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ABSTRACT

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Using a large panel of administrative records this study confirms the predictions of the ranking model of Blanchard and Diamond (1994) that an individual's probability of leaving unemployment decreases with unemployment duration and increases with economic growth. However, the ranking model of Blanchard and Diamond (1994) makes the further prediction that negative genuine duration dependence will be stronger the more depressed the labour market. In conflict with this prediction this study provides persuasive empirical evidence that the pattern of negative genuine duration dependence does not change over the business cycle. Moreover it is shown that the finding in previous studies that negative genuine duration dependence becomes stronger the more depressed the labour market arises from failure to control for cyclical fluctuations in the composition of the newly unemployed. This finding carries a strong warning for policy assessment: unless controlled for cyclical fluctuations in the composition of the newly unemployed an evaluation of a policy designed to get the long-term unemployed into work will be biased towards a success in times of high economic growth and towards a failure in times of low economic growth.

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1. Introduction

An individual's probability of leaving unemployment is widely observed to decrease with the elapsed duration in unemployment, i.e. the presence of negative duration dependence in the probability of leaving unemployment. This implies that the long-term unemployed are the more disadvantaged unemployed. For this reason welfare programs designed to get the unemployed back into work often target the long-term unemployed in particular by providing wage subsidies, training or job search assistance. Examples are the New Deal program in the United Kingdom (Bell et al. 1999), and the Targeted Jobs Tax Credit (Katz, 1996) and Welfare to Work programs (Leonard, 1999) in the United States. When evaluating a welfare program designed to get the (long-term) unemployed into work it is of importance to understand the extent to which an individual's probability of leaving unemployment is affected by the business cycle and the duration in unemployment. This issue also emerges in the literature on aggregate unemployment dynamics that is concerned with the source of cyclical fluctuations in the average durations of unemployment (Darby et al., 1985, and Baker, 1992, Abbring et al., 2001).

The main objective of this study is to examine the cyclical sensitivity of genuine duration dependence in individuals' probabilities of leaving unemployment. As is well known, the commonly observed decrease in individuals' probabilities of leaving unemployment with elapsed duration of unemployment can be explained by both sorting and genuine negative duration dependence (Lancaster, 1979, Layard et al, 1991, Van den Berg and Van Ours, 1994). Sorting refers to a dynamic selection mechanism based on a relationship between individual heterogeneity and job performance, i.e. those perceived to be most productive are hired first (Salant, 1977). An economic model explaining genuine negative duration dependence is the ranking model of Blanchard and Diamond (1994), in which an employer ranks applicants by their unemployment durations and hires the one with the shortest duration. This ranking model also predicts a decrease in the probability of leaving unemployment when the labour market becomes more depressed and, moreover, that genuine negative duration dependence is stronger the more depressed the labour market. The latter result comes from the fact that the less depressed the labour market the lower the ratio of applications to

vacancies, and, consequently, the more likely the unemployed is the sole applicant; hiring then occurs whether or not the unemployed is long-term unemployed. Empirical evidence points to procyclical sensitivity of the probability of leaving unemployment (Syder, 1985, Butler and McDonald, 1986, Dynarski and Sheffrin, 1990, Layard et al., 1990, Baker, 1992). Empirical evidence on cyclical sensitivity of genuine duration dependence is scarce and inconclusive, mainly due to data restrictions. In support of the ranking model Dynarski and Sheffrin (1990) show, using individual-level data, that the hazard of leaving unemployment decreases with duration, increases when the unemployment rate decreases, and increases more so the longer the duration in unemployment. This latter result is based on a negative and significant interaction term of the national unemployment rate and a dummy variable for an elapsed duration over three months. In conflict with the ranking model, Imbens and Lynch (1992) find a positive interaction effect from the duration of non-employment with the national unemployment rate. Using aggregate data from the US, Sider (1985) concludes that the probabilities of leaving unemployment are more cyclically sensitive the shorter the duration in unemployment, while Butler and McDonald (1986) conclude that the probabilities of leaving unemployment are more cyclically sensitive the longer the duration and Abbring et al. (2001) that in an economic boom duration dependence becomes stronger at low durations and less strong at higher durations.

This study is organized as follows. Section 2 describes the data. The data used are administrative data from the United Kingdom on individuals' unemployment related benefit claims covering 361,723 claims of 111,506 men from the fourth quarter in 1982 up to the first quarter in 1998. These individual-level data are unique in the sense that the number of observations is large in both the time and cross-section dimensions. This allows us to disentangle the effects on the probability of leaving unemployment of the business cycle, elapsed duration (ranking effects) and individual heterogeneity (sorting effects). A quarterly series of the Gross Domestic Product is used to control for business cycle effects. Section 3 formulates the econometric model, a proportional hazard rate model (Lancaster, 1979), and discusses the estimation procedure. Unobserved individual heterogeneity is explicitly controlled for to avoid spurious correlations between the probability of

leaving unemployment and elapsed duration (Lancaster, 1979). Section 4 reports and discusses the estimation results. Section 5 summarizes and concludes.

2. The Data: Joint Unemployment and Vacancy Operating System (JUVOS).

The JUVOS is representative sample of all computerized claims for unemployment related benefits in the United Kingdom and is from 1982 onwards updated on a monthly basis by National Statistics. In principle the sample includes all individuals who make a claim for unemployment benefits, Income Based Job Seekers Allowance or National Insurance credits, and whose National Insurance number ends in specific pair of digits. This sampling scheme yields a random and representative stock sample of the unemployed population at any point in time over the observation period. Based on the JUVOS National Statistics publishes the Claimant-count for the UK.

