn from the interview month is assumed to apply for the period extending from the month after the interview month of the preceding wave until the interview month of the current wave[10]. For the information on employment characteristics used for the analysis of entry into employment, however, the information is assumed to apply to the employment spell the interview month falls in.

Table 3 provides a synthetic overview of the explanatory variables used and how they are defined. The education level - the primary variable of interest here - is defined as in table 1, except that, because of an otherwise insufficient number of observations at the monthly level, education levels 30 and 31 have been aggregated into a single category, as well as level 32 and level 33. Further variables have been included in the regressions to control for observed heterogeneity. The set of explanatory variables limits to those variables that can be constructed in a comparable way for both countries. Most explanatory variables are drawn from the GSOEP and *Emploi* data and are self-explaining in the way they are described in table 3. They will not be further commented here. Some variables, however, deserve additional explanations.

The information on the regional monthly unemployment rate is drawn from the online time-series service of the Federal Office for Statistics for Germany and computed on the basis of the *Emploi* data for France. Tenure is represented by a set of dummy variables. The information on tenure is drawn from the yearly interview and therefore applies to the interview month. It has then been incremented by one for each month pertaining in the employment spell, provided the person has reported in the subsequent wave to have incurred no job change in that year. The information on the following wave makes it possible to cross-check this variable. For the analysis of exit out of unemployment, the baseline hazard, which represents the spell duration elapsed until the month of the observation, is specified, as explained in section 4.2, as piecewise constant. Because the number of observations declines as the elapsed spell duration increases, the month dummies have been aggregated for longer elapsed durations such as described in table 3.

Finally, an indicator of the income replacement ratio (IRR) is constructed, i.e. the ratio of the expected unemployment compensation to the expected labour earnings. The idea is that the higher the unemployment compensation is compared to the potential earnings to be obtained from working, the lower the probability that the individual leaves unemployment will be. The IRR is constructed in a similar way for

10 An alternative would be to consider that the information drawn from the interview month applies partly to a certain period before the interview month, partly to a certain period after the interview month (e.g. for half of the time extending from the current interview month to the next one). This approach was not retained because it would have implied that we lose the first 6 months for France, which is problematic in view of the short overall period of observation available.

Table 3: Explanatory variables

Variables	Definition
Variables common to both analyses	
Education level	6 categories: level 1,level 20, level 21, level 30/31, level 32/33, level 40, level 41 (see table 1)
Sex	2 categories: female, male
Marital status	2 categories: married, not married
Children<6	Number of children below 6 years of age
Home ownership	2 categories: owner of the house/appartment living in (himself or spouse), not owner
Age	6 categories: age 25 to 30, age 31 to 35, age 36 to 40, age 41 to 45, age 46 to 50, age 51 to 55
City size	3 categories: fewer than 20,000 inhabitants, between 20 and 100,000 inhabitants, 100,000 inhabitants or more
Unempl. rate	Monthly regional unemployment rate
Current quarter	4 categories: 1st quarter (January to March), 2nd quarter (April to June), 3rd quarter (July to September), 4th quarter (October to December)
Variables specific to the analysis of entry into unemployment	
Tenure	9 categories: <1 year, 1-1.5 years, 1.5-2 years, 2-3 years 3-4 years, 4-7 years, 7-10 years, 10-15 years, ≥15 years
Firm size	6 categories: <5 employees, 5-19 employees, 20-199 employees, 200-1999 employees, ≥2,000 employees, missing
Industry	9 categories: industry (mechanical and electrical engineering, stone, iron, steel and chemical industry, paper, textile, food industry, other), agriculture/energy (agriculture, forestry, fishing, energy, mining), construction, trade (wholesale and retail), banking (banking, insurance, real estate), transports (transports and communications), private services (personal services, eating and drinking, other services to professionals or private households), public services (welfare services, government, non-profit institutions, other), missing
Prev. employment	3 categories: non-employed, employed, missing
Time trend	Month variable
Variables specific to the analysis of unemployment duration	
Duration	9 categories: 1 month, 2 months, 3 months, 4-6 months, 7-9 months, 10-12 months, 13-15 months, 16-18 months, ≥19 months
Prev. employment	2 categories: non-employed, employed
IRR	Predicted ratio of unempl. compensation to labour earnings
Quarter spell begin	4 categories: same as current quarter
Time trend	For Germany: 9 year dummies for 1991 to 1999. For France: month, month squared, month cubed

both countries. In a first step, a reduced-form wage equation[11] has been run on the basis of the yearly data[12], with gender, education, age and age squared, the number of children below 6 years of age, region, city size and year dummies as explanatory variables. Then, using the estimation results (see table 10 in the appendix), the income that could be potentially earned by the unemployed individuals in the sample of analysis can be predicted ("out-of-sample" prediction)[13].

In a second step, the unemployment benefits need to be computed. Unfortunately, the information on the unemployment benefits perceived is not available on a monthly basis neither in the French nor in the German data. For France, the information on the perceived unemployment compensation available for the month of the yearly interview for those unemployed during that month is used. The logarithm of the unemployment compensation is regressed on gender, education, age and age squared, number of children below 6, region, city size, year dummies, but also on the duration of the current unemployment episode, the latter information being given by the unemployed in the yearly interviews (see estimation results in table 10 in the appendix). For Germany, there is information on the average monthly unemployment compensation[14] perceived in the previous year for people who were unemployed that year. This information is matched to the unemployment spells, and the logarithm of the unemployment compensation is regressed on the basis of this data set on the same variables as for France, and on the duration of the unemployment spells until the month observed, which has been constructed from the spell data. Like for wages, the predicted unemployment benefits is computed. The IRR is then the ratio of the predicted wage to the predicted unemployment compensation. Table 12 in the annex provides descriptive statistics for the variables used for the analysis of entry into and exit out of unemployment, on the basis of the estimation samples.

6 Education and entry into unemployment

6.1 Specification tests

Table 4 presents the results of specification tests with respect to the choice of the variables to be included in the regression. Due to the extremely long computation time of the estimation with the mass points (about 5 days), these specification tests are based on estimations with no modelling of unobserved heterogeneity[15].

11 The sample used for the estimation has the same selection criteria (nationality, age, period considered) as the sample used for the analysis of unemployment spells.

12 The wage earned is not available at the monthly level, neither for Germany nor for France.

13 Since the logarithm of the (monthly gross) wage has been used as a dependent variable, the prediction is given by $exp(\hat{\beta} + 1/2\hat{\sigma}^2)$, where $\hat{\beta}$ is the vector of estimated coefficients and $\hat{\sigma}$ is the standard error of the estimation (see Greene, 2000, p.69).

14 Defined here as unemployment benefits (*Arbeitslosengeld*) plus unemployment assistance (*Arbeitslosenhilfe*).

15 For France, this is no restriction at all, since unobserved individual heterogeneity is found not to affect significantly the hazard out of employment, see table 5.

Table 4: Tests on coefficients: χ^2 (p> χ^2)

Hazard rate into:	Germany Unempl.	Germany Non-empl.	France Unempl.	France Non-empl.
Tests on gender interactions				
Female * Education	6.57 (0.36)	22.69 (0.00)	4.52 (0.60)	5.71 (0.46)
Female * Married	3.25 (0.07)	31.25 (0.00)	0.60 (0.44)	20.28 (0.00)
Female * Children<6	1.12 (0.29)	79.80 (0.00)	7.91 (0.00)	120.89 (0.00)
Female * Age	4.41 (0.49)	24.06 (0.00)	6.76 (0.24)	15.50 (0.00)
Female * City size	1.06 (0.59)	0.87 (0.65)	1.25 (0.54)	0.85 (0.65)
Female * Unempl. rate	0.05 (0.83)	0.73 (0.39)	0.16 (0.69)	0.16 (0.69)
Tests on specific coefficients (with only significant gender interactions)				
Education	18.03 (0.00)	31.77 (0.00)	76.37 (0.00)	18.63 (0.00)
Female	1.28 (0.26)	4.06 (0.04)	9.99 (0.08)	2.74 (0.09)
Tenure	83.76 (0.00)	37.83 (0.00)	59.20 (0.00)	38.05 (0.00)
Firm size	26.68 (0.00)	7.49 (0.19)	106.44 (0.00)	97.11 (0.00)
Industry	15.43 (0.05)	143.49 (0.00)	24.88 (0.00)	5.81 (0.67)
Prev. empl. status	55.83 (0.00)	4.05 (0.04)	237.77 (0.00)	29.41 (0.00)
Married	5.56 (0.06)	42.18 (0.00)	14.31 (0.00)	21.85 (0.00)
Children<6	1.68 (0.43)	0.17 (0.68)	0.03 (0.86)	1.70 (0.19)
Owner	3.51 (0.06)	0.01 (0.91)	15.20 (0.00)	1.10 (0.29)
Age	3.49 (0.62)	20.25 (0.00)	13.12 (0.22)	97.30 (0.00)
City size	5.97 (0.05)	7.18 (0.03)	1.20 (0.55)	3.61 (0.05)
Unemployment rate	5.02 (0.03)	1.44 (0.49)	7.19 (0.01)	4.36 (0.04)
Current quarter	1.68 (0.64)	57.51 (0.00)	90.20 (0.00)	162.50 (0.00)
Month	6.33 (0.01)	5.98 (0.01)	105.80 (0.00)	124.85 (0.00)
Tests on overall significance (finally retained specification)				
Overall Wald test	1,366.3 (0.00)		3,825.8 (0.00)	
Partial Wald tests	498.5 (0.00)	875.6 (0.00)	2,663.5 (0.00)	1,174.8 (0.00)

