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Temporary Layoffs and the Duration of Unemployment:
An Empirical Analysis

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Abstract

The results reported in this article show that at least 40 % of all unemployment spells in Denmark are due to temporary layoffs. The duration of unemployment is analysed taking into account the distinction between temporary and permanent layoffs. The importance of this distinction is investigated by comparing the results from a single risk model with the results from a competing risks model. The results show that there are several important differences between the recall hazard rate and the new job hazard rate with respect to both duration dependence and explanatory variables.

1. Introduction

It has been recognized for a long time that many of the workers who are laid off in the U.S. and Canada return to their previous employers after their spell of unemployment. These temporary layoffs constitute a large proportion of all unemployment, and they have given rise to a huge amount of both theoretical and empirical research. However, in a European context temporary layoffs have not received much attention, presumably because there seems to be a common belief that this phenomenon is much less common in European labour markets. This view has for instance been brought forward by FitzRoy and Hart (1985), who also question the conventional wisdom that the reason behind this is a more widespread use of short-time working.

The distinction between temporary and permanent layoffs will be important when analysing the duration of unemployment, since the type of spell may be expected to have considerable impact on the behaviour on both the supply side and the demand side of the labour market. In the vast majority of studies of unemployment durations that have emerged during the past 10 years the distinction has nevertheless been ignored, but recently a few studies have noted the importance; see Ham and Rea (1987), Han and Hausman (1990) and Katz and Meyer (1988)[1].

The purpose of this article is twofold: firstly, it is pointed out that in Denmark a very large fraction of all unemployment spells are due to temporary layoffs, and secondly, the duration of unemployment is analysed taking into account the fact that an unemployment spell may end by one of several different causes. The latter is done through specification and estimation of competing risks models with cause specific hazard rates. The results from this model are compared with the results from an econometric duration model ignoring the distinction, i.e. a single risk model.

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1. Edin (1989) also analyses different exits out of unemployment, but he distinguishes between transitions to regular employment, to public labour market programs, and out of the labour force.

The seminal work of Feldstein (1976) gives the theoretical background for the existence of temporary layoffs. When considering the duration of unemployment, search theory is relevant, and a number of contributions have analysed the possibility of recall to the previous job and its consequences on the duration of unemployment; see for instance Burdett and Mortensen (1980), Pissarides (1982), White (1983), and Katz (1986). The duration of a temporary layoff is determined mainly through the probability of recall and the firm may influence this by choosing the optimal point in time to recall workers; see Haltiwanger (1984) and Pissarides (1982). The optimal job-searching strategy for workers on layoff clearly depends on the probability of recall, and this probability will typically influence both the reservation wage and the search intensity for a new job. Workers may or may not search for a new job while on temporary layoff depending on the level of the recall probability, and they may also change their search activity during the layoff. If the recall probability changes over time (or the worker is uncertain about the likelihood of recall) that will also lead to changes in the probability of finding and accepting a new job. A realistic situation may be that the longer a worker is unemployed without recall, the lower he will perceive the recall probability to be. Katz (1986) discusses this case and shows that it leads to an increasing (over time) search intensity for a new job and a declining reservation wage, which together gives a transition rate into a new job with positive duration dependence (at the same time as the recall transition rate has negative duration dependence, although this is rather mechanically or exogenously determined). The main thing to notice from this discussion of theoretical contributions is that there are reasons to expect that the mechanisms behind reemployment in the previous job and in a new job are quite different. Explanatory factors may hence influence the transition rates in different ways, and the duration dependence of the two transition rates may also be different.

The article is organized as follows. It starts with a brief description of the data and of how the spells of temporary and permanent layoffs are constructed. Then the magnitude of temporary layoffs are presented. Section 3 contains the analysis of the unemployment durations. Firstly, various methodological issues are discussed and the specification of the econometric model is described. Secondly, the estimation results from the analysis of the unemployment durations are presented and discussed. Finally, some concluding remarks are given in section 4.

2. Data and the amount of temporary layoffs

The data used in this study are drawn from a large Danish longitudinal data set. The complete data set consists of a random sample of approximately 240,000 adults (approximately 5% of the Danish adult population) with information taken from a number of Danish administrative registers[2]. The data set contains information on a large number of demographic, educational, and labour market variables as well as information on income and wealth for the years 1976-1985.

However, the data set only contains detailed information on unemployment from the beginning of 1979, since this type of information has only been centrally registered since then. The data on employment drawn from the supplementary pension scheme (ATP) cover the years up till 1984 included. As a consequence, spells of employment and unemployment can only be constructed for the years 1979-1984.

The results reported here are all based on a subsample of the complete data set selected by random sampling of approximately 11,000 persons. This section will first give a brief description of the variables of the data set which are used in the subsequent duration analysis. Next, it will be described how unemployment spells are constructed on the basis of the data from the unemployment register and how the data from the supplementary pension scheme may be employed to classify these spells into temporary and permanent layoff spells. Finally, a descriptive analysis of the unemployment spells is given presenting some measures of the amount of temporary layoffs as well as a sensitivity analysis of these measures.

The variables of the data set comprise a number of demographic variables. AGE and MARRIED are self explanatory. The indicator variable PROVINCE takes on the value of 1 when the person lives outside the Copenhagen metropolitan area. The variable CHILD 0-6 indicates the presence of children in the pre-school age. The variable SICK is an indicator variable taking the value 1 when the person has received sickness benefits during the year. As a general rule sickness benefits are received if a person has a spell of illness for more than 13 weeks. The only educational variable included is the indicator variable APPRENTICE, which takes on the value 1 when the person has had an apprenticeship.

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2. A detailed description of a former version of the data set is given by Westergård-Nielsen (1984).