In the UK, individuals who become unemployed are entitled to benefits up to twelve months if they have paid enough National Insurance Contributions. The period of entitlement has been reduced to a maximum of six months in October 1996. These insurance-based benefits are not means tested. Individuals who are not entitled to these benefits or individuals who exhaust these benefits are eligible for means tested benefits nowadays known as Income Based Job Seekers Allowance. This allowance is part of the UK welfare system and, as long as the mean tested criteria is met, has an indefinite duration. In short, in this study unemployment is defined as claiming unemployment related benefits. A JUVOS-record consists of the start and end date of the claim. Furthermore, information is gathered on individuals' gender and date of birth, marital status and the region in which the claim is made. The eleven regions considered are the standard regions as defined in Sweeney (1996): 'South East' (including Greater London), 'South West', 'East Anglia', 'East Midlands', 'West Midlands', 'North West', 'Yorkshire and Humberside', 'North', 'Scotland', 'Wales' and 'Northern Ireland'. Individuals in the region 'Northern Ireland' are included only from the first quarter of 1994 onwards.

The sample used in this study is restricted to men aged 18-59 years throughout the period of claim and the sampling period is from the fourth quarter in 1982 up to the first quarter of 1998 inclusive[1]. In total 116,510 men over the period 1982.IV-1998.I make up for 384,016 spells of unemployment. This is about a 1% representative stock sample of the population unemployed men aged 18-59 years. The stock sample is used for descriptive statistics only and the empirical analysis is carried out on the flow sample in order to obtain consistent estimates of the parameters of the distribution of unemployment durations (Lancaster, 1990, section 3.1). The flow sample includes all spells of unemployment that started in or after 1982.IV and after the individual turned 18 years of age. For individuals living in Northern Ireland unemployment spells are removed that started before 1994.I. This amounts to an exclusion of 22,293 spells of unemployment (5.8%). The flow sample consists of 111,506 men over the period 1982IV-1998I who made up for 361,723 spells of unemployment. Only 2.7% of these are right-censored.

Figure 1 reports on the number of unemployed men in the UK over the period 1982.IV-1998.I in both the stock and flow sample. The stock sample shows that while unemployment remains fairly stable in the first half of the 1980's, in the second half of the 1980's unemployment declined up to 1990, unemployment rose again during the recession years of the early 1990's, and after 1993 there has been a steady decline in unemployment up to 1998. Over time the proportion of the stock of unemployed included in the flow sample is rising rapidly. The flow sample includes virtually all unemployed of the stock sample after a couple of years. Figure 2 reports on the average elapsed duration in both samples and the differences are quite striking. Although only a very small percentage has been deleted from the stock sample to create the flow sample Figure 2 shows that the observations excluded are the long-term unemployed who have a disproportionately large weight in

[1] Many unemployed women have a partner who is an earner. After exhausting the benefits these women are unlikely to be entitled to Income Based Job Seekers Allowance and therefore leave the JUVOS without actually having found employment. For this reason only men are included in this study. For unemployed men this issue does not seriously affect the unemployment count (Nickell, 1999). After April 1998 the New Deal program has been implemented which affects the registration of claims for a non-random group of unemployed. Hence, the data is censored at this point in time.

the average duration in the stock sample. The pattern of elapsed duration over the business cycle is in line with descriptive statistics in Layard et al. (1991, Chap. 5). Low levels of unemployment are characterized by decreasing elapsed durations in the late 1980's. Throughout the 1990's unemployment decreased while elapsed duration increased. Figure 3 reports on the aggregate flows into and from unemployment. Both the inflow and outflow are observed to be procyclical. The difference between the inflow and outflow determines the change in aggregate unemployment. Figure 4 reports on the hazard rate of leaving unemployment and the Survival function at a given duration. Figure 4 shows the commonly observed decrease in the hazard of leaving unemployment with elapsed duration. The increase in the aggregate hazard in the 5^{th} quarter is caused by men who are not entitled to Income Based Job Seekers Allowance after having received unemployment benefits for one year. Whether or not they actually found employment is not observed. The Survival function shows that over 90% of the unemployed leave unemployment within 2 years, 1% is still unemployed after 5 years and 0.2% is still unemployed after 8 years. Table 1 reports the frequency distribution of the number of spells of unemployment observed per individual in the flow sample. About 65% of the individuals in the sample experience more than one spell of unemployment during the observation period. Table 2 reports on the distribution of unemployment across the regions. Apart from a negative employment shock in the early nineties that in particular affected the 'South-East', the distribution is fairly constant over time. As is discussed in section 3.1, a series of the Gross Domestic Product (GDP) is used as a macroeconomic indicator to control for business cycle effects. Figure 5 reports on both the national unemployment rate and detrended (logarithm of) GDP per quarter. Important for this study is the fact that the time span of the sample includes more than one entire business cycle.

3. The Econometric Model

The econometric framework chosen to model the individuals' probability of leaving unemployment is a proportional hazard model. The approach taken is considered to be reduced-form approach and is

taken in most empirical studies analysing individuals' unemployment durations. I refer to Lancaster (1990) for an excellent overview of the literature on the usage of these models and the linkage with the economic framework of job search theory.

The number of unemployment spells experienced by individual i is denoted by K_i, the starting date of the k^{th} unemployment spell is denoted by τ_{ik}, the duration of the k^{th} unemployment spell by t_{ik} and c_{ik} is a dummy variable equal to 1 if the k^{th} unemployment spell is incomplete (right-censored) and equal to 0 otherwise. N denotes the number of individuals in the sample. X_{ik} is a vector of observed individual characteristics, which are constant within a spell but may vary across spells. The unobserved individual specific characteristic is denoted by ν_i and is assumed to be constant across spells. The hazard rate of a transition from unemployment into employment, i.e. the instantaneous conditional probability of leaving unemployment, is denoted by $h(t_{ik} \mid \tau_{ik}, X_{ik}, \upsilon_i; \beta)$, where β is a parameter vector. The density function of the duration of unemployment, t_{ik}, is given by (Lancaster, 1990):

$$g(t_{ik} \mid \tau_{ik}, X_{ik}, \nu_i; \beta) = h(t_{ik} \mid \tau_{ik}, X_{ik}, \nu_i; \beta) \exp\left\{ - \int_0^{t_{ik}} h(s \mid \tau_{ik}, X_{ik}, \nu_i; \beta) ds \right\}. \quad (1)$$