A first series of χ^2-tests aims at examining whether there are some gender differences in the impact of certain variables on the hazard rate out of employment into unemployment and into non-employment[16]. These tests are based on an estimation of the model where some (sets of) variables have been interacted with the female dummy. The interactions which proved not to be significant at the 10 percent level at least were dropped from the specification. In a second step, the (joint) significance of the (sets of) variables themselves has been tested, on the basis of a specification including the significant gender interaction terms. Here again, only the (sets of) variables significant at the 10 percent level at least have been retained for the final specification. Given that the computation time increases exponentially with the number of parameters to be estimated, it proved particularly desirable to drop the

16 In these tests, the null hypothesis is that the variable(s) considered is (are) not significantly different from zero. The figure in parentheses gives the probability to which the null hypothesis can be rejected.

insignificant variables from the model. The variables included in the equation of the hazard into unemployment are allowed to differ from those retained for the equation of the hazard into non-employment. Finally, the overall Wald test tests, on the basis of the final specification with respect to the variables included, the hypothesis that all the slope coefficients of both equations are jointly insignificant, which is strongly rejected. The so-called partial Wald tests run the tests again for each destination state separately ans also proves to be strongly rejected.

Table 5: Other specification tests

		Germany	**France**
Tests for IIA		χ^2 (p> χ^2)	χ^2 (p> χ^2)
Hausman	Omitted: unempl.	5.21 (1.00)	1.46 (1.00)
	Omitted: non-empl.	7.36 (1.00)	25.76 (1.00)
Small Hsiao	Omitted: unempl.	59.61 (0.42)	47.56 (0.65)
	Omitted: non-empl.	51.69 (0.71)	47.81 (0.64)
Wald test for combining outcomes		χ^2 (p> χ^2)	χ^2 (p> χ^2)
Comb. unempl. and non-empl.		393.55 (0.00)	732.66 (0.00)
Comb. unempl. and empl.		508.97 (0.00)	2,663.53 (0.00)
Comb. non-empl. and empl.		875.43 (0.00)	1,174.76 (0.00)
Test for number of mass points		*IC*	*IC*
IC_A	No mass point	-5,154.6	-9,228.5
	2 mass points	-5,154.7	-9,230.5
IC_B	No mass point	-5,582.1	-9,672.1
	2 mass points	-5,592.0	-9,684.8
IC_H	No mass point	-5,282.6	-9,356.4
	2 mass points	-5,285.6	-9,361.5

Table 5 presents some further specification tests related to the functional form assumption. Given the enormous computation time, the tests of the IIA assumption is run on the model without unobserved heterogeneity. If the alternatives prove to be independent even without modelling of unobserved heterogeneity, they are necessarily independent in the less restrictive model where unobserved individual heterogeneity is controlled for. The tests results show that for both countries, the IIA assumption is fulfilled, both on the basis of the Hausman tests and on the basis of the Small Hsiao tests (see the explanation of these tests and on the testing procedure in section 4.2).

Furthermore, a Wald test examines the hypothesis that some of the alternatives might be combined or aggregated into a single category, in which case the specification should binomial rather than multinomial. In other words, the hypothesis is tested that the coefficients of two categories do not differ significantly from each other, for all the possible combinations. As show the results in table 5, the multinomial specification seems to be appropriate for France as well as for Germany, since none of the categories should be combined.

Finally, the number of mass points describing unobserved individual heterogeneity has to be determined. Table 5 reports the value of the three information criteria defined in section 4.2. The preferred model is that yielding the lowest IC value. As can be seen, all three information criteria lead to the same conclusion. For France like for Germany, accounting for individual unobserved heterogeneity by distinguishing two mass points does not improve the fit of the model, which means that the best model should not include any mass point.

6.2 Estimation results

Table 6 presents the full estimation results of the determinants of the hazard rate from employment into unemployment and non-employment respectively. The focus of the analysis is on the impact of education on the risk of entering unemployment. Therefore, the transition from employment to non-employment will not be specifically commented upon, but the results are reported in table 6 for the sake of completeness. The impact of the other variables than education on the risk of entering unemployment will only be briefly reviewed.

6.2.1 Effect of education

The results in table 6 show that the individuals in the reference group, i.e. individuals with a poor education level (level 1, no vocational education, see table 1) have the highest risk of losing their job for entering unemployment, anything else being constant. Indeed, all the education dummies exhibit a negative sign. This is true in both France and Germany.

By identical other characteristics, in France, the completion of a higher education degree seems to particulary protect individuals against the unemployment risk. Vocational degrees do reduce the risk of entering unemployment in France, but not to the same extent as higher education degrees. In Germany, the best protection against unemployment seems to be given, all else equal, by vocational qualifications of intermediate level (level 3), whereas university graduates face a comparatively higher unemployment risk. This seems to indicate that the German system of vocational education performs better than the French one in terms of relative job placement, while the French system of higher education proves more efficient than the German one in terms of the relative reduction of the unemployment risk.

At the higher education level, lower tertiary qualifications seem to better protect against the unemployment risk than upper tertiary qualifications in both countries[17] but particularly in Germany. An explanation for this is probably that the lower tertiary qualifications typically have a practical focus and are more oriented towards

17 A simple χ^2-test shows that the hypothesis of equality of the coefficients is rejected at the 1 percent level.

Table 6: Determinants of hazard rate from employment

	Germany		France	
Hazard rate into:	**Unempl.**	**Non-empl.**	**Unempl.**	**Non-empl.**
	coef. (s.e)	**coef. (s.e)**	**coef. (s.e)**	**coef. (s.e)**
Education level (ref.: Level 1)				
Level 20	-0.35* (0.17)	-0.06 (0.18)	-0.24** (0.08)	0.14 (0.13)
Level 21	-0.46** (0.12)	-0.74** (0.00)	-0.37** (0.10)	-0.13 (0.16)
Level 30 or 31	-0.62** (0.14)	-0.01 (0.00)	-0.62** (0.14)	-0.38† (0.22)
Level 32 or 33	-0.67** (0.17)	-0.29** (0.00)	-0.55** (0.12)	-0.13 (0.19)
Level 40	-0.57** (0.19)	-0.68* (0.30)	-0.80** (0.12)	-0.27† (0.16)
Level 41	-0.32** (0.17)	-0.50* (0.24)	-0.73** (0.13)	-0.60** (0.19)
Fem. * Level 20		0.07 (0.20)		
Fem. * Level 21		0.62* (0.31)		
Fem. * Level 30 or 31		0.62* (0.28)		
Fem. * Level 32 or 33		0.64** (0.24)		
Fem. * Level 40		0.50 (0.36)		
Fem. * Level 41		0.45 (0.37)		
Female		0.77* (0.38)	0.17** (0.07)	0.36† (0.22)
Tenure (ref.:<1 year)				
1-1.5 years	-0.17 (0.11)	0.22 (0.10)	-0.53** (0.09)	-0.25 (0.21)
1.5-2 years	-0.16 (0.12)	0.20 (0.11)	-0.77** (0.11)	-0.98** (0.29)
2-3 years	-0.23* (0.11)	-0.21† (0.13)	-0.91** (0.11)	-0.66** (0.24)
3-4 years	-0.47** (0.13)	-0.28† (0.16)	-0.91** (0.15)	-0.63* (0.28)
4-7 years	-0.89** (0.22)	-0.33* (0.17)	-1.63** (0.14)	-0.61** (0.22)
7-10 years	-1.28** (0.27)	-0.58** (0.19)	-2.03** (0.16)	-0.90** (0.23)
10-15 years	-1.32** (0.28)	-0.48** (0.18)	-2.36** (0.18)	-1.32** (0.25)
≥15 years	-1.67** (0.28)	-0.89** (0.22)	-3.06** (0.16)	-0.93** (0.21)
Firm size (ref.: <5 employees)				
5-19 employees	0.49** (0.11)		0.27** (0.10)	-0.32† (0.19)
20-199 employees	0.18* (0.09)		0.24** (0.10)	-0.23 (0.16)
200-1999 employees	0.01 (0.96)		0.18† (0.10)	-0.35* (0.15)
≥2000 employees	-0.32* (0.14)		-0.05 (0.11)	-0.11 (0.14)
Missing	0.42† (0.22)		0.99** (0.10)	1.10** (0.14)
Industry branch (ref.: Industry)				
Agriculture, energy	-0.36 (0.26)	-0.31 (0.21)	-0.04 (0.16)	
Construction	0.18 (0.12)	0.54* (0.24)	-0.17 (0.17)	
Trade	-0.09 (0.11)	0.15 (0.16)	0.09 (0.12)	
Banking	-0.36* (0.15)	0.01 (0.20)	0.13 (0.20)	
Transports	-0.32† (0.18)	0.45* (0.23)	-0.35† (0.19)	
Private services	-0.12 (0.17)	0.70** (0.20)	0.15 (0.11)	
Public services	-0.29** (0.10)	-0.01 (0.14)	-0.16 (0.11)	
Missing	1.69** (0.00)	1.70** (0.18)	-0.82† (0.44)	

to be continued...