The labour market variables are partly indicator variables giving the unemployment insurance fund (which is overlapping with trade union) and the industry of the worker, and partly measurement variables. The unemployment insurance fund variables are SID, KAD, METAL, HK, CONSTR, ACADEMIC, and OTHER. The industry variables are quite comprehensive and will often be grouped together in the empirical analysis. The names of the variables will be self explanatory. PART TIME takes on the value of 1 when the person is part time insured. Most often that covers a part time worker. The variable EXPERIENCE measures the accumulated work experience since entry to the labour market as a wage earner. The variable REPLACEM is the replacement ratio between the unemployment benefits and the wage. WEALTH measures the net taxable wealth of the person and may thus be either negative or positive.

In addition to these variables the data set also contains information on unemployment for all individuals who are members of an insurance fund (and a few others who experience unemployment and receive social benefits). This information comes from the unemployment register and gives for each week the fraction of the week for which unemployment benefits are paid. Information on employment is given for all persons who are wage earners and it comes from the register for the supplementary labour market pension (ATP). It basically consists of the number of hours worked (although approximated by a stepwise linear function) at a given employer within a specified period.

The main purpose of the unemployment register is administrative, as it is used for disbursing unemployment benefits. As a consequence the quality of the data is considered to be high. For analytical purposes it is, however, necessary to convert the fractions of weeks into genuine spells of unemployment. Several problems arise in constructing such spells due to the administrative rules and practices that have been used when recording the data. These problems have been overcome by applying certain definitions to the data and by constructing a simulation algorithm, which is used to simulate the administrative rules that infer with the data registration process (mainly the rules of the Danish vacation act). The result of removing the spurious effects of the vacation act is that the average duration of unemployment spells increases while the number of spells decreases. These constructed unemployment spells correspond closer to the theoretical definition of unemployment[3].

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3. A further description of these data issues is given by Jensen and Westergård-Nielsen (1990).

The next step is to identify those unemployment spells that end in reemployment with the same employer[4]. Again, certain definitions have to be made. Since there will always be an element of judgement, it has been chosen to apply a relatively restrictive strategy, which rather identifies too few spells as temporary, than the opposite. As a consequence only unemployment spells directly following an employment spell can be considered as temporary layoff. If the same employer is registered as having paid contributions to the supplementary pension scheme immediately before and immediately after the unemployment spell, the spell will be characterized as temporary layoff. There are, however, a few caveats in the classification procedure which leads to a downward bias in the estimate of the number of temporary layoffs.

Another type of unemployment related to temporary layoff will not be identified by the classification algorithm used here. That is the unemployment that is created when a person regularly has periodic employment with a few different employers within the same industry interleaving with short term unemployment. With the work force "rotating" between employers in this way, the method described above will not characterize the interleaving unemployment spells as temporary layoffs. Nielsen (1987) found that in certain industries it is very common with many periodic jobs. The Danish construction industry is characterized by many small firms within the same sector and it is very common with the described "rotation" of workers, hence we may expect an extra downward bias in the estimate of the amount of temporary layoffs. The same argument applies to the hotel and restaurant sector.

For the analysed sample, it is found that 40% of all unemployment spells are due to temporary layoff. Because these spells are generally shorter than permanent layoff spells this amounts only to 16% of the total unemployment. However, the whole technique makes this a very conservative assessment. Another Danish source using a different data set and also including short-time working suggests that 20% of the total unemployment is due to temporary layoffs in a more broad sense[5]. Our results do not show any significant cyclical variation in the amount of temporary layoffs over the investigated six-year period.

The method used above classifies all unemployment spells where the worker returns to the previous employer as temporary layoffs regardless of the duration. The amount of temporary layoff unemployment will of course depend on whether long unemployment

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4. This definition of temporary layoff corresponds closely to the definition used by Feldstein (1975,1976).
5. See Brüniche-Olsen (1986).

spells are allowed to be classified as temporary layoffs. It will probably not be associated with any promise of reemployment if an unemployment spell of, say, 18 months duration ends with the worker returning to the previous employer. Instead that situation will typically be caused by specific educational and geographical reasons that makes the person immobile. It may thus be interesting to investigate the sensitivity of the two measures of temporary layoff unemployment when using various duration limits in the definition of temporary layoffs.

The percentage of the unemployment spells categorized as temporary layoffs is rather insensitive to the duration limit, which is because the temporary layoffs are concentrated among spells with short duration. Not until the duration limit reaches 10 weeks (from above) has it any importance for the proportion of spells. The duration limit is more important for the proportion of unemployment since long unemployment spells have a higher weight in this measure. A rather smooth decrease can be observed in this proportion when the duration limit is lowered, for instance from 16 % to 14 % if a 40 weeks limit is applied and to 8 % if a 10 weeks limit is applied.

The amount of temporary layoff unemployment found in this study for Denmark is similar to the amount found for other countries. Robertson (1989) reports that in Canada more than 50 % of all unemployment spells are terminated because the worker returns to the previous employer. In manufacturing this proportion is even 75 %. Temporary layoffs constitute more than 30 % of the total unemployment. These figures are based on data from administrative registers and are hence comparable with the Danish figures. Lilien (1980) has investigated the amount of temporary layoff unemployment in manufacturing in the U.S. for the period 1965-1976, and he finds that 68 % of all spells are temporary layoffs and that these spells are equal to 30 % of the total unemployment in manufacturing in the U.S. Apart from the fact that these figures are estimated from establishment data, they are comparable with the Danish and Canadian figures. Katz and Meyer (1988) report that 57 % of all unemployment spells in Missouri and Pennsylvania, USA, are temporary layoffs and they find this to equal 32 % of the total unemployment. This result is, however, based on a small sample for the period 1979-1980 and includes only persons actually receiving unemployment benefits. Due to differences in the unemployment insurance systems these figures are not directly comparable to the figures for Denmark.