The survival function is given by:

$$1 - G(t_{ik} \mid \tau_{ik}, X_{ik}, \nu_i; \beta) = \exp\left\{ - \int_0^{t_{ik}} h(s \mid \tau_{ik}, X_{ik}, \nu_i; \beta) ds \right\}. \quad (2)$$

The likelihood contribution for a right-censored spell is the survival function. For each individual the set of observations is denoted by $H_i = \{\tau_{ik}, t_{ik}, c_{ik}, X_{ik}\}_{k=1,..,K_i}$. A support point approach as described in Heckman and Singer (1984) is used to model the distribution of the unobserved individual specific characteristic ν_i. I refer to Huh and Sickles (1994) for a discussion on the empirical implementation of this method and the comparison with alternative parametric approaches, and to Baker and Melino (2000) for a further discussion on identification issues. The number of mass points is assumed to be fixed and equal to P. The mass points are denoted by ν_p and the corresponding probability mass is given by $\Pr(\nu_i = \nu_p) = \pi_p$. Using the mass point distribution and the ingredients described above the likelihood function for a sequence of unemployment spells of individual i is given by:

$$L_i\left(H_i \mid \theta\right)=\sum_{p=1}^{P}\left(\prod_{k=1}^{K_i}\left[g(t_{ik} \mid \tau_{ik}, X_{ik}, \nu_p; \beta)\right]^{1-c_{ik}}\left[1-G(t_{ik} \mid \tau_{ik}, X_{ik}, \nu_p; \beta)\right]^{c_{ik}}\right)\pi_p . \qquad (3)$$

Where $\theta=\left(\beta, \nu_1, .., \upsilon_P, \pi_1, .., \pi_P\right)$. The Maximum Likelihood estimates are given by:

$$\hat{\theta}=\arg\max_{\theta}\sum_{i=1,..,N}\ln\left(L_i\left(H_i \mid \theta\right)\right). \qquad (4)$$

The model has been set up in continuous time. In the empirical analysis the duration data are discretised in quarterly units. This is taken into account in the estimation procedure and for this reason the econometric framework is more appropriately referred to as a discrete time hazard rate model. This facilitates the calculations of the integrated hazard functions and makes it feasible to estimate this model using a very large data set.

3.1 The Empirical Specification of the Hazard of Leaving Unemployment within One Quarter

The observed exogenous covariates available are the region in which the claim is made and the marital status of the individual. Hence X_{ik} contains a set of region specific dummy variables and a dummy variable equal to 1 if the individual is single and 0 otherwise. The status 'single' applies to individuals who are not married or cohabitating. As discussed above, the distribution of the unobserved individual specific characteristics is estimated using a support point approach. Genuine duration dependence is parameterised by using quarter specific dummy variables, i.e. a semi-parametric specification is chosen to have maximum flexibility in the pattern of duration dependence. The last duration interval is chosen to be equal to the 31st quarter and D equal to 32 includes all elapsed durations over 31 quarters. As discussed in section 2, only 0.2% of the unemployed have durations exceeding 31 quarters. Business cycle effects are taken into account by using a macroeconomic indicator. Note that duration dependence and calendar time are not separately identified using nonparametric specifications for both (Imbens, 1994). Following Butler and McDonald (1986) I use a detrended series of the logarithm of the Gross Domestic Product (LNGDP)

as an indicator for the cyclical fluctuations in labour demand.[2] This I refer to as the indicator for the business cycle (see Figure 5). The business cycle is allowed to affect the probability of leaving unemployment differently at different durations. This makes it possible to examine whether or not the pattern of genuine negative duration dependence in individuals' probabilities of leaving unemployment changes over the business cycle, as found in previous studies and as also predicted by the ranking model of Blanchard and Diamond (1994). Furthermore, one may expect the composition of the newly unemployed to change over the business cycle (Darby et al., 1985). This is modelled by allowing the intercept to vary with the state of the business cycle at the time of entering unemployment. The empirical hazard rate function of leaving unemployment is formalized as follows:

$$\ln\left(h(s \mid \tau_{ik}, X_{ik}, \upsilon_i; \beta)\right) = \beta_0 + \sum_{d=2}^{D} \beta_{1d} I(s=d) + \beta_2 LNGDP_{\tau_{ik}+s}$$

$$+ \sum_{d=2}^{D} \beta_{2d} LNGDP_{\tau_{ik}+s} \times I(s=d) + X_{ik}\beta_3 + \beta_4 LNGDP_{\tau_{ik}} + \nu_i \,. \qquad (5)$$

The β_{1d}'s determine the pattern of genuine duration dependence in the baseline situation of LNGDP=0, i.e. the growth in GDP is at its trend value. β_2 denotes the effect of the business cycle on the probability of leaving unemployment, the β_{2d}'s determine the change in the pattern of genuine duration dependence over the business cycle and β_3 is a vector containing the effects of the regional dummy variables and marital status. β_4 is the effect of cyclical fluctuations in the composition of the newly unemployed on the probability of leaving unemployment. In addition, seasonal effects in the composition of the newly unemployed and the hazard of leaving unemployment are modelled by including dummy variables for each quarter of entry in and exit from unemployment.

[2] Dynarski and Sheffrin (1990) and Imbens and Lynch (1992) use the national unemployment rate (UR, see Figure 5) as a macroeconomic indicator. Preliminary results indicated that LNGDP basically does a better job explaining the cyclical fluctuations in the probability of leaving unemployment than does UR. This is explained by the fact that LNGDP is a better proxy for labor demand than UR. Sider (1985) uses the Industrial Production Index.