...table 6 continued

Hazard rate into:	Germany Unempl. coef. (s.e)	Germany Non-empl. coef. (s.e)	France Unempl. coef. (s.e)	France Non-empl. coef. (s.e)
Previous employment status (ref.: Non-employed)				
Unemployed	1.19** (0.00)	-0.42* (0.21)	1.29** (0.08)	-1.17** (0.22)
Missing	0.36** (0.00)			-0.86** (0.29)
Marital status (ref.: Not married)				
Married	-0.26† (0.14)	-0.50** (0.19)	-0.24** (0.06)	-0.51** (0.18)
Female * Married	0.28† (0.16)	1.35** (0.24)		1.03** (0.23)
Number of children				
Female* Children<6		0.69** (0.08)	0.33** (0.12)	0.98** (0.09)
Home ownership	-0.24† (0.13)		-0.25** (0.06)	
Age (ref.: Age 25-30)				
Age 31-35		-0.48† (0.27)		
Age 36-40		-0.63** (0.19)		
Age 41-45		-0.45* (0.14)		-0.20 (0.31)
Age 46-50		-0.28 (0.29)		-0.27 (0.30)
Age 51-55		0.69** (0.17)		1.56** (0.21)
Female * Age 31-35		0.37* (0.18)		
Female * Age 36-40		-0.11 (0.22)		
Female * Age 41-45		-0.29† (0.19)		-0.16 (0.16)
Female * Age 46-50		-0.38† (0.23)		-0.48 (0.33)
Female * Age 51-55		-1.32** (0.20)		-1.00** (0.33)
City cize (ref.: <20.000 inh.)				
20-100,000 inh.	-0.32* (0.14)	-0.03 (0.11)		
≥100,000 inh.	-0.26† (0.15)	-0.28* (0.11)		-0.19† (0.10)
Unemployment rate				
Unempl. rate/10	0.60** (0.27)		0.26** (0.10)	0.32* (0.15)
Current quarter (ref.: 1st quarter)				
2nd quarter		0.20† (0.12)	-0.82** (0.09)	-1.55** (0.14)
3rd quarter		0.15 (0.13)	-0.43** (0.08)	-1.01** (0.13)
4th quarter		-0.20 (0.14)	-0.26** (0.09)	-0.97** (0.15)
Month/10	0.15** (0.06)	0.11* (0.06)	-0.25** (0.06)	
Constant	-7.04** (0.44)	-6.19** (0.37)	2.98* (1.44)	3.88** (1.21)
Number of observations	136,948		490,848	
Number of spells	4,791		15,734	
Number of individuals	4,498		15,000	
Log-likelihood	-5,067.6		-9,145.5	

Significance level : † : 10% ∗ : 5% ∗∗ : 1%

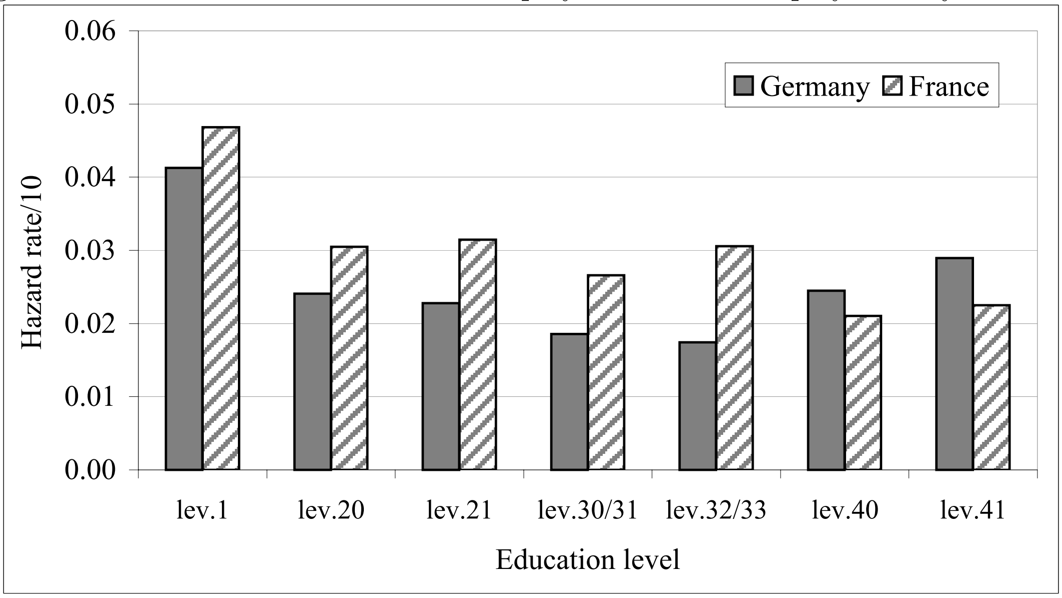
the needs of the economy, while upper tertiary education also includes subjects like philosophy or languages that are less demanded by the economy.

As appears from table 4, where the interactions between the female dummy and the education variables proved not to be significant, the impact of education on the risk of entering unemployment does not differ significantly for men and women.

6.2.2 Predicted hazard from employment into unemployment

Using the estimation results, it is possible to predict - taking the right-censoring issue into account - the hazard rate into unemployment of certain groups of individuals over the period observed. The predicted hazard rate is computed for people with average characteristics in their group. Therefore, it results from the estimated coefficients, on the one hand, but also from the characteristics of the groups.

Figure 8: Predicted hazard rate out of employment into unemployment by education

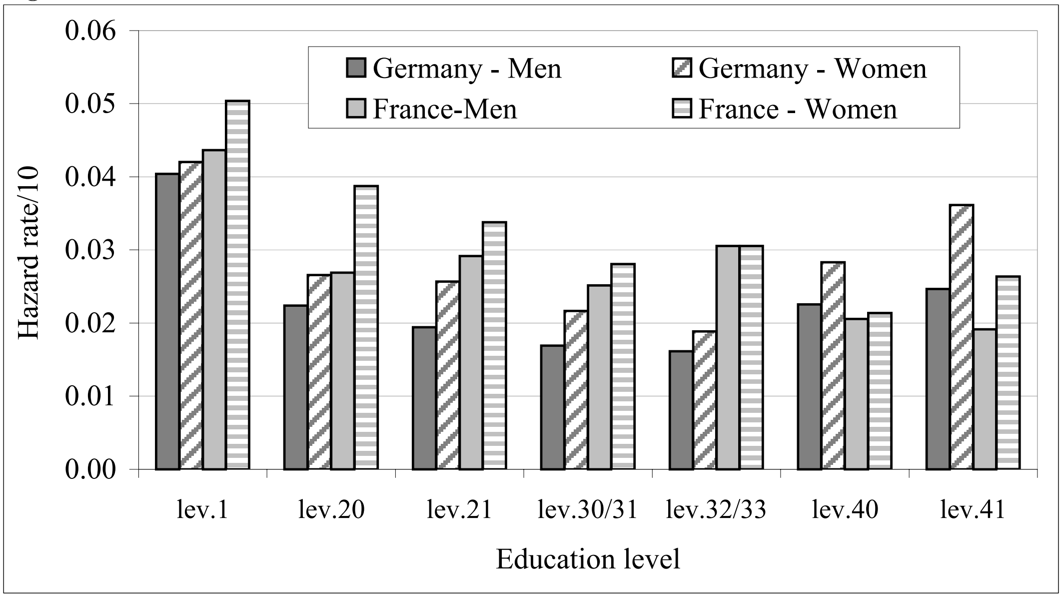


As can be seen in figure (8), the least qualified (level 1) have the highest risk of entering unemployment in both France and Germany. In Germany, individuals with an advanced vocational qualification (level 3) have the lowest unemployment risk, whereas in France, higher education graduates do so. Interestingly, the risk of entering unemployment is higher in France than in Germany at lower qualification levels, but is lower at higher education levels.

Looking into more detail (figure 9), it appears that in both countries, women face a higher risk of entering unemployment than men at all education levels[18]. In Germany, the gender gap is rather small at lower education levels, while it is highest among university graduates. In France, the gender gap is more pronounced in poorly qualified groups, while it is lowest for groups with intermediate qualifications, in particular for general maturity degree or lower tertiary degree holders (levels 32/33

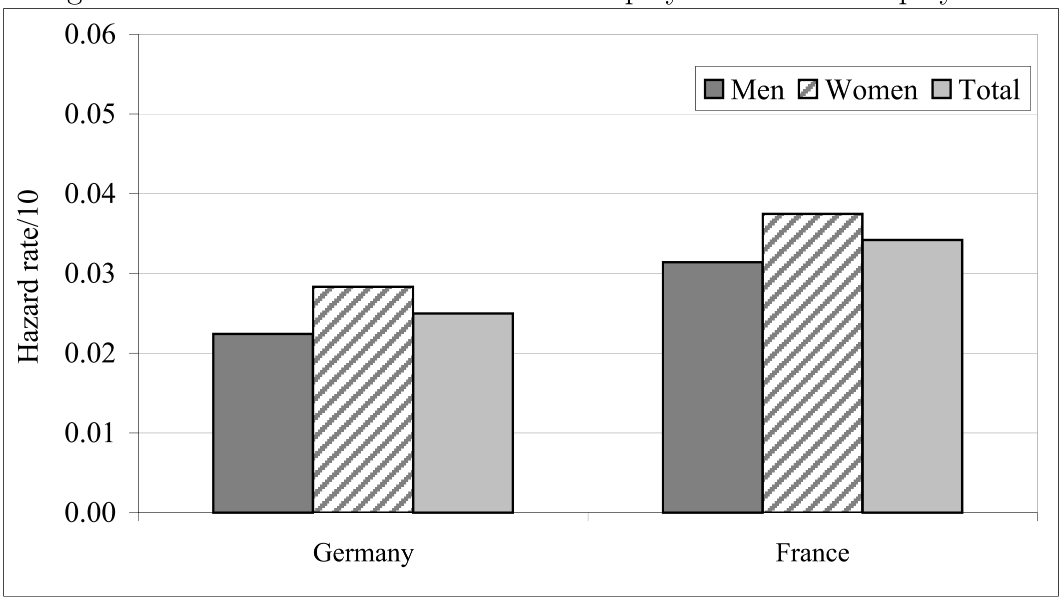
18 As mentioned above, the gender differences do not result from a different impact of education on the risk of entering unemployment, but rather from an different impact of gender as such on the one hand, and from different average characteristics across genders on the other hand.