3. Duration of unemployment distinguishing temporary and permanent layoffs

Whether an unemployment spell is a temporary or a permanent layoff may be expected to have considerable impact on the individual behaviour for instance with respect to job search, and hence when analysing the duration of unemployment the two cases may be very different both with respect to duration dependence and with respect to the effects of explanatory variables. As mentioned in the introduction several theoretical arguments can be given for the differences between temporary and permanent layoffs, and hence we should not *a priori* analyse the duration of unemployment ignoring this distinction.

We have in an earlier study (Jensen and Westergård-Nielsen (1990)) found that there are important distinguishing characteristics between temporary and permanent layoffs. Estimation of a binary choice model for the probability that a given spell is due to either temporary or permanent layoff shows that there are distinct differences between persons experiencing the two types of layoffs. Furthermore, in that analysis, the sign of the coefficient of the replacement ratio seems to conform with the theory of compensating wage differentials. It is found that a lower replacement ratio (higher wage) means a higher probability of temporary layoff. Thus, it seems reasonable to assume that wage compensation is given to those temporarily laid off. In this article we do, however, only focus our attention on analysis of the duration of the two types of unemployment spells. We will first briefly consider the econometric methodology, and then the estimation results are presented and discussed.

3.1. Econometric methodology

The econometric analysis of the unemployment durations is in this study performed through analysis of the hazard function for the unemployment durations. This method has gained increasingly popularity since it was first applied by Lancaster (1979). The hazard function is the conditional density that the unemployment spell ends at time t given that it had not done so before time t

$$h(t) = f(T = t \mid T \geq t)$$

where T is the duration of the unemployment spell. The survivor and density function for the unemployment duration associated with $h(t)$ are given by

$$S(t) = e^{-\int_0^t h(s)ds}$$

$$f(t) = h(t)e^{-\int_0^t h(s)\,ds}$$

If all unemployment spells are of the same type or if the cause by which the spell ends is not taken into consideration, the approach just described would be sufficient to analyse the duration of unemployment with a given specification of the hazard function. This will be referred to as a *single risk model*, since it implicitly assumes that there is only one way to leave unemployment. If, on the other hand, unemployment may end by one of several different causes, a cause specific hazard rate may be specified for each cause j, $h_j(t)$, giving rise to a *competing risks model*.

For the competing risks model with several cause specific hazard rates the density of a complete spell ending by cause j is given by

$$f_j(t) = h_j(t)S(t)$$

where the survivor function (the probability of a spell lasting longer than t) is equal to

$$S(t) = e^{-\int_0^t h(s)\,ds}$$

with $h(s) = \sum_j h_j(s)$. Hence, an incomplete spell contributes $S(t)$ to the likelihood function, whereas a complete spell ending by cause j contributes $f_j(t)$. In the absence of cross-restrictions on the parameters of the cause specific hazard rates in the competing risks model, the log-likelihood function is additively separable in the parameters of each hazard rate, which means that maximum likelihood estimates can be found by maximizing each term separately. Estimating the parameters of h_j thus boils down to maximizing a log-likelihood function of the form

$$\ln L_j = \sum_i \left[-\int_0^{t_i} h_j(s)\,ds + \delta_{ij}\ln h_j(t_i) \right]$$

where $\delta_{ij} = 1$ if the spell ends by cause j and $\delta_{ij} = 0$ if it ends by another cause or is right censored. It is thus seen that estimation of the parameters of h_j is performed by treating unemployment spells ending by all other causes as right censored. The maximum likelihood estimates of the unknown parameters are found by the iterative Newton-Raphson method with analytic first and second derivatives.

For the empirical analysis the hazard functions will be specified conditional on a vector of explanatory variables $\mathbf{x}$, and we will use the proportional hazard specification where the hazard function factors into the product of a function of t and a function of the vector $\mathbf{x}$

$$h(t \mid \mathbf{x}) = \lambda(t)\gamma(\mathbf{x})$$

The individual specific factor $\gamma(\mathbf{x})$ will be specified as $e^{\beta \mathbf{x}}$, where β is a vector of unknown parameters to be estimated. The baseline hazard $\lambda(t)$ is supposed to pick up the duration dependence of the hazard function, and it will be specified as a Weibull hazard function t^{ρ}. Notice, that this parametrization of the Weibull hazard function implies that it exhibits negative (positive) duration dependence when the coefficient ρ is negative (positive).

We want to focus our attention on the differences that may exist between temporary and permanent layoff spells both with respect to explanatory variables and with respect to the duration dependence. To investigate the importance of these differences we specify and estimate both a single risk model and a competing risks model for reemployment. In the single risk model we only specify the total reemployment rate $h_S(t \mid \mathbf{x})$ without taking into consideration the type of reemployment. In the competing risks model we allow for the fact that reemployment may occur either (1) with the previous employer, or (2) with a new employer. Hence, two separate cause specific hazard rates are specified, $h_T(t \mid \mathbf{x})$ being the hazard rate for returning to the previous employer and $h_P(t \mid \mathbf{x})$ being the hazard rate for finding a new job. The total reemployment rate in the competing risks model is then equal to the sum of these two rates. Estimation of the reemployment rate $h_S(t \mid \mathbf{x})$ in the single risk model will not be able to distinguish between different effects on the two types of reemployment. The main advantage of the competing risks model is that it allows us to specify and estimate the impact of the explanatory variables on the two separate employment rates.

In fact, we implicitly consider an additional risk or possibility of exit from unemployment in both the single risk model and the competing risks model: the person may leave the state of unemployment by a transition out of the labour force rather than into employment[6]. In the sample there are a few unemployment spells that are terminated by the person leaving the labour force. These spells are treated as right censored spells both in the estimation of the hazard rate for reemployment in the single risk model and in the estimation of the

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6. Micklewright (1988) forcefully argues for distinguishing transitions out of the labour force from transitions to reemployment.

competing risks model. Hence, what we term a single risk model is strictly speaking a competing risks model with two types of exit, and our competing risks model does in fact have three types of exit (although we do not estimate the parameters of the cause specific hazard rate for transitions out of the labour force).