4. Empirical Results

The model as outlined in section 3 is estimated and the estimation results are reported in the Appendix. To facilitate the discussion the estimation results are summarized in Tables 3 and 4, and Figure 6. Table 3 reports on the change in the reference probability with a change in elapsed duration (interacted with the state of the business cycle) or in one of the explanatory variables. The three states of the business cycle chosen are the two extremes at low and high economic growth, i.e. LNGDP equal to –4 and 4, respectively, and average growth, i.e. LNGDP is equal to 0 (see Figure 5).

Genuine duration dependence over the business cycle

Table 3 (top) shows that the probability of leaving unemployment increases with economic growth at all durations. This is in line with the results in Dynarski and Sheffrin (1990) and with the observed countercyclical behaviour of the aggregate average durations of unemployment (Sider, 1985, Layard et al., 1991, Baker, 1992). The baseline probability of leaving unemployment within one quarter is about 64% lower in times of low economic growth than in times of high economic growth (0.392 versus 0.645).

Table 3 (top) shows that up to the 24th quarter the probability of leaving unemployment decreases with duration at all three states of the business cycle. To examine the extent to which the pattern of genuine negative duration dependence changes over the business cycle the normalized hazards of leaving unemployment are graphed in Figure 6. The discussion underneath is restricted to durations under 32 quarters.[3] Figure 6 shows that the pattern of genuine negative duration dependence is less steep in times of high economic growth than in times of low economic growth. Hence, the disadvantaged position of a long-term unemployed relatively to a short-term unemployed seems to improve in an economic upturn. A likelihood ratio test rejects the null-hypothesis that the

[3] As discussed before, D=32 comprises all durations over 31 quarters that are experienced by less than 0.2% of the unemployed.

pattern of genuine duration dependence does not change over the business cycle.[4] These findings are in favour of the ranking model. However, even though calculated at the extremes of the business cycle the differences between the slopes in Figure 6 are very small up to the 20th quarter. The fact that the pattern of genuine duration dependence is upward sloping from the 20th quarter onwards in the situation of high growth is also a reason for interpreting the differences between the slopes with extreme caution.[5] Indeed, Table 4 shows that the point-wise confidence intervals at each of the extremes of the business cycle overlap the confidence interval for the situation of average economic growth for almost all durations. A notable exception is at the elapsed duration equal to 5 quarters. At the duration of 5 quarters there is a considerable amount of heterogeneity that I cannot control for, i.e. some individuals are and some are not entitled to Income Based Job Seekers Allowance. Therefore, given the differences between the slopes in Figure 6 are insignificant at almost all durations I conclude that the disadvantaged position of a long-term unemployed relatively to a short-term unemployed does not really improve in an economic upturn.

The conclusion that the pattern of genuine duration dependence does not change over the business cycle is in contrast with some of the empirical results in the studies mentioned in the introduction and the prediction of the ranking model of Blanchard and Diamond (1994). For this reason I re-estimate the model without controlling for individual heterogeneity and changes in the composition of the newly unemployed. The resulting pattern of negative duration dependence over the business cycle is shown in Figure 7. Figure 7 shows that in the data there are considerable differences in the pattern of duration dependence over the business cycle and Figure 8 shows that these differences get stronger once controlled for individual heterogeneity. Results not reported here show that these differences are highly significant at each of the durations from the third quarter onwards. Although, in the complete model, I control for cyclical fluctuations in the composition of the newly unemployed in a rather crude way it does wipe out most of the differences between the slopes in Figure 8 and leaves the remaining differences to be mostly insignificant, as discussed above and shown in Figure 6 and Table 4. Dynarski and Sheffrin (1990) do not control for fluctuations in

[4] The LR-test statistic is equal to 227 (the critical value is 38.9).
[5] Also note that 99% of the unemployed leave unemployment before the 20th quarter.

the composition of the newly unemployed over the business cycle, which may explain their findings that are in line with the pattern in Figure 8.

The seasonal differences in the probability of leaving unemployment show that there is relatively low demand for labour in the first and fourth quarter of a year (Table 3). This finding can be attributed to the Christmas holidays when job search and recruitment activity is low. The probability of leaving unemployment in the third quarter is 7.7% higher than in the second quarter.

The composition of the newly unemployed over the business cycle

Individuals who become unemployed in times of high economic growth are found to have on average a lower probability of leaving unemployment than those who become unemployed in times of high economic growth (Table 3). This finding does not support the hypothesis put forward in Darby et al. (1985) who argue that in time of low economic growth more individuals enter unemployment with longer spells of unemployment because they are more difficult to match. Abbring et al. (2001), for instance, also find no support for the hypothesis put forward in Darby et al. (1985). The difference in the probability of leaving unemployment between entrants in situations of high and low growth is large and significant (0.445 versus 0.568). As discussed above, the effect of this source of heterogeneity on the pattern of duration dependence is sufficiently to reduce the difference in the degree of negative genuine duration dependence over the business cycle to almost zero (Figures 6 and 8). Seasonal differences in the composition of the inflow with respect to the effect on the probability of leaving unemployment are small.

Individual heterogeneity

Table 3 shows that the regional differences in the probability of leaving unemployment are relatively small and marital status has no significant effect on the probability of leaving unemployment. In line with Layard et al. (1991) this leads to the conclusion that regional differences in unemployment rates are to a large extent due to differences in the incidence of unemployment.

As discussed in section 3 a discrete mass point approach is taken to model unobserved individual specific heterogeneity. As it turns out, two support points suffice under the normalization

of one of them being equal to 0. The distribution of unobserved heterogeneity is reported at the bottom of Table 3. The results make clear that controlling for individual heterogeneity is of major empirical importance when estimating the pattern of genuine duration dependence, as can also be inferred from comparing Figures 7 and 8. This finding is in contrast with the conclusions in Van den Berg and Van Ours (1994). Without controlling for unobserved heterogeneity one obtains stronger negative duration dependence in the probability of leaving unemployment.

