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The Duration of Unemployment and the Dynamics of Labour Sector Adjustment:

Parametric Evidence from the Canadian Annual Work Patterns Survey, 1978-80, 1982-85

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The Duration of Unemployment and the Dynamics of Labour Sector Adjustment

Contents

Foreword

Over the course of the last two years the Unemployment Issues Group of the Economic Council of Canada has been conducting research into various aspects of unemployment, and labour sector adjustment. The author of this study, who is currently a member of this group, argues that while the unemployment rate is one of the most cited indicators of the state of the economy, it does not, in itself, offer an unambiguous indication of the way in which the labour sector adjusts to change, or of the difficulties that individuals have in finding re-employment. This is because the unemployment rate is determined not only by the number of individuals that become unemployed but also by the length of time they spend unemployed. Accordingly the purpose of his study is to examine the determinants of the duration of unemployment spells, and therefore to shed some light upon how the labour sector responds to both positive and negative shocks.

While there are many studies of the duration of unemployment to be found in the economics literature very few are conducted over a time span that includes periods of both recession and recovery. One of the contributions of this work is to examine unemployment spell durations over the course of the business cycle. The most interesting conclusion that arises when data over the period 1978-85 are examined concerns the difficulties faced by older workers in finding re-employment after a job separation. While it was much more difficult for all individuals to find employment after the 1981-82 recession, older individuals, meaning those older than 55 years of age, were particularly disadvantaged. It is not simply that individuals of this age category have a lower probability of finding re-employment than their counterparts, this probability deteriorates, in both an absolute and a relative sense, progressively during the recession and during each year of the recovery. The author suggests that the labour sector appears to respond to change in an evolutionary way, shedding the old, hiring the young.

The study, however, does not address why the standing of older workers has deteriorated so profoundly. Is it because they lack the skills for the new jobs that are being created? Is it because they choose to retire? Or is it because they are pushed into involuntary retirement as a result of discriminatory hiring practices? These questions, which are central to the making of labour sector policy, remain to be answered. They pose a challenge to future researchers.

It should be noted while this research was conducted under the auspices of the Unemployment Issues Group the findings remain the sole responsibility of the author, in particular they have not been endorsed by the members of the Economic Council.

Judith Maxwell
Chairman

Abstract

The fact that the labour sector is continually confronted with shocks of both a positive and an adverse nature, that these shocks are likely to be more frequent and more severe in the coming years, and that a premium should be placed upon policies that promote flexibility and adjustment has been emphasized by numerous observers. The single most cited summary measure of the state of the labour sector is the unemployment rate, but this measure is an ambiguous indicator of the adjustment process. The unemployment rate may be high due to large inflows of individuals that end up spending very little time unemployed, a scenario that suggests adaptability, or it may be high because once they become unemployed individuals tend to spend very long periods without work, an indication of rigidity. In fact, it is the length of time spent in unemployment, not merely the fact of being unemployed, that is important for individual welfare and for an appreciation of the way in which the labour sector responds to change. Accordingly the purpose of the research reported in this paper is to examine the determinants of the duration of unemployment spells.

The data used in the study are derived from the Annual Work Patterns Survey for the years 1978-80, 1982-85, a period of time long enough to contain both positive and negative shocks. An unemployment spell is defined to begin when a transition from employment to unemployment is made, and it is defined to end when a transition back to employment from either unemployment or not in the labour force occurs. Thus the analysis applies strictly to individuals experiencing a job separation, for whatever reason.

Each year of the data is analysed separately by parametric models of spell duration. The validity of the results are limited by the use of explicit distributional assumptions, but an attempt is made to assess their robustness by using as many different distributions as possible. In fact the results are robust across distributions, but not across years.

At least three major results are obtained. First, and most importantly, there is a systematic relationship between the duration of unemployment and age that is subject to change over the period

under analysis. During the pre-1982 period spell duration and age are related by a U-shaped relationship in which the young and the old suffer significantly longer spells than the prime aged groups, but during the post-1982 period the experience of the young is indistinguishable from the prime age groups while that of the old deteriorates substantially, in both a relative and an absolute sense. Further, the "old" are identified to be those individuals 55 to 69 years of age, the behaviour of those 45 to 54 years of age being indistinguishable from the 35 to 44 year old group. Second, spell durations do not appear to differ that greatly between the provinces. Quebec and to a slightly lesser extent Newfoundland are notable exceptions to this rule, but in general spell duration does not depend in a systematic way upon regional variables regardless of the cyclical state of the economy. Third, there is no simple relationship between education and unemployment spell duration: higher levels of education sometimes imply shorter spell durations, and sometimes longer durations, and sometimes do not influence spell durations at all.

The results also offer an indication of the cyclical movement of average spell durations. In general, spell durations appear to move counter-cyclically. However, this pattern does vary among the subgroups of the data. In particular, the average spell length of unemployed older workers increases not only during 1982, but also during each year of the subsequent recovery.

These results allow one, in a speculative manner, to piece together a picture of the way the labour sector responds to shocks. In particular, it has been suggested in the literature that the focus of policy should be on the levels and distribution of the inflows into unemployment rather than on the duration of the time spent unemployed. The present results suggest, however, that adverse shocks are associated with a change in the structure of unemployment durations, not simply with the composition of the unemployed. Thus the persistence of unemployment rates that is observed over the sample period is at least in part due to longer unemployment spells, not simply to greater inflows of individuals that normally spend a long time unemployed. Further, the labour sector may be seen to respond to severe negative shocks in an evolutionary manner rather than by direct substitution of labour across sectors. Older workers in declining sectors that experienced an employment separation during the recovery were encouraged into what might be described as semi-permanent or permanent retirement, while younger workers were rehired at an increasing rate in the sectors of growth. If this picture is indeed accurate policymakers should respond with a mix of policies that offer both assistance for adjustment, and compensation for loss.

Acknowledgment

An earlier draft of this paper was prepared under contract with the Unemployment Issues Group of the Economic Council of Canada. This revision has