In the competing risks model each cause specific hazard rate is specified as proportional hazard functions with Weibull baseline hazards as described above. We thus estimate and report the parameters of the following three hazard rates

$$h_j(t \mid \mathbf{x}) = t^{\rho_j} e^{\beta_j \mathbf{x}}, \quad j = S, T, P$$

3.2. Estimation results

For the duration analysis the sample has been divided into eight different sex-age categories. The four age groups are 16-24 years, 25-39 years, 40-54 years and 55 years and older. Both the two cause specific hazard rates in the competing risks model and the hazard rate for reemployment in the single risk model have been estimated. The latter is estimated treating all unemployment spells that end with a transition into employment similarly. This allows us to compare the results that take into account the distinction between temporary and permanent layoffs and the results of ignoring this distinction. The maximum likelihood estimates of the coefficients of the hazard rates are given in tables 1 and 2.

Let us first consider the impact of the explanatory variables on the hazard rates. Many of the explanatory variables have different effects on the two cause specific hazard rates in the competing risks model. As an example consider the sickness variable for which the results show the same pattern for all groups. It has a positive impact on the new job rate h_P, but a negative impact on the recall rate h_T. If we consider only the single risk hazard rate h_S, we may first notice that the effect of the sickness variable is insignificant for all groups except women 40-54 years old. Furthermore, the estimates for the eight groups vary with respect to signs, which together with the insignificance lead us to the conclusion that the sickness variable has no effect on unemployment durations when we only consider

the single risk hazard rate. This is, however, because quite clear effects on the two separate hazard rates have been masked by ignoring the distinction between temporary and permanent layoffs[7].

The results about the sickness variable merit some further interpretation. The negative impact on the recall rate is most probably caused by demand side effects in the sense that the employers do not want to rehire persons with a known history of health problems. One can imagine at least two reasons behind the results showing the positive effect on the new job rate. Either it is possible for the workers to conceal their health problems for potential employers or the workers with health problems are deliberately searching for new jobs which are less demanding or have better work environments.

One of the few variables that have an unambiguous effect on the two cause specific hazard rates is the indicator for children in the pre-school age for women. The effect of having children in the pre-school age is negative for women, so that women with young children tend to have longer unemployment durations than women without children or with older children. This negative effect is a consequence of a negative impact on both the recall rate and the new job rate. However, the results do not tell us the reasons behind this negative effect, but some possible explanations are a voluntary reduced search activity of the women, possibly due to a lack of day-care facilities, and a reaction from potential employers.

In general, the single risk hazard rate has fewer significant coefficients than the two cause specific hazard rates. This means that in a number of cases where an explanatory variable has a significant effect on either the recall rate or the new job rate (or both), this effect is not discovered when only considering the single risk hazard. Even if an effect is discovered from the estimates for the single risk hazard, the underlying effects on the two cause specific hazard rates may differ with respect to size as well as with respect to signs. This occurs because the estimates for the single risk hazard simply reflects an average effect, which depends on the relative number of different transitions.

The same picture emerges even more strongly when we consider the duration dependence in the unemployment durations as it is given by the estimation results. If we start by looking only at the single risk hazard rates we see that for all groups there is a strong negative duration dependence. When we instead look at the results from the competing risks model we see that this strong negative duration dependence is a consequence of an even stronger

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7. Similar results can be obtained for a number of the other explanatory variables by examining the estimates in tables 1 and 2.

negative duration dependence in the recall rate h_T and no (significant) duration dependence in the new job rate h_P. Hence, the two cause specific hazard rates in the competing risks model show very different duration dependencies, and these results clearly illustrate the danger of only estimating and looking at the single risk hazard rate. It will not be able to capture the heterogeneous shapes of the cause specific hazard rates and may in fact lead to rather misleading conclusions about duration dependence, which in turn may cause erroneous policy recommendations.

Information about the number of spells and the values of the log-likelihood function are reported in table 3 together with some tests for the model. Two hypotheses about equality of the coefficients of the recall hazard rate and the new job hazard rate have been tested by likelihood ratio tests. First, the hypothesis that the two cause specific hazard rates are equal has been tested, i.e. the hypothesis $h_T = h_P$ (all coefficients are equal). This hypothesis is strongly rejected for all eight groups[8]. Next, the hypothesis that all the coefficients of the two cause specific hazard rates except the constant term are equal has been tested along the lines suggested by Narendranathan and Stewart (1989). Also this hypothesis is strongly rejected by the likelihood ratio test for all eight groups.

To further illustrate the difference in duration dependence and in magnitudes between the recall hazard rate and the new job hazard rate we have graphed the hazard rates for a reference person in each group[9]. These graphs are shown in figure 1, where both the hazard rate obtained from the estimation of the single risk model and the two cause specific hazard rates from the competing risks model are graphed. It is seen that except for the oldest group the new job hazard rate is higher than the recall hazard rate after the short initial period of decrease. In general, it is also seen that men have higher hazard rates than women, which reflects that they experience shorter unemployment durations.

Table 4 gives the expected unemployment durations for the reference person in each group. By varying the characteristics of the reference person we have also illustrated the effect of changes in the explanatory variables on the expected durations. These results give a more intuitive understanding of the influence of the explanatory variables. It is seen that

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8. A similar result has been obtained in the studies by Ham and Rea (1987), Han and Hausman (1990), and Katz and Meyer (1988).

9. The reference person is defined as a person with the typical characteristics of each group. The exact values of the explanatory variables are given in the note to table 4.

changes in the explanatory variables have relatively large effects on the expected durations, and there will thus be large differences between persons with different characteristics even within the same sex-age group.

Finally, consider the REPLACEM variable which has a negative effect on the hazard rates in all the cases where the effect is significantly different from zero (at a 5% significance level). These negative effects mainly occur for men. The negative effect means that the higher the replacement ratio is, the longer the unemployment duration tends to be. This result is in accordance with predictions from search theoretic models, where higher unemployment benefits reduce the search costs for a given wage offer distribution. Hence, our empirical results concerning the effect of unemployment insurance on unemployment duration are what would be expected from theoretical considerations. Our result that the replacement ratio does not have much influence on the hazard rates for women can be interpreted as indicating that their value of time in alternative (non-market) activities is higher than it is for men.