5. Summary and Conclusions

The main objective of this study is to examine the cyclical sensitivity of genuine duration dependence in individuals' probabilities of leaving unemployment. The availability of individual-level data covering more than one economic cycle and with a relatively large number of observations makes it possible to disentangle the effects on the probability of leaving unemployment of elapsed duration (ranking effects), individual heterogeneity (sorting effects) and the business cycle. A quarterly series of the Gross Domestic Product is used to control for business cycle effects. The most important results can be summarized as follows:

(i) In line with previous studies, both ranking and sorting effects explain the decrease in the probability of leaving unemployment with elapsed duration.

(ii) Concerning the effects of the business cycle on the probability of leaving unemployment the results are in line with previous studies. The (baseline) probability of leaving unemployment within one quarter is about 64% lower in times of low economic growth than in times of high economic growth. In line with Layard et al. (1991) this implies that a large proportion of the increase in the national unemployment rate during a recession is due to an increase in individuals' durations of unemployment. This underlines the importance of controlling for business cycle effects when evaluating a policy designed to get the unemployed back into work.

(iii) Based on Figure 6 and Table 4 I conclude that the pattern of genuine negative duration dependence in individuals' probabilities of leaving unemployment does not change over the business

cycle. This conclusion is in conflict with the theoretical prediction of the standard ranking model of Blanchard and Diamond (1994) and with the results of some of the empirical studies discussed in the introduction. Moreover it is shown that the finding in previous studies such as Dynarski and Sheffrin (1990) that this pattern becomes stronger the more depressed the labour market is caused by failing to control for cyclical fluctuations in the composition of the newly unemployed (Figure 8). I find that individuals who become unemployed in times of low economic growth have on average a higher probability of leaving unemployment than those who become unemployed in times of high economic growth. This finding is not in support of the hypothesis put forward in Darby et al. (1985).

These findings carry a strong warning for policy assessment: unless controlled for cyclical fluctuations in the composition of the newly unemployed an evaluation of a policy designed to get the long-term unemployed back into employment will be biased towards a success in times of high economic growth and towards a failure in times of low economic growth.

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Appendix: Estimation results: the dependent variable is the duration in unemployment. The standard errors are in parentheses. The average log-likelihood function equals –6.27.

Covariate	p.e.	s.e.	Covariate	p.e.	s.e.
Constant	-1.25	0.02			
Genuine Duration Dependence (in Quarters) and Business Cycle Effects (LNGDP, Fig.5)					
Duration = 1	0.00	-	LNGDP	0.06	0.003
Duration = 2	-0.32	0.01	(Duration = 2)xLNGDP	-0.004	0.003
Duration = 3	-0.41	0.01	(Duration = 3)xLNGDP	0.01	0.003
Duration = 4	-0.62	0.01	(Duration = 4)xLNGDP	0.01	0.004
Duration = 5	-0.47	0.01	(Duration = 5)xLNGDP	0.02	0.004
Duration = 6	-0.59	0.01	(Duration = 6)xLNGDP	0.02	0.01
Duration = 7	-0.77	0.02	(Duration = 7)xLNGDP	0.02	0.01
Duration = 8	-0.96	0.02	(Duration = 8)xLNGDP	0.02	0.01
Duration = 9	-0.83	0.02	(Duration = 9)xLNGDP	-0.01	0.01
Duration = 10	-0.98	0.02	(Duration = 10)xLNGDP	0.02	0.01
Duration = 11	-1.01	0.03	(Duration = 11)xLNGDP	0.01	0.01
Duration = 12	-1.16	0.03	(Duration = 12)xLNGDP	0.01	0.01
Duration = 13	-1.10	0.03	(Duration = 13)xLNGDP	0.03	0.01
Duration = 14	-1.17	0.03	(Duration = 14)xLNGDP	0.02	0.01
Duration = 15	-1.13	0.04	(Duration = 15)xLNGDP	0.01	0.01
Duration = 16	-1.30	0.04	(Duration = 16)xLNGDP	0.05	0.02
Duration = 17	-1.24	0.04	(Duration = 17)xLNGDP	0.03	0.02
Duration = 18	-1.26	0.05	(Duration = 18)xLNGDP	0.03	0.02
Duration = 19	-1.20	0.05	(Duration = 19)xLNGDP	0.04	0.02
Duration = 20	-1.28	0.06	(Duration = 20)xLNGDP	0.04	0.02
Duration = 21	-1.27	0.06	(Duration = 21)xLNGDP	0.05	0.02
Duration = 22	-1.41	0.08	(Duration = 22)xLNGDP	0.08	0.03
Duration = 23	-1.21	0.07	(Duration = 23)xLNGDP	0.06	0.03
Duration = 24	-1.50	0.09	(Duration = 24)xLNGDP	0.09	0.03
Duration = 25	-1.29	0.09	(Duration = 25)xLNGDP	0.11	0.04
Duration = 26	-1.28	0.09	(Duration = 26)xLNGDP	0.08	0.04
Duration = 27	-1.45	0.11	(Duration = 27)xLNGDP	0.11	0.05
Duration = 28	-1.29	0.11	(Duration = 28)xLNGDP	0.10	0.05
Duration = 29	-1.45	0.13	(Duration = 29)xLNGDP	0.20	0.06
Duration = 30	-1.67	0.15	(Duration = 30)xLNGDP	0.22	0.07
Duration = 31	-1.51	0.14	(Duration = 31)xLNGDP	0.09	0.07
Duration > 31	-1.36	0.05	(Duration > 31)xLNGDP	0.15	0.02
Seasonal Effects					
First Quarter	0.00	-	Third Quarter	0.13	0.01
Second Quarter	0.06	0.01	Fourth Quarter	-0.13	0.01
Regional Effects					
South East	0.00	-	Yorkshire and Humberside	0.01	0.01
East Anglia	0.10	0.01	North West	-0.03	0.01
South West	0.07	0.01	North	-0.02	0.01
West Midlands	-0.05	0.01	Wales	-0.003	0.01
East Midlands	0.01	0.01	Scotland	0.004	0.01
			Northern Ireland	-0.13	0.02
Age Effects					
18-24 years	0.00	-	40-44 years	-0.02	0.03
25-29 years	-0.01	0.01	45-49 years	0.05	0.03
30-34 years	0.01	0.01	50-54 years	0.03	0.01
35-39 years	0.01	0.02	55-59 years	0.04	0.01
Effects of Marital Status			**Inflow Heterogeneity**		
Not Single	0.00	-	LNGDP	-0.03	0.002
Single	-0.006	0.006	First Quarter	0.00	-
Unobserved Heterogeneity			Second Quarter	0.01	0.01
ν_1, $Pr(\nu_i=\nu_1)=0.15$	0.00	-	Third Quarter	0.03	0.01
ν_2, $Pr(\nu_i=\nu_2)=0.85$	0.57	0.02	Fourth Quarter	0.05	0.01