Figure 9: Predicted hazard rate out of employment into unemployment by education and gender



and 40). The gender gap in favour of men, however, is rather large among French tertiary level graduates.

Figure 10: Predicted hazard rate out of employment into unemployment



On the whole, in both countries, the risk is higher for women than for men and the gender gap has the same order of magnitude (see figure 10). The overall risk of exiting employment for entering unemployment is higher in France than in Germany.

6.2.3 Effect of the other variables

In this section, the effect of the control variables is only briefly commented, since this is not the focus of the analysis. As appears from table 6, the employment characteristics affect significantly the risk of entering unemployment. Tenure seems to play a particularly important role for the unemployment risk: the longer tenure is, the lower the risk of entering unemployment. The effect of tenure seems to be more pronounced in France than in Germany *ceteris paribus*. Also firm size play a significant role, though not so clear-cut than tenure. For both countries, working in small firms (between 5 and 200 employees) seems to increase the probability of becoming unemployed compared to very small firms (with less than 5 employees) but also so compared to larger firms. The industry branch also plays a significant role, as well as the employment status occupied before the employment spell observed. Thus, in both countries, people who experienced unemployment before the current employment spell prove to be more likely to enter unemployment again.

Also the household composition matters. In Germany, being married reduces the unemployment risk for men, while it increases it for women. In France, being married reduces the unemployment risk for both men and women, but having children increases the unemployment risk for women only. In both France and Germany, being owner of the home one is living in reduces the unemployment risk.

Furthermore, the age of the individual proved to have no significant impact on the risk of entering unemployment, neither in France nor in Germany. City size has only in Germany a significant effect, the unemployment risk being higher in small towns there. Besides, in both countries, the higher the regional monthly unemployment rate is, the higher the personal risk of entering unemployment. Seasonal effects, as measured by the quarter of observation, can only be identified in France. In Germany, there is a increasing trend in unemployment risk over the period observed (1997-1999), while the trend is decreasing in France over the period.

7 Education and exit out of unemployment

7.1 Specification tests

Analogue to the approach followed in section 6.1, the first step consists in determining an adequate specification. Table 7 reports the results of χ^2-tests on the coefficients of the variables, with a view to determining the variables to be included in the equations (more details on the tests in section 6.1).

Here again, only the gender interactions significant at the 10 percent level at least have been kept in the finally retained specification. Then, on the basis of the equations including the significant interaction terms only, further tests on the variable coefficients have been run, and here again, only the significant ones at the 10 percent significance level at least have been retained. The variables included are allowed to differ for the equation of the hazard from unemployment into employment

Table 7: Tests on coefficients: χ^2 (p> χ^2)

	Germany		**France**	
Hazard rate into:	**Unempl.**	**Non-empl.**	**Unempl.**	**Non-empl.**
Tests on gender interactions				
Female * Education	5.75 (0.45)	8.34 (0.21)	9.22 (0.17)	10.01 (0.12)
Female * Duration	7.26 (0.40)	10.95 (0.14)	10.19 (0.25)	11.93 (0.15)
Female * Married	5.05 (0.02)	32.93 (0.00)	0.12 (0.73)	1.29 (0.26)
Female * Children<6	4.03 (0.04)	10.19 (0.00)	24.56 (0.00)	4.65 (0.03)
Female * Age	7.11 (0.21)	6.42 (0.27)	8.02 (0.15)	5.07 (0.28)
Female * City size	6.29 (0.04)	1.00 (0.60)	16.44 (0.00)	3.89 (0.15)
Female * Unempl. rate	0.53 (0.47)	1.47 (0.22)	14.74 (0.00)	4.51 (0.03)
Tests on specific coefficients (with only significant gender interactions)				
Education	51.83 (0.00)	13.07 (0.36)	13.30 (0.04)	6.44 (0.32)
Female	3.72 (0.05)	0.55 (0.46)	0.76 (0.38)	0.01 (0.92)
Duration	95.28 (0.00)	18.34 (0.02)	166.85 (0.00)	17.47 (0.03)
Previously employed	35.07 (0.00)	7.01 (0.01)	68.89 (0.00)	6.72 (0.01)
Married	8.78 (0.01)	0.17 (0.86)	3.41 (0.18)	2.37 (0.31)
Children<6	0.13 (0.72)	14.67 (0.00)	29.99 (0.00)	15.35 (0.00)
Owner	0.90 (0.34)	5.47 (0.02)	0.82 (0.37)	0.36 (0.55)
Age	54.66 (0.00)	17.71 (0.00)	48.21 (0.00)	16.20 (0.00)
City size	15.80 (0.00)	0.30 (0.86)	26.18 (0.00)	4.74 (0.09)
Unemployment rate	12.79 (0.00)	0.32 (0.57)	0.01 (0.99)	0.50 (0.60)
IRR	11.01 (0.00)	0.06 (0.81)	9.68 (0.00)	0.20 (0.65)
Current quarter	11.70 (0.01)	7.07 (0.07)	63.40 (0.00)	126.80 (0.00)
Quarter of spell begin	3.94 (0.27)	0.29 (0.96)	10.32 (0.02)	5.49 (0.14)
Year	19.54 (0.01)	35.05 (0.00)		
Month			141.80 (0.00)	57.61 (0.00)
Tests on overall significance (finally retained specification)				
Overall Wald test	641.7 (0.00)		1,231.5 (0.00)	
Eq. specific Wald tests	447.5 (0.00)	190.9 (0.00)	915.5 (0.00)	313.9 (0.00)

and for the equation of the hazard into non-employment. The overall Wald test and the equation specific Wald tests are run on the basis of the final equations in terms of the variables included and give a measure of the fit of the model.

Table 8 reports the results of further tests aiming at determining the appropriate functional form. First, for both countries, the multinomial logit specification seems to be appropriate since the IIA assumption is fulfilled for both countries on the basis of the Hausman test and on the basis of the Small Hsiao test (see details on these tests in section 4.2 and in section 6.1). Furthermore, the Wald tests reported in table 8 show that it is adequate to distinguish between exit into employment and exit into non-employment and that none of the outcome categories should be combined. Moreover, all three information criteria (see section 4.2) lead to the conclusion that the optimal number of mass points is two.

Table 8: Other specification tests

		Germany	France
Tests for IIA		χ^2 (p> χ^2)	χ^2 (p> χ^2)
Hausman	Omitted: empl.	17.16 (0.97)	22.67 (0.54)
	Omitted: non-empl.	2.44 (1.00)	-1.37 (-.–)
Small Hsiao	Omitted: empl.	43.58 (0.49)	32.84 (0.71)
	Omitted: non-empl.	48.96 (0.28)	33.00 (0.70)
Wald test for combining outcomes		χ^2 (p> χ^2)	χ^2 (p> χ^2)
Comb. empl. and non-empl.		352.42 (0.00)	392.64 (0.00)
Comb. empl. and unempl.		447.46 (0.00)	915.50 (0.00)
Comb. non-empl. and unempl.		190.92 (0.00)	313.88 (0.00)
Tests for number of mass points		*IC*	*IC*
IC_A	No mass point	-5,344.6	-7,668.6
	2 mass points	-5,331.1	-7,696.8
	3 mass points	-5,333.1	-7.698.8
IC_B	No mass point	-5,619.0	-7,926.1
	2 mass points	-5,613.1	-7,862.4
	3 mass points	-5,622.7	-7,872.5
IC_H	No mass point	-5,435.7	-7,752.3
	2 mass points	-5,424.6	-7,683.1
	3 mass points	-5,429.2	-7,687.7

7.2 Estimation results

The full estimation results for both countries are reported in table 9. This part of the analysis focusses on the reemployment probability, i.e. on the transition from unemployment to employment. The results corresponding to the second possible outcome (exit from unemployment into non-employment) are nevertheless reported in the table.

7.2.1 Effect of education

As the estimation results show (table 9), broadly speaking, the higher the education level is, the higher is the probability to exit unemployment and find a job again, everything else being equal. Judging from the magnitude of the coefficients, the education degree seems to have a stronger discriminating power in the chances of being reemployed in Germany than in France, all else equal.