It is unlikely that we have been able to include all individual characteristics which affect the hazard rates as explanatory variables. It is well known that such unobserved heterogeneity may create bias in the estimates. To investigate whether there is unobserved heterogeneity a specification diagnostic has been applied to the estimated models (see Jensen (1987) or Lancaster (1985) for a derivation of this score test). The values of the diagnostic are shown in table 3 and they indicate that the models are plagued by unobserved heterogeneity, so that the estimates may be biased. Specifically, the results show that both the recall and the new job hazard rates are biased toward more negative duration dependence or less positive duration dependence than if all the heterogeneity had been taken account of in the models. Hence, the unobserved heterogeneity affects the two hazard rates in the same direction, so our conclusions about the differences between these two hazard rates still tend to hold[10].

It should be noticed that the results about the duration dependence of the hazard rates of course are restricted by the functional form chosen. In the Weibull specification with only one coefficient to capture the time variation, the hazard rates will be either monotonically increasing or decreasing and that may be too restrictive. If the baseline hazard is mis-specified, it may also cause the estimates of the other coefficients in the model to be biased.

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10. For this reason we have avoided the additional, basically arbitrary, distributional assumptions about the unobserved term and the additional computational difficulties involved in correcting the results for unobserved heterogeneity.

Furthermore, such misspecification may also cause the problem of unobserved hete-rogeneity to be exaggerated and may hence account for the high values of the specification diagnostic[11].

4. Conclusion

The results reported in this article show that at least 40 % of all unemployment spells in Denmark are due to temporary layoffs and that these spells account for at least 16 % of all unemployment. Hence, temporary layoffs are an important and common phenomenon, a fact which has hitherto been ignored for European labour markets. A reasonable ex-planation of the prevalence of temporary layoffs in Denmark may be found in the structure of the unemployment insurance system, and to the degree that this system is different from what is found in other European countries, the results do not necessarily carry over to other countries.

The duration of unemployment has been analysed taking into account the distinction be-tween temporary and permanent layoffs. The importance of this distinction is investigated by comparing the results from a single risk model with the results from a competing risks model where reemployment may occur either with the previous employer or with a new employer. Estimation of the competing risks model with cause specific hazard rates for reemployment shows that the determinants of the unemployment duration have very dif-ferent effects on the recall hazard rate and the new job hazard rate with respect to signs as well as significance. If we compare the duration dependence exhibited by the single risk hazard and the competing risks hazards we see that the former masks the shapes of the latter. The results indicate that all the negative duration dependence in the single risk hazard rate for reemployment (neglecting the type of layoff) seems to be due to the negative duration dependence in the recall hazard rate, whereas the new job hazard rate reveals no duration dependence or even a slightly positive duration dependence. Many of these dif-ferences are in accordance with the predictions from theoretical search models taking into account the possibility of recall to the previous job.

The estimates from the single risk model mask these differences, and hence a number of important implications may be overlooked if only the single risk hazard rate is estimated and analysed. It will not be able to reflect the underlying mechanisms and to capture the heterogeneous shapes of the cause specific hazards. The usefulness of the competing risks

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11. For some evidence pointing in this direction see Han and Hausman (1990).

approach is clearly illustrated by our results, that show that several of the effects are quite different for the two cause specific hazard rates. For previous and future studies of the duration of unemployment our results indicate that neglecting the different types of layoffs may lead to a serious bias in the results and conclusions.

In the few previous studies investigating the duration of unemployment with temporary and permanent layoffs for the U.S. there has been some emphasis on the effects of exhaustion of unemployment insurance on the hazard rates[12]. This issue has not been dealt with here, since it is of much less importance with the Danish unemployment insurance system, where the risk of running out of benefits is essentially non-existing. Such institutional differences will also have an important influence on the hazard rates and thereby on the expected durations of unemployment.

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12. See Han and Hausman (1990) and Katz and Meyer (1988).

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Table 1. Maximum likelihood estimates of the coefficients of the hazard rates for men (reemployment hazards).