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Figure 1: The number of unemployment related benefit claims per quarter.

Figure 2: The average elapsed duration of unemployment.

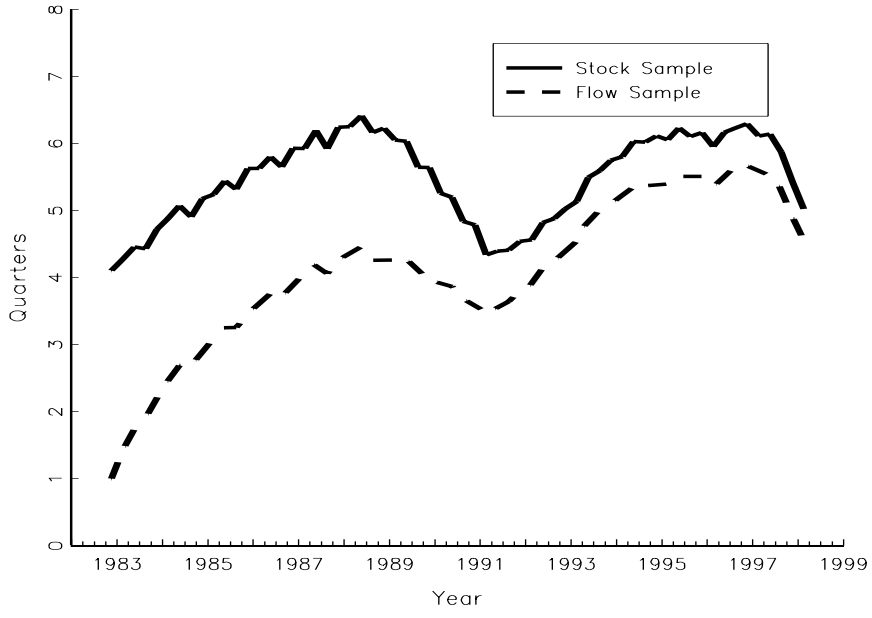


Figure 3: The quarterly flow into and out of unemployment.

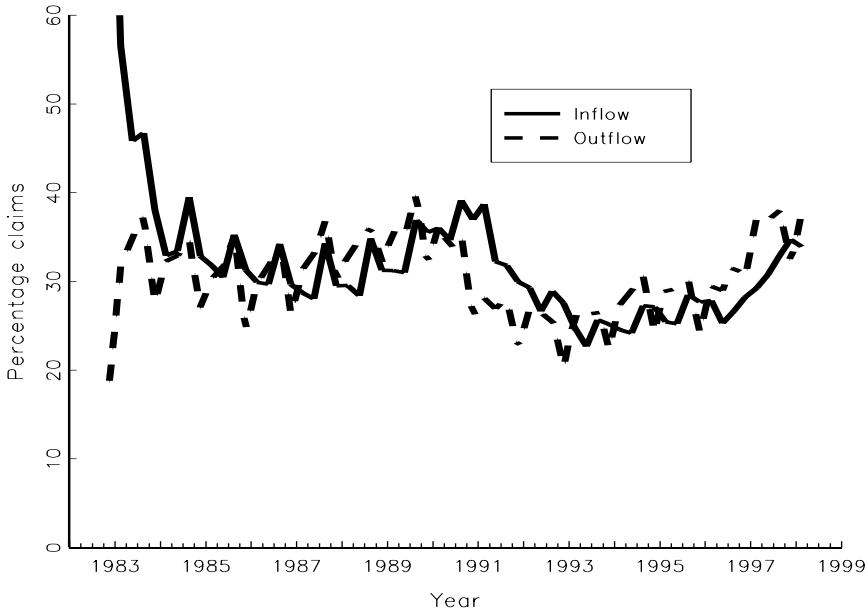


Figure 4: Kaplan-Meier estimates of the hazard of leaving unemployment within a quarter and the corresponding survival function up to 32 quarters in Unemployment.

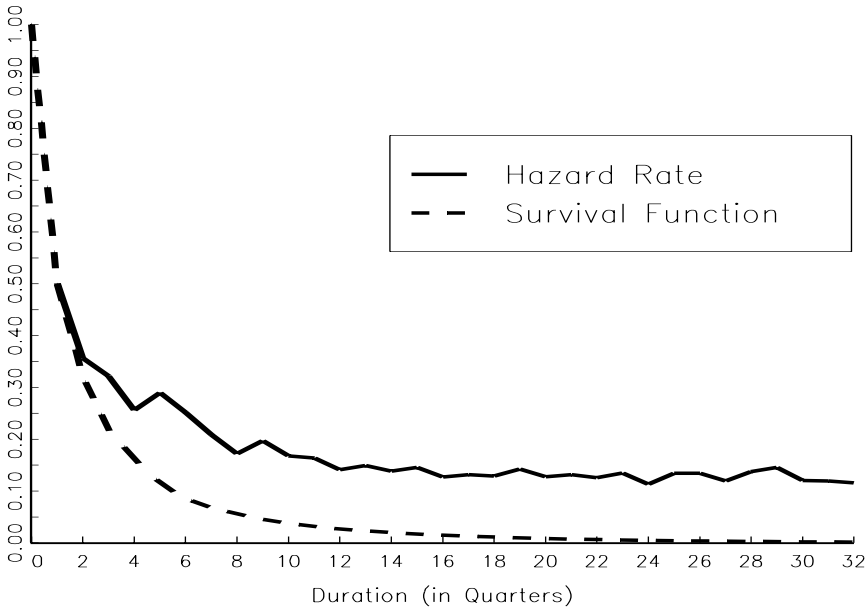


Table 1: Frequency distribution of the number of unemployment spells per individual.