In France and in Germany alike, tertiary level education is associated with the best reemployment prospects. In other words, even if advanced vocational qualifications offer a better protection than higher education against the risk of entering unemployment in Germany, as we have seen in section 6, once unemployed, they are not associated with a better reemployment probability. At the higher education level, there is only little difference between lower and upper tertiary education

Table 9: Determinants of hazard rate from unemployment

	Germany		**France**	
Hazard rate into:	**Empl.**	**Non-empl.**	**Empl.**	**Non-empl.**
	coef. (s.e)	**coef. (s.e)**	**coef. (s.e)**	**coef. (s.e)**
Education level (ref.: Level 1)				
Level 20	0.33**(0.11)		0.15† (0.09)	
Level 21	0.57**(0.12)		0.23**(0.11)	
Level 30 or 31	0.57**(0.14)		0.35**(0.15)	
Level 32 or 33	0.78**(0.17)		0.35**(0.16)	
Level 40	0.94**(0.19)		0.42**(0.15)	
Level 41	0.90**(0.17)		0.45**(0.16)	
Female	-0.23† (0.13)			
Duration (ref.: 1 month)				
2 months	0.08 (0.11)	-0.55† (0.30)	-0.06 (0.10)	-0.17 (0.48)
3 months	0.13 (0.12)	-0.35 (0.30)	0.14 (0.15)	0.71† (0.40)
4-6 months	-0.04 (0.11)	-0.18 (0.24)	0.03 (0.15)	1.07**(0.35)
7-9 months	-0.00 (0.13)	-0.07 (0.26)	-0.12 (0.16)	1.57**(0.36)
10-12 months	-0.11 (0.15)	0.26 (0.27)	-0.13 (0.17)	1.41**(0.37)
13-15 months	-0.11 (0.18)	0.80**(0.28)	-0.29† (0.18)	0.61 (0.52)
16-18 months	-0.47* (0.22)	0.01 (0.41)	-0.27† (0.17)	1.53**(0.44)
$\geq$19 months	-0.51**(0.17)	0.04 (0.28)	-0.35* (0.17)	0.61 (0.56)
Previously employed	0.52**(0.10)	-0.40**(0.15)	0.74**(0.11)	-0.41* (0.21)
Marital status (ref.: Not married)				
Married	0.27**(0.10)			
Female * Married	-0.31* (0.14)	0.85**(0.16)		
Number of children				
Children<6		-1.08**(0.42)	0.30**(0.07)	-0.80 (0.65)
Female* Children<6	-0.22* (0.11)	1.39**(0.44)	-0.54**(0.12)	1.37* (0.67)
Home ownership		0.35* (0.15)		
Age (ref.: Age 25-30)				
Age 31-35	0.03 (0.09)	-0.29† (0.18)	-0.26**(0.11)	-0.32 (0.23)
Age 36-40	-0.10 (0.11)	-0.64**(0.24)	-0.25* (0.13)	-0.84**(0.29)
Age 41-45	-0.09 (0.12)	-0.38† (0.24)	-0.50**(0.14)	-1.48**(0.38)
Age 46-50	-0.57**(0.14)	-0.85**(0.30)	-0.42**(0.15)	-0.17 (0.27)
Age 51-55	-0.92**(0.16)	-0.89**(0.27)	-1.00**(0.15)	-0.81* (0.33)
City cize (ref.: <20.000 inh.)				
20-100,000 inh.	-0.32**(0.12)		-0.04 (0.12)	-0.57* (0.29)
$\geq$100,000 inh.	-0.35**(0.11)		-0.37**(0.09)	-0.36† (0.19)
Female * 20-100,000 inh.	0.28† (0.17)		-0.36† (0.20)	
Female * $\geq$100,000 inh.	0.30† (0.16)		0.31**(0.13)	

to be continued...

...table 9 continued

Hazard rate into:	Germany Empl. coef. (s.e)	Germany Non-empl. coef. (s.e)	France Empl. coef. (s.e)	France Non-empl. coef. (s.e)
Unemployment rate				
Unempl. rate/10	-0.62** (0.19)			
Female * Unempl. rate/10			-0.27** (0.09)	0.30* (0.14)
IRR	-1.39** (0.58)		-1.46** (0.52)	
Current quarter (ref.: 1st quarter)				
2nd quarter	-0.18* (0.09)	-0.35† (0.20)	-0.51** (0.08)	-3.04** (0.44)
3rd quarter	-0.07 (0.09)	-0.21 (0.19)	-0.39** (0.07)	-2.42** (0.32)
4th quarter	-0.25** (0.09)	0.07 (0.18)	-0.40** (0.07)	-1.81** (0.25)
Quarter of spell begin (ref.: 1st quarter)				
2nd quarter			-0.22** (0.09)	
3rd quarter			-0.05 (0.08)	
4th quarter			-0.14† (0.08)	
Time trend (ref. G: 1991)				
1992	-0.07 (0.22)	1.18* (0.55)		
1993	-0.42* (0.22)	0.61 (0.56)		
1994	-0.34 (0.22)	0.19 (0.57)		
1995	-0.14 (0.22)	0.92† (0.55)		
1996	-0.29 (0.23)	0.21 (0.56)		
1997	-0.15 (0.23)	-0.11 (0.57)		
1998	0.04 (0.23)	0.76 (0.55)		
1999	-0.18 (0.24)	0.16 (0.58)		
Month			-0.22** (0.04)	-0.82** (0.22)
Month squared/10			0.15** (0.02)	0.49** (0.11)
Month cubed/100			-0.03** (0.00)	-0.09** (0.02)
Constant	-2.31** (0.50)	-4.54** (0.58)	-1.09* (0.47)	-0.61 (1.39)
Mass points				
ε_1	1.21** (0.14)		1.73** (0.10)	
ε_2	-0.52		-0.58	
$Pr(\varepsilon_1)$	0.30** (0.08)		0.25** (0.04)	
$Pr(\varepsilon_2)$	0.71		0.75	
Number of observations	15,089		23,112	
Number of spells	1,827		3,380	
Number of individuals	1,198		2,157	
Log-likelihood	-5,257.1		-7,530.8	

Significance level : † : 10% * : 5% ** : 1%

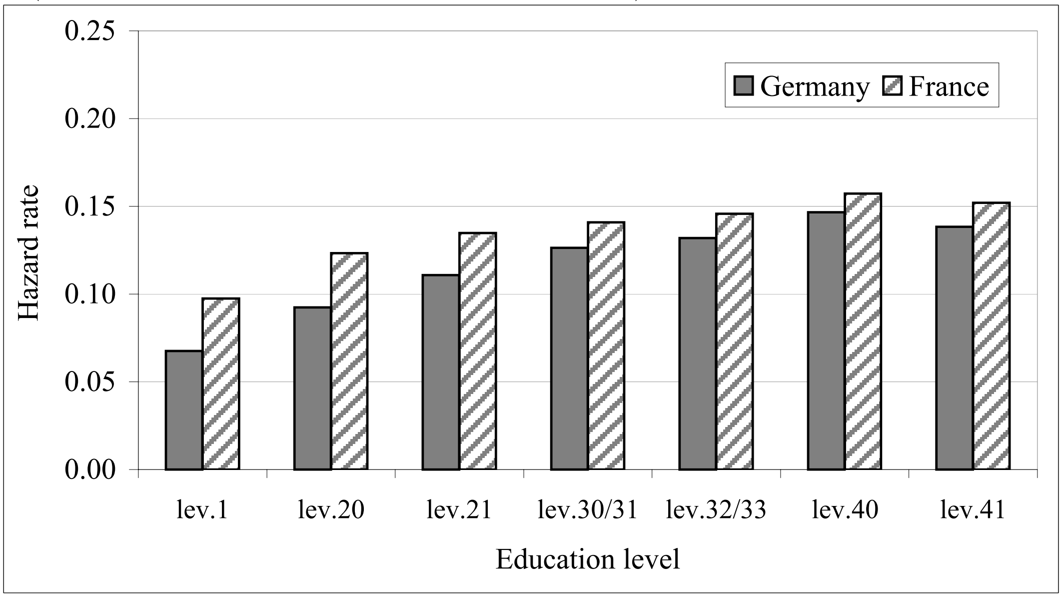
in terms of reemployment probability after an episode of unemployment, all else constant.

Like for entry into unemployment, the education level is not found to exert a different impact for men and women on the exit out of unemployment into employment.

7.2.2 Predicted hazard from unemployment into employment

The hazard rate out of unemployment and into employment can be predicted for subgroups of individuals on the basis of the estimated coefficients and of group-specific characteristics means, taking right-censoring into account. One hazard rate is computed for each of the identified heterogeneity groups and the overall hazard rate is calculated as the sum of the heterogeneity group specific hazard rates, weighted by the estimated probabilities of belonging to the respective heterogeneity group. Because the period of observation is longer in the German sample, due to an otherwise insufficient number of observations (see section 5.1), the hazard rates for the German sample are computed for a maximum unemployment duration of 36 months, like for the French sample.

Figure 11: Predicted hazard rate out of unemployment into employment by education (over a max. of 36 months of unemployment)



As can be seen from figure 11, at all education levels, the hazard of exiting unemployment for employment is higher in France than in Germany. The gap between France and Germany, however, seems somewhat more pronounced at lower qualification levels (until education level 2).