TYPE	16-24			25-39			40-54			55-77		
	h_S	h_T	h_P	h_S	h_T	h_P	h_S	h_T	h_P	h_S	h_T	h_P
CONSTANT	-2.6077	-3.6616	-3.1708	-2.4957	-2.8317	-3.7161	-2.8912	-3.7033	-3.7922	-4.8635	-6.8654	-4.1538
	0.5103	0.9398	0.6121	0.2321	0.3440	0.3186	0.3907	0.5187	0.6038	0.9796	1.2299	1.6047
EXPERIENCE	0.1209	0.2449	0.0632	0.0458	0.0815	0.0096	0.0329	0.0549	0.007	-0.0061	0.0054	-0.0254
	0.0238	0.0433	0.0209	0.0064	0.0094	0.0089	0.0072	0.0100	0.0105	0.0103	0.0145	0.0148
AGE	-0.0805	-0.0728	-0.0894	-0.0478	-0.0606	-0.0372	-0.0444	-0.0573	-0.0336	0.0095	0.0183	-0.0049
	0.0202	0.0415	0.0262	0.0077	0.0116	0.0103	0.0102	0.0139	0.0155	0.0178	0.0227	0.0293
APPRENTICE	-0.0602	-0.3844	0.0881	0.0615	0.1001	0.0397	0.1418	0.3646	-0.0931	0.0028	0.0370	0.0885
	0.0785	0.1499	0.0933	0.0462	0.0682	0.0631	0.0795	0.1099	0.1179	0.1465	0.1973	0.2187
MARRIED	-0.0119	-0.0934	0.0383	0.0390	-0.1042	0.1538	0.2789	0.5159	0.0425	0.3206	0.6586	-0.2318
	0.1463	0.2724	0.1744	0.0552	0.0818	0.0753	0.0681	0.0978	0.0983	0.1141	0.1539	0.1742
PROVINCE	0.1759	0.5103	0.0734	0.1790	0.3138	0.1037	0.0950	0.3645	-0.1453	-0.0004	0.3180	-0.5386
	0.0734	0.1614	0.0833	0.0481	0.0768	0.0622	0.0736	0.1095	0.1037	0.1297	0.1784	0.1993
SICK	-0.0085	-0.3228	0.1251	0.0587	-0.3301	0.3554	-0.0341	-0.2230	0.1388	-0.0557	-0.3372	0.2948
	0.0699	0.1368	0.0820	0.0464	0.0776	0.0589	0.0751	0.1100	0.1049	0.1280	0.1917	0.1759
CHILD 0-6	0.2626	0.3248	0.2118	0.1828	0.2789	0.1101	-0.1261	-0.2630	0.0776	0.1316	0.1502	0.4361
	0.1547	0.2821	0.1872	0.0559	0.0809	0.0777	0.1096	0.1479	0.1645	0.5963	0.7361	1.0312
WEALTH	0.0049	0.0229	-0.0053	0.0009	0.0062	-0.0040	0.0048	0.0050	0.0052	-0.0009	-0.0012	0.0004
	0.0051	0.0075	0.0067	0.0017	0.0024	0.0023	0.0016	0.0022	0.0025	0.0026	0.0036	0.0039
REPLACEM	-0.2196	-0.8149	0.0430	-0.6595	-0.5281	-0.8532	0.1758	0.4421	-0.1780	-0.8452	-1.7851	0.8071
	0.1968	0.3490	0.2395	0.1195	0.1751	0.1648	0.1994	0.2733	0.2901	0.2881	0.3736	0.4805
industries MANUFACT	0.0489	0.3674	-0.0794	0.1549	0.2731	0.0807	0.0189	0.2006	-0.3414	1.1497	1.9746	-0.1922
	0.1073	0.1853	0.1329	0.0764	0.1058	0.1110	0.1020	0.1357	0.1565	0.1741	0.2604	0.2706
CONSTRUCT	0.2871	0.5426	0.1952	0.2385	0.2664	0.2743	0.1171	0.2454	-0.0895	0.9311	1.7260	-0.2972
	0.1128	0.1915	0.1406	0.0759	0.1065	0.1090	0.1072	0.1436	0.1618	0.1744	0.2625	0.2647
SERVICE	0.1184	0.1561	0.1151	0.0330	-0.1624	0.2355	-0.0621	-0.0306	-0.1414	0.8192	1.1558	0.3024
	0.1075	0.1961	0.1299	0.0759	0.1107	0.1060	0.1092	0.1491	0.1618	0.1797	0.2775	0.2491
PUBLIC	-0.0106	-0.1623	0.0438	0.0071	-0.0897	0.1211	-0.0806	0.0847	-0.3627	0.5877	0.9573	-0.0175
	0.1110	0.2187	0.1315	0.0835	0.1262	0.1135	0.1150	0.1558	0.1717	0.1872	0.2888	0.2582
insurance funds SID	0.1326	0.4563	-0.0134	0.0263	-0.0082	0.0801	-0.0419	-0.1215	0.1540	0.5062	0.9423	0.0233
	0.0746	0.1479	0.0876	0.0508	0.0755	0.0687	0.0824	0.1084	0.1285	0.1271	0.1811	0.1915
METAL	-0.1769	-0.5046	-0.0900	-0.0592	-0.1330	0.0213	0.0543	0.0269	0.0734	-0.2071	-0.3630	0.0681
	0.1086	0.2445	0.1220	0.0758	0.1135	0.1022	0.1319	0.1662	0.2174	0.2209	0.3381	0.2958
CONSTR	-0.0613	0.1306	-0.1245	0.0554	-0.0031	0.1308	-0.0213	-0.2514	0.3010	0.4542	0.9170	-0.5966
	0.1119	0.2124	0.1327	0.0715	0.1038	0.0990	0.1019	0.1356	0.1558	0.1884	0.2382	0.3406
ρ	-0.1260	-0.3398	-0.0011	-0.1848	-0.3237	-0.0272	-0.1953	-0.3230	0.0384	-0.1790	-0.2420	-0.0176
	0.0178	0.0266	0.0234	0.0115	0.0149	0.0175	0.0160	0.0188	0.0291	0.0257	0.0310	0.0479

Asymptotic standard errors are given below the estimates.

The lenght of unemployment spells is measured in days.

Table 2. Maximum likelihood estimates of the coefficients of the hazard rates for women (reemployment hazards).