Number of Spells	1	2	3	4	5	6	7	8	9	>9
% of Individuals	35.1	19.9	13.9	9.1	6.5	4.7	3.2	2.4	1.7	4.2

Table 2: The regional distribution of unemployment in the stock sample for selected quarters.

Cells: share	1982IV	1985IV	1988IV	1991IV	1994IV	1997IV
South East	0.25	0.25	0.22	0.30	0.30	0.27
East Anglia	0.03	0.03	0.02	0.03	0.03	0.03
South West	0.07	0.07	0.06	0.08	0.07	0.07
West Midlands	0.11	0.11	0.09	0.10	0.09	0.09
East Midlands	0.06	0.06	0.07	0.06	0.06	0.06
Yorkshire and Humberside	0.09	0.10	0.10	0.09	0.09	0.10
North West	0.15	0.14	0.15	0.13	0.11	0.12
North	0.07	0.07	0.09	0.06	0.07	0.07
Wales	0.06	0.06	0.06	0.05	0.05	0.05
Scotland	0.11	0.11	0.14	0.10	0.09	0.11
Northern Ireland	-	-	-	-	0.04	0.04
All Regions	1.00	1.00	1.00	1.00	1.00	1.00

Figure 5: Macroeconomic indicators. Source: National Statistics, www.statistics.gov.uk.

Table 3: The empirical results. Each cell contains the probability of leaving unemployment within a quarter. Standard errors are in parentheses. The reference probability is equal to 0.503 and the *'s show the corresponding characteristics.

Duration dependence over the business cycle	**Low Growth (LNGDP=-4)**	**Average Growth (LNGDP=0)**	**High Growth (LNGDP=4)**
Duration = 1 Quarter	0.392 (0.005)	0.503 (0.005)*	0.645 (0.009)
Duration = 2 Quarters	0.289 (0.004)	0.364 (0.004)	0.459 (0.007)
Duration = 4 Quarters	0.204 (0.004)	0.270 (0.004)	0.357 (0.007)
Duration = 8 Quarters	0.139 (0.005)	0.192 (0.004)	0.264 (0.010)
Duration = 12 Quarters	0.118 (0.006)	0.158 (0.005)	0.213 (0.011)
Duration = 16 Quarters	0.089 (0.008)	0.137 (0.006)	0.212 (0.015)
Duration = 20 Quarters	0.092 (0.012)	0.140 (0.008)	0.210 (0.019)
Duration = 24 Quarters	0.062 (0.012)	0.113 (0.010)	0.205 (0.025)
Duration = 28 Quarters	0.072 (0.019)	0.138 (0.015)	0.265 (0.047)
Duration = 32 Quarters	0.056 (0.006)	0.129 (0.007)	0.298 (0.030)
Season			
First Quarter	0.503 (0.005)*		
Second Quarter	0.532 (0.005)		
Third Quarter	0.573 (0.006)		
Fourth Quarter	0.444 (0.005)		
Composition of the newly unemployed			
Low Growth (LNGDP=-4)	0.568 (0.007)	First Quarter	0.503 (0.005)*
Average Growth (LNGDP=0)	0.503 (0.005)*	Second Quarter	0.505 (0.005)
High Growth (LNGDP=4)	0.445 (0.006)	Third Quarter	0.518 (0.005)
		Fourth Quarter	0.527 (0.005)
Region			
South East	0.503 (0.005)*		
East Anglia	0.555 (0.008)		
South West	0.537 (0.006)		
West Midlands	0.478 (0.005)		
East Midlands	0.507 (0.006)		
Yorkshire and Humberside	0.508 (0.005)		
North West	0.489 (0.005)		
North	0.493 (0.005)		
Wales	0.501 (0.006)		
Scotland	0.505 (0.005)		
Northern Ireland	0.443 (0.011)		
Age at the Start of the Spell of Unemployment			
18-24 years	0.503 (0.005)*		
25-29 years	0.496 (0.005)		
30-34 years	0.506 (0.005)		
35-39 years	0.507 (0.012)		
40-44 years	0.492 (0.014)		
45-49 years	0.529 (0.018)		
50-54 years	0.520 (0.008)		
55-59 years	0.522 (0.006)		
Marital Status			
Single	0.503 (0.005)		
Not Single (married/cohabiting)	0.500 (0.004)*		
Unobserved heterogeneity			
Low Skilled (ν_1=0.00, Pr(ν_i=ν_1)=0.15)	0.286 (0.007)		
High Skilled (ν_2=0.57, Pr(ν_i=ν_2)=0.85)	0.503 (0.005)*		

Figure 6: The pattern of genuine duration dependence over the business cycle when controlled for individual heterogeneity and cyclical fluctuations in the composition of the newly unemployed.