On the whole (see figure 12), once unemployed, the reemployment probability is higher in France than in Germany. This is particularly true for men. In both countries, the reemployment prospects of unemployed men are better than those of unemployed women, but the gender gap is significantly stronger in France.

Looking at gender differences by education level (figure 13), it appears that at all education levels and in both countries, men have significantly higher chances

Figure 12: Predicted hazard rate out of unemployment into employment (over a max. of 36 months of unemployment)

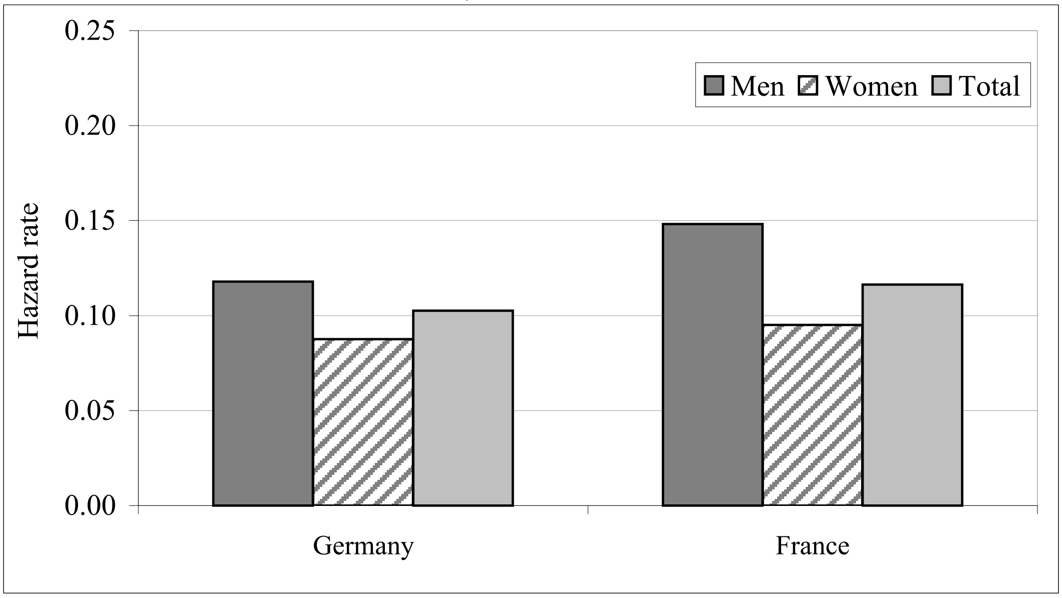
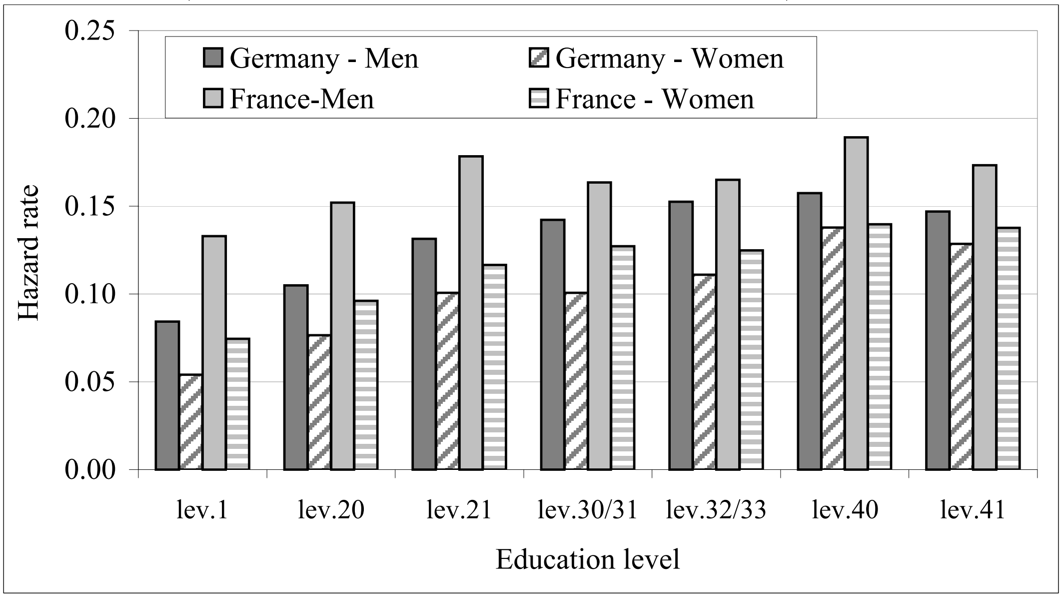


Figure 13: Predicted hazard rate out of unemployment into employment by education and gender(over a max. of 36 months of unemployment)



of being reemployed than women after an episode of unemployment. The gender gap in favour of men is far more marked in France at lower qualification levels (no or basic vocational degree, level 1 and 2), rather similar for both countries at the intermediate education level (level 3), but again more pronounced in France among tertiary level graduates (level 4).

7.2.3 Effect of the other variables

The effect of the other variables can be read from table 9. As mentioned previously, the optimal number of mass points amounts to two for both countries. This means that the French and the German samples can be divided into two heterogeneity groups respectively. The first group has, for some unobserved reason, an above average probability of exiting unemployment (positive mass point), while the second group has a slightly below average propensity to leave unemployment. In both countries, the probability of belonging to the former group is significantly lower than that of belonging to the latter group.

In both countries, the reemployment rate seems to decline with unemployment duration, i.e. there is a negative duration dependence, even if unobserved individual heterogeneity is controlled for. However, this negative impact of unemployment duration only turns significant for unemployment periods longer than 15 months in Germany and longer than 12 months for France, so, broadly speaking, for the long-term unemployed.

In France and in Germany alike, individuals who were employed immediately before their current episode of unemployment prove to have a higher probability of reemployment compared to those who inactive before their current unemployment spell.

The composition of the household matters also for exit from unemployment. In Germany, being married is associated with higher chances of finding employment again, while it reduces the reemployment prospects of women. Having young children further reduces the probability of exiting unemployment for employment for Germany women. In France, the marital status does not have a significant impact as such on the reemployment probability of men and women, but the presence of young children does: it increases the reemployment probability of men, whereas it reduces that of women. Being the owner of the apartment or house one is living in proves to exert no significant impact.

Though the age has been found not to affect significantly the risk of entering unemployment, it does play a role for the reemployment probability of unemployment individuals. Broadly speaking, the older unemployed have lower chances of getting employed again. In Germany, this effect is only significant for unemployed aged above 45, who have a significant lower probability of finding a job again than the reference group of people aged between 25 and 30. This reemployment rate is particularly low among the age group 51-55, everything else being constant. In the French sample, all the age dummies prove negative and significant in statistical terms. Unemployed individuals aged between 31 and 40 have a significantly lower reemployment probability than the age group 25-30, but a higher one than individuals older than 40. Like for Germany, the age group 51-55 also faces the lowest reemployment probability in France.

The effect of city size is significant and differs across genders in both countries: living in a large city is associated with a lower reemployment probability for men, but a higher one for women. The higher the unemployment in the region is, the lower the chances of exiting unemployment. In France, this effect only concerns women. As expected, the Income Replacement Ratio (IRR) such as approximated here (see definition discussion in section 5.2) proves to have a significant negative effect on the reemployment probability in both countries. Finally, the estimation results reported in table 9 point to some seasonal effects as well as time trend.

8 Conclusion

This paper analyses the relationship between educational attainment and unemployment risk for two countries, France and Germany, which are plagued with high unemployment rates. Thus, the objective is to compare the extent to which various educational outcomes offer a protection against the unemployment risk. A look at the literature reveals that the empirical evidence on this topic is extremely scarce - particularly for France and Germany - and do not lead to conclusive results as to the empirical link between education and unemployment. The econometric analysis conducted in this paper aims at filling this gap in research. The starting point of the analysis is a broad comparison of the structure of unemployment on the basis of comparable microdata sets, the *Emploi* survey for France and the GSOEP for Germany. The unemployment rate proves to be higher in France than in Germany at all education levels, but particularly for basic vocational and intermediate qualifications. In both France and Germany, women face a higher unemployment rate than men, but the gender unemployment gap is far more pronounced in France.

The econometric analysis focusses on the risk for the employed to enter unemployment, on the one hand, and on the risk for the unemployed not to get reemployed, on the other hand. The impact of educational attainment on both components is examined. The methodological framework applied for this analysis is a discrete time competing risks hazard rate model which makes use of the panel structure of the GSOEP and the *Emploi* data sets and of the availability of retrospective monthly data on the employment history available in both data sets.

The estimations lead to the following results. Broadly speaking, the higher the education level is, the lower the risk of entering unemployment is and the better are the reemployment prospects once unemployed. However, this does not apply at all levels and in the same way for both countries. In both countries, individuals with a poor level of education face, *ceteris paribus*, the highest risk of losing their job and entering unemployment, but also the poorest reemployment prospects when unemployed. In Germany, however, the best protection against the risk of entering unemployment is given, all else equal, by vocational qualifications of intermediate levels, whereas university graduates face a higher unemployment risk. Once unemployed, however, German university graduates have better chances of getting reemployed than graduates of intermediate vocational qualifications. In France, tertiary level education offers, like in Germany, the best protection against the risk of not exiting unemployment, but also against the risk of entering unemployment. As a result, the risk of entering unemployment is higher in France than in Germany at lower qualification levels, but lower at higher education levels. The reemployment prospects of the unemployed are better in France than in Germany at all education levels, but particularly at lower qualification levels.