TYPE	16-24			25-39			40-54			55-77		
	h_S	h_T	h_P	h_S	h_T	h_P	h_S	h_T	h_P	h_S	h_T	h_P
CONSTANT	-5.1345	-7.3283	-5.9206	-3.2426	-3.3466	-5.3055	-3.4196	-4.1900	-5.3855	-2.5434	-2.4229	-6.4060
	0.5592	0.9360	0.7565	0.3127	0.4646	0.4439	0.5309	0.7362	0.8578	1.4596	1.8498	2.4926
EXPERIENCE	0.0005	0.1340	-0.1404	0.0312	0.0614	-0.0122	0.0060	0.0096	-0.0033	-0.0143	0.0076	-0.0561
	0.0230	0.0369	0.0272	0.0067	0.0086	0.0108	0.0072	0.0088	0.0128	0.0128	0.0176	0.0194
AGE	0.0244	0.0468	0.0059	-0.0445	-0.0761	-0.0055	-0.0229	-0.0404	0.0121	-0.0063	-0.0333	0.0661
	0.0236	0.0365	0.0314	0.0070	0.0094	0.0105	0.0112	0.0137	0.0198	0.0260	0.0335	0.0431
APPRENTICE	-0.1719	-0.4811	0.1591	0.0770	0.1509	-0.0095	0.1224	0.0672	0.2315	-0.4227	-0.8308	0.3218
	0.0895	0.1367	0.1204	0.0502	0.0651	0.0789	0.0871	0.1130	0.1400	0.2649	0.3853	0.3851
MARRIED	0.1525	0.3837	-0.0939	0.0560	0.1054	-0.0170	0.0865	0.4294	-0.4896	0.1284	0.1875	0.0187
	0.0798	0.1081	0.1220	0.0427	0.0566	0.0653	0.0750	0.1015	0.1180	0.1447	0.2000	0.2128
PROVINCE	0.2785	1.0454	-0.1890	0.1048	0.2819	-0.0932	0.0795	0.4454	-0.4402	0.0340	0.4883	-0.4303
	0.0774	0.1479	0.0953	0.0524	0.0737	0.0756	0.0814	0.1165	0.1217	0.1612	0.2433	0.2167
SICK	0.0637	0.0273	0.1140	0.0371	-0.0900	0.2362	0.1617	-0.0126	0.4812	-0.1511	-0.6806	0.6751
	0.0696	0.0995	0.0978	0.0455	0.0609	0.0688	0.0771	0.0998	0.1247	0.1452	0.2081	0.2205
CHILD 0-6	-0.1563	-0.1325	-0.2394	-0.1756	-0.1281	-0.2323	-0.3582	-0.4233	-0.1502			
	0.0815	0.1123	0.1205	0.0423	0.0553	0.0659	0.1528	0.1855	0.2718			
WEALTH	0.0191	0.0046	0.0275	0.0024	0.0074	-0.0037	-0.0029	0.0029	-0.0118	-0.0009	-0.0017	-0.0005
	0.0104	0.0154	0.0146	0.0034	0.0043	0.0056	0.0037	0.0042	0.0070	0.0072	0.0102	0.0105
REPLACEM	-0.6445	-1.1415	-0.0784	-0.0043	0.2183	-0.3632	-0.2542	-0.0110	-0.5832	-0.5013	-0.3408	-1.0292
	0.2197	0.2971	0.3241	0.1385	0.1887	0.2048	0.2036	0.2610	0.3317	0.3557	0.4998	0.5312
industries MANUFACT	1.2932	2.3765	0.8691	1.0481	1.5067	0.5725	1.2032	1.8883	0.5700	0.7497	0.9096	0.1095
	0.2000	0.5129	0.2321	0.2061	0.3392	0.2639	0.3121	0.5094	0.4029	0.2538	0.3185	0.4784
CONSTRUCT	0.8307	1.1576	1.0153	0.7967	0.6084	1.1017	0.6034	2.0650				
	0.2780	0.6245	0.3236	0.2731	0.4535	0.3454	0.6608	0.7801·				
SERVICE	1.2244	2.0450	1.0675	0.9181	1.1996	0.7529	1.1510	1.7815	0.5974	0.6145	0.3993	0.9368
	0.1956	0.5125	0.2160	0.2055	0.3396	0.2595	0.3097	0.5075	0.3951	0.2269	0.3006	0.3508
PUBLIC	1.1477	2.0972	0.8714	1.0308	1.3978	0.7635	1.0809	1.7435	0.4496	0.4920	0.4557	0.4405
	0.1925	0.5090	0.2114	0.2031	0.3367	0.2557	0.3092	0.5071	0.3947	0.2249	0.2912	0.3596
insurance funds KAD	0.0832	0.0567	0.1542	-0.0182	0.0839	-0.1767	0.1493	0.1863	0.0331	-0.2445	0.0793	-1.0161
	0.0840	0.1150	0.1245	0.0548	0.0686	0.0913	0.0705	0.0840	0.1320	0.1564	0.1892	0.3043
HK	-0.0174	0.1466	-0.1619	-0.2245	-0.3250	-0.1010	-0.6546	-1.0492	-0.2844	-0.6870	-0.4699	-0.9730
	0.0835	0.1242	0.1156	0.0556	0.0760	0.0816	0.1037	0.1524	0.1504	0.2063	0.2958	0.2975
PART TIME	-0.0128	0.0753	-0.1565	0.1387	0.1347	0.1462	-0.0019	0.0611	-0.1240	-0.0847	-0.2397	0.0907
	0.1486	0.2188	0.2047	0.0524	0.0686	0.0817	0.0763	0.0934	0.1327	0.1669	0.2164	0.2712
ρ	-0.1980	-0.3638	0.0467	-0.2673	-0.3968	0.0004	-0.2587	-0.3541	0.0104	-0.2845	-0.3655	-0.0764
	0.0174	0.0214	0.0294	0.0106	0.0121	0.0204	0.0161	0.0180	0.0347	0.0298	0.0349	0.0583

Asymptotic standard errors are given below the estimates.

The lenght of unemployment spells is measured in days.

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Table 3. Test statistics for maximum likelihood estimation of the hazard rates.

Men												
	16-24			25-39			40-54			55-77		
TYPE	h_S	h_T	h_P	h_S	h_T	h_P	h_S	h_T	h_P	h_S	h_T	h_P
Number of spells	1459	1459	1459	3046	3046	3046	1570	1570	1570	730	730	730
Number of completed spells	1332	403	929	2747	1273	1474	1346	768	578	566	351	215
Log-likelihood function	-7118	-2482	-5339	-14529	-7438	-8800	-7056	-4290	-3565	-3024	-1950	-1370
Specification diagnostic	4.56		3.12	5.30	13.33	2.76	3.96	4.68	4.23	2.51	1.56	4.38
Test for $h_T = h_P$ except constant		228			374			242			160	
Test for $h_T = h_P$		440			388			268			192	

Women												
	16-24			25-39			40-54			55-77		
TYPE	h_S	h_T	h_P	h_S	h_T	h_P	h_S	h_T	h_P	h_S	h_T	h_P
Number of spells	1277	1277	1277	2769	2769	2769	1202	1202	1202	374	374	374
Number of completed spells	1153	548	605	2582	1516	1066	1107	733	374	319	196	123
Log-likelihood function	-6255	-3185	-3703	-13573	-8431	-6667	-5689	-3915	-2355	-1687	-1092	-763
Specification diagnostic	4.99		3.56	9.11		19.62	5.37	6.21		3.36	4.92	3.33
Test for $h_T = h_P$ except constant		330			450			254			90	
Test for $h_T = h_P$		332			530			372			106	

The specification diagnostic is for unobserved heterogeneity. Some values are missing due to numerical difficulties. It follows a standard normal distribution in the case with no unobserved heterogeneity.