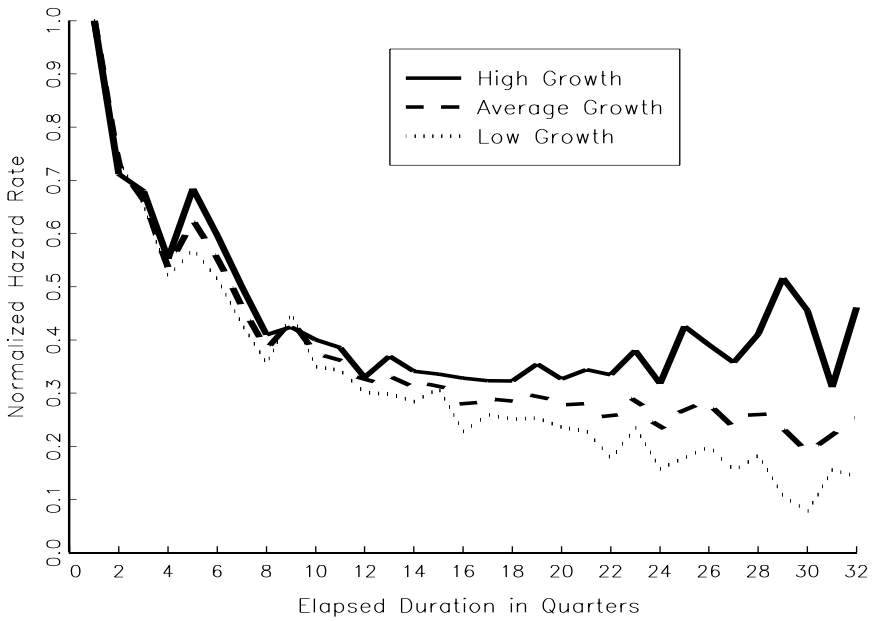


Table 4: Normalized hazard rates at three different states of the business cycle for selected durations. The standard errors are in parentheses.

Duration (in quarters)	1	2	4	8	12	16	20	24	28	32
Low growth	1.000	0.737	0.520	0.356	0.301	0.227	0.236	0.157	0.183	0.144
(LNGDP=-4)	(-)	(0.008)	(0.008)	(0.011)	(0.016)	(0.021)	(0.030)	(0.031)	(0.048)	(0.016)
Normal growth	1.000	0.724	0.536	0.382	0.315	0.273	0.277	0.224	0.274	0.257
(LNGDP=0)	(-)	(0.004)	(0.005)	(0.007)	(0.009)	(0.012)	(0.017)	(0.020)	(0.030)	(0.013)
High growth	1.000	0.712	0.553	0.410	0.330	0.328	0.326	0.318	0.410	0.461
(LNGDP=4)	(-)	(0.009)	(0.010)	(0.015)	(0.018)	(0.023)	(0.029)	(0.039)	(0.073)	(0.046)

Figure 7: The pattern of genuine duration dependence over the business cycle without controlling for individual heterogeneity and cyclical fluctuations in the composition of the newly unemployed.

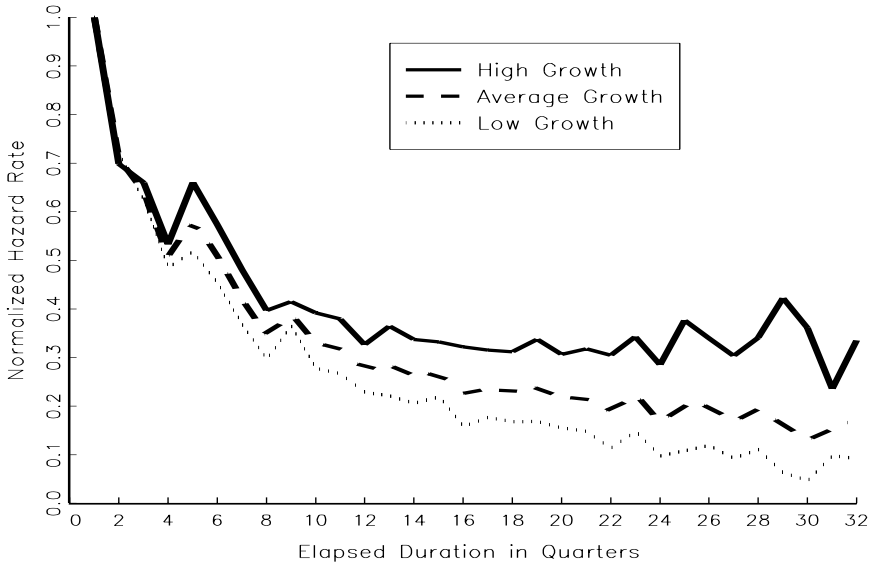
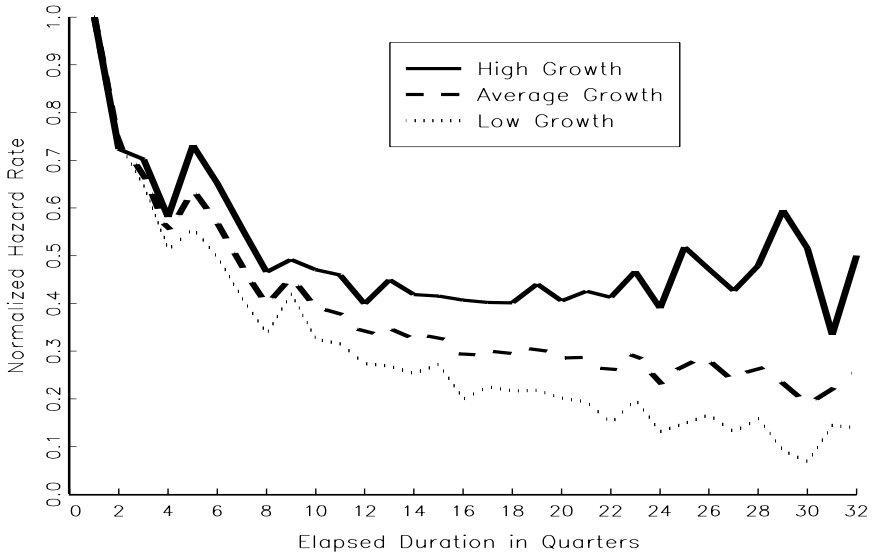


Figure 8: The pattern of genuine duration dependence over the business cycle when controlled for individual heterogeneity but not for cyclical fluctuations in the composition of the newly unemployed.



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