The impact of education on both the risk of entering and the risk of not leaving unemployment turns out not to differ significantly for men and women, all else equal. Thus, it seems that the educational degrees of men and women are valued in the same way by the labour market in terms of unemployment risk. However, because men and women have different characteristics, both within and between educational groups, and because the effect of other variables varies across genders, the unemployment risk does differ across genders. In France and in Germany alike, women face at all education levels both a higher risk of entering unemployment and a higher risk of not finding reemployment than men when unemployed, though the magnitude of the gender gap varies across education levels.

On the whole, the risk of entering unemployment is higher in France than in Germany, but once unemployed, the risk of not finding reemployment is higher in Germany. In both countries, women face a higher unemployment risk than men, through the joined effect of a higher risk of entering unemployment and a higher risk of not finding reemployment once unemployed. The gender gap has the same order of magnitude for both countries as far as the risk of entering unemployment is concerned, but French unemployed women seem to have a greater comparative disadvantage in finding a new job than their German counterparts, so that the gender gap is higher in France regarding reemployment prospects.

To conclude this paper, the results seem to indicate that the unemployment problem in Germany lies to a greater extent than in France in a comparatively high persistence of unemployment, while the French unemployment problem rather lies in a greater lack of job security compared to Germany, particulary at lower qualification levels. Furthermore, the results point to a comparatively better performance of the German system of vocational education in ensuring job stability, while the French system of higher education offers a better relative protection against the risk of entering unemployment. This might be one the reasons why people strive more for access to higher education in France, while a larger proportion of German people aims at completing vocational qualification.

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Appendix

Figure 14: Unemployment rate by education for men - Germany

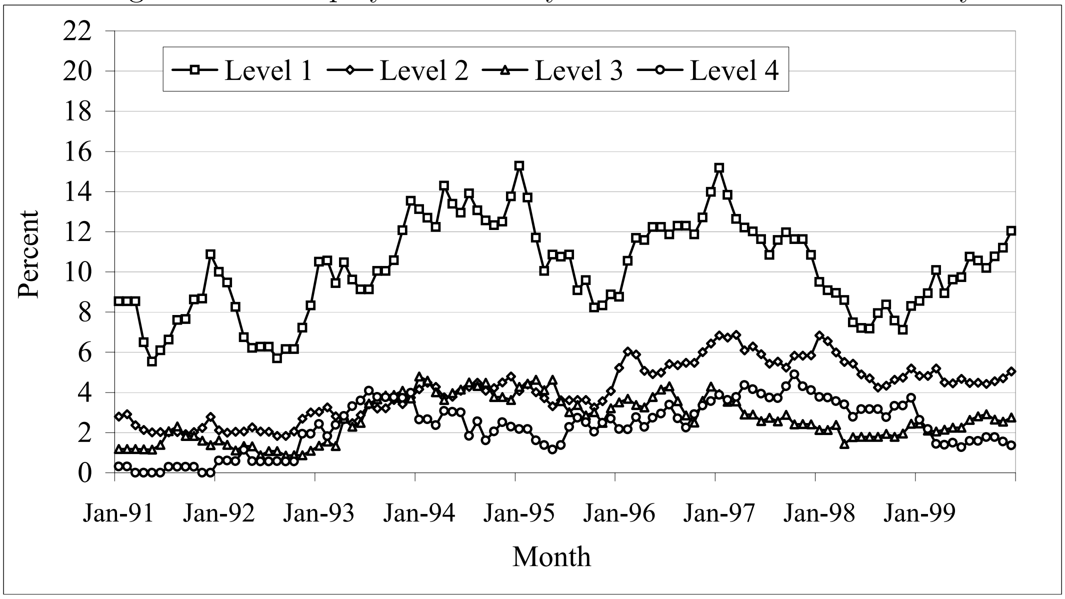

Figure 15: Unemployment rate by education for women - Germany

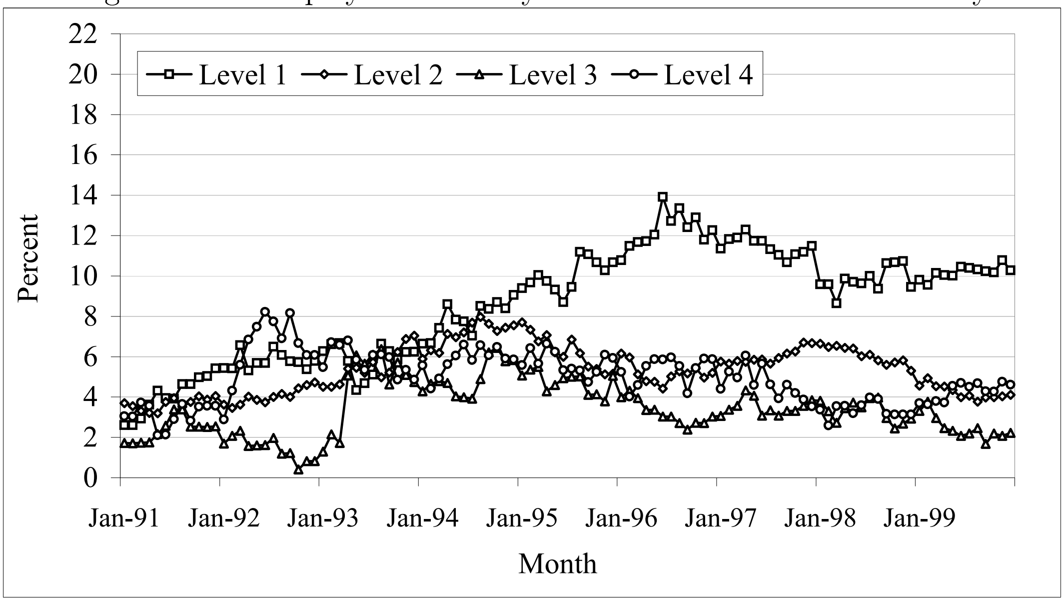

Figure 16: Unemployment rate by education for men - France

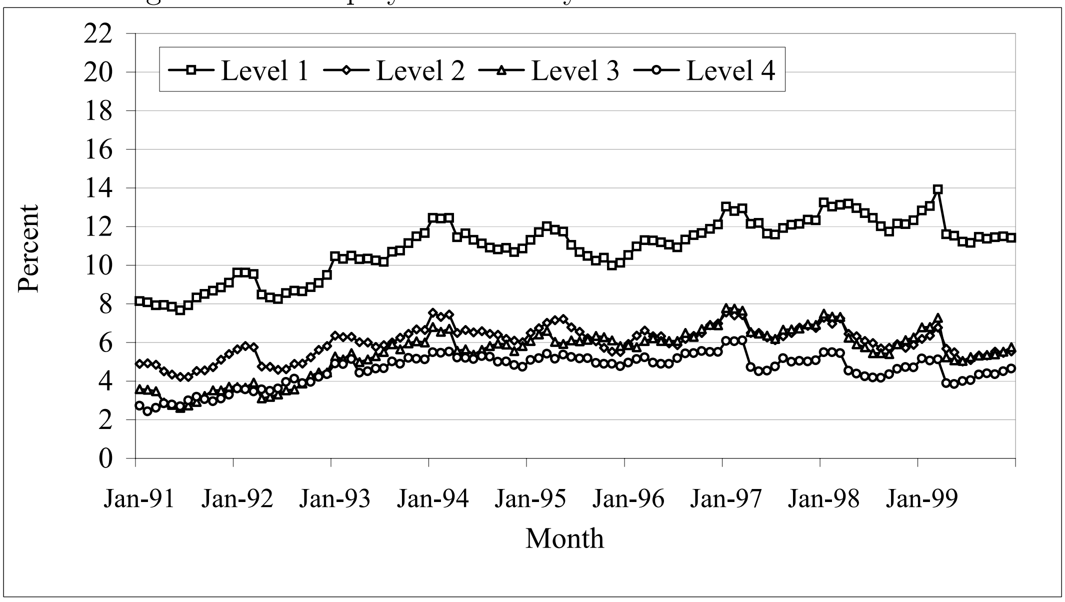

Figure 17: Unemployment rate by education for women - France

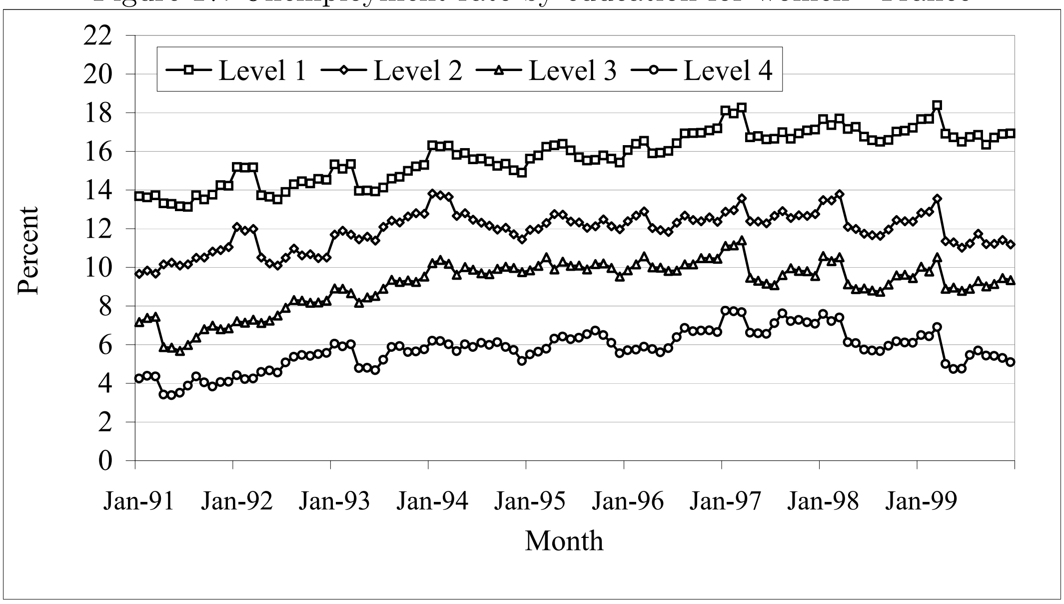

Table 10: Regression results: wage equation

Variable	Germany coef.	Germany (s.e)	France coef.	France (s.e)
Education level (ref.: Level 10)				
Level 12	0.26**	(0.02)	0.27**	(0.01)
Level 20	0.18**	(0.01)	0.18**	(0.00)
Level 21	0.24**	(0.01)	0.31**	(0.00)
Level 30	0.40**	(0.01)	0.42**	(0.01)
Level 31	0.32**	(0.02)	0.41**	(0.01)
Level 32	-0.16**	(0.02)	0.46**	(0.01)
Level 33	0.32**	(0.01)	0.41**	(0.01)
Level 40	0.53**	(0.01)	0.61**	(0.00)
Level 41	0.63**	(0.01)	0.77**	(0.00)
Female	-0.56**	(0.00)	-0.40**	(0.00)
Age				
Age/10	0.23**	(0.03)	0.58**	(0.01)
Age squared/100	0.02**	(0.00)	0.05**	(0.01)
Children<6	-0.02**	(0.01)	0.04**	(0.00)
City cize (ref.: <20.000 inh.)				
20-100,000 inh.	0.05**	(0.01)	0.04**	(0.00)
≥100,000 inh.	0.10**	(0.01)	0.05**	(0.00)
Regional dummies	Yes		Yes	
Year dummies	Yes		Yes	
Constant	6.98**	(0.06)	7.68**	(0.03)
Observations	53,486		151,839	
R^2	0.32		0.33	

Significance level : † : 10% ∗ : 5% ∗∗ : 1%

Table 11: Regression results: unemployment compensation equation

	Germany		France	
Variable	**coef.**	**(s.e)**	**coef.**	**(s.e)**
Education level (ref.: Level 10)				
female	-0.38**	(0.01)	-0.18**	(0.01)
Level 12	0.12**	(0.02)	0.13**	(0.02)
Level 20	0.06**	(0.01)	0.09**	(0.02)
Level 21	0.16**	(0.01)	0.17**	(0.02)
Level 30	0.18**	(0.02)	0.29**	(0.06)
Level 31	0.26**	(0.02)	0.20**	(0.03)
Level 32	0.01	(0.05)	0.26**	(0.03)
Level 33	-0.04	(0.02)	0.28**	(0.06)
Level 40	0.27**	(0.02)	0.29**	(0.02)
Level 41	0.21**	(0.02)	0.45**	(0.03)
Female	-0.38**	(0.01)	-0.18**	(0.01)
Age				
Age/10	0.27**	(0.05)	0.21**	(0.06)
Age squared/100	0.03**	(0.01)	0.04**	(0.01)
Children<6	-0.02**	(0.01)	0.06**	(0.01)
City cize (ref.: <20.000 inh.)				
20-100,000 inh.	0.02†	(0.01)	-0.02	(0.02)
≥100,000 inh.	0.04**	(0.01)	0.01	(0.01)
Unemployment duration (ref.: G:<12 months, F:1 month)				
2 months			0.17**	(0.02)
3-5 months			0.34**	(0.02)
6-11 months			0.33**	(0.02)
12-17 months	0.00	(0.01)	0.28**	(0.02)
18-23 months	-0.07**	(0.02)	0.18**	(0.03)
24-35 months	-0.20**	(0.02)	0.12**	(0.02)
≥36 months	-0.44**	(0.02)	-0.10**	(0.02)
Regional dummies	Yes		Yes	
Year dummies	Yes		Yes	
Constant	6.46**	(0.09)	8.24**	(0.12)
Observations	11,083		11,604	
R^2	0.25		0.15	

Significance level : † : 10% ∗ : 5% ∗∗ : 1%

Table 12: Descriptive statistics (estimation samples, %)

Spells of:		Employment		Unemployment	
		Germany	France	Germany	France
Education level	Level 1	11.1	30.6	25.4	45.8
	Level 20	27.9	21.8	32.8	19.5
	Level 21	18.0	12.1	15.0	10.3
	Level 30 or 31	16.1	6.7	9.3	4.9
	Level 32 or 33	8.0	6.2	4.6	6.8
	Level 40	6.6	11.9	3.4	7.3
	Level 41	12.4	10.6	9.5	5.4
Sex	Male	56.8	54.1	49.4	40.2
	Female	43.2	45.9	50.6	59.8
Duration	1 month			11.9	14.6
	2 months			10.0	11.7
	3 months			8.5	9.8
	4-6 months			18.8	21.1
	7-9 months			13.0	14.2
	10-12 months			9.2	10.3
	13-15 months			6.2	6.2
	16-18 months			4.5	4.3
	≥19 months			18.1	7.7
Tenure	<1 year	8.1	1.4		
	1-1.5 years	6.1	3.7		
	1.5-2 years	5.5	3.5		
	2-3 years	8.7	7.8		
	3-4 years	6.2	4.4		
	4-7 years	16.3	11.5		
	7-10 years	14.4	12.1		
	10-15 years	12.5	13.3		
	≥15 years	22.0	38.9		
	Missing	0.3	0.0		
Firm size	<5 employees	13.4	29.1		
	5-19 employees	16.2	10.0		
	20-199 employees	25.2	14.0		
	200-1999 employees	21.2	19.9		
	≥2000 employees	23.8	22.7		
	Missing	0.9	4.3		

to be continued...

...table 12 continued

	Spells of:	Employment		Unemployment	
		Germany	**France**	**Germany**	**France**
Industry branch	Industry	31.6	17.6		
	Agriculture, energy	3.0	8.2		
	Construction	5.7	5.8		
	Trade	12.7	11.9		
	Banking	9.0	4.3		
	Transports	5.4	4.4		
	Private services	3.4	16.3		
	Public services	27.9	31.3		
	Missing	1.10	0.2		
Previous empl. status	Employed			77.0	82.8
	Unemployed	4.6	5.2		
	Non-employed	6.2	1.7	23.0	17.2
	Left-censored	89.2	93.1		
Marital status	Married	69.6	68.9	54.3	49.3
	Not married	30.4	31.1	45.7	51.7
Children<6	0 child	81.4	82.6	79.7	81.5
	1 child	13.9	13.7	14.7	15.3
	2 child	4.4	3.5	5.0	2.9
	3 child	0.3	0.2	0.5	0.3
	4 child	0.0	0.0	0.1	0.0
Home ownership	Owner	48.7	70.0	25.9	47.5
	Not owner	51.3	30.0	74.1	52.5
Age	Age 25-30	19.0	11.3	27.7	22.0
	Age 31-35	21.1	14.4	21.2	19.1
	Age 36-40	19.2	18.0	16.2	16.8
	Age 41-45	16.4	20.1	11.8	16.4
	Age 46-50	14.4	20.5	11.2	12.8
	Age 51-55	9.9	15.7	11.9	12.9
City size	<20.000 inh.	43.6	49.8	41.8	0.44
	20-100,000 inh.	27.6	11.9	24.5	14.8
	≥100,000 inh.	28.8	38.2	33.7	41.0
*Unemployment rate**		9.3	11.7	9.1	12.6
		(2.1)	(3.0)	(2.4)	(3.3)
*IRR**				33.9	44.8
				(7.2)	(9.5)
Current quarter	1st quarter	21.7	27.8	24.6	30.3
	2nd quarter	26.3	24.4	23.4	20.0
	3rd quarter	26.2	24.1	25.0	22.9
	4th quarter	25.8	23.7	26.6	26.9

to be continued...

...table 12 continued

Spells of:		**Employment**		**Unemployment**	
		Germany	**France**	**Germany**	**France**
Quarter of spell begin	1st quarter			21.4	18.9
	2nd quarter			12.4	33.0
	3rd quarter			14.4	24.3
	4th quarter			51.7	23.9
Year	1991			2.2	
	1992			5.3	
	1993			9.5	
	1994			12.7	
	1995			12.8	
	1996	11.7		14.5	
	1997	11.5		16.2	11.0
	1998	12.9	40.5	14.1	33.4
	1999	12.5	47.7	12.7	43.2
	2000		11.8		12.0

*For metric variables, the figure in parentheses refers to the standard error.