The two tests for equality are under the null χ^2 distributed with 17 and 18 degrees of freedom, respectively (except for women, 40-54 years, which have 16 and 17, and women, 55-77 years, which have 15 and 16 degrees of freedom).

Table 4. Expected duration of unemployment for reference persons (in weeks).

	Women				Men			
	(1) Reference female	(2) (1) living in Copen-hagen	(3) (1) with children	(4) (1) in KAD	(5) Reference male	(6) (5) living in Copen-hagen	(7) (5) in METAL	(8) (5) in SID
16-24 years	9.9	14.1	12.1	8.0	12.8	15.6	19.2	13.4
25-39 years	14.4	16.6	18.3	9.1	10.7	13.3	13.6	12.3
40-54 years	23.3	26.0	37.8	7.3	10.7	12.0	11.0	12.3
55-77 years	18.5	19.4		8.3	8.7	8.7	14.9	6.2

The reference female is defined by MARRIED=1, PROVINCE=1, REPLACEM=0.8, SERVICE=1, HK=1, AGE=20,33,48,60, and EXPERIENCE=0,10,20,30 respectively for the four age groups.
The reference male is defined by MARRIED=1, PROVINCE=1, REPLACEM=0.8, CONSTRUCT=1, CONSTR=1, AGE=20,33,48,63, and EXPERIENCE=0,10,25,40 respectively for the four age groups.
All other variables are set to zero.

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Figure 1. Hazard rates for reference persons.
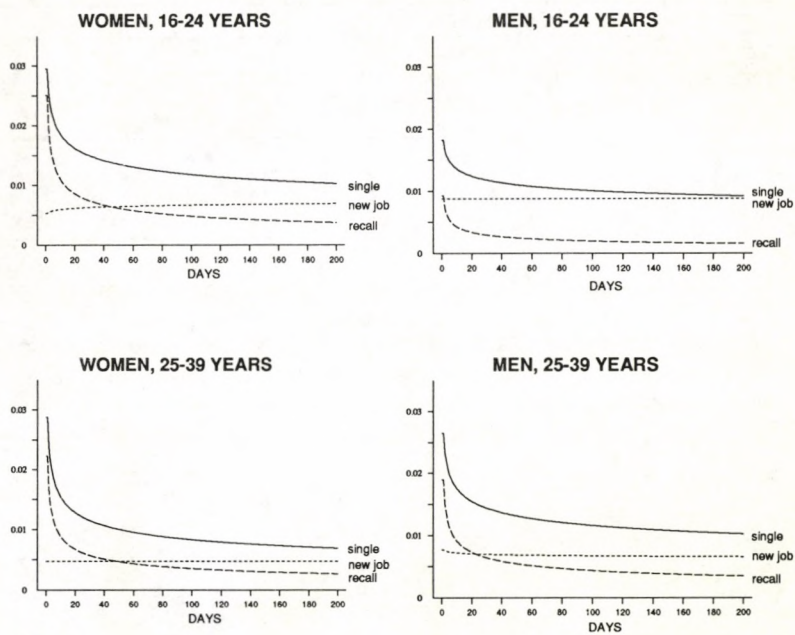
The reference person is defined in the note to table 4.

Figure 1 (continued). Hazard rates for reference persons.

WOMEN, 40-54 YEARS

MEN, 40-54 YEARS

WOMEN, 55-77 YEARS

MEN, 55-77 YEARS
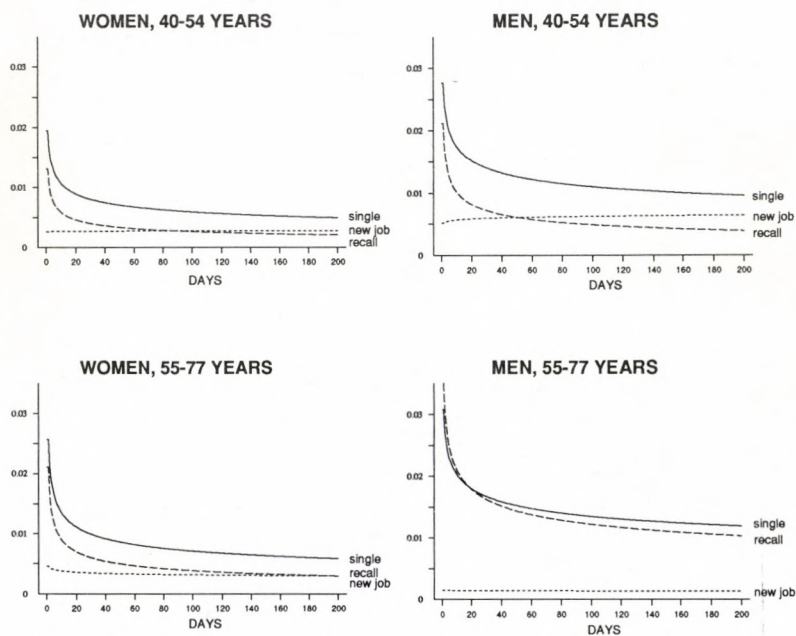
The reference person is defined in the note to table 4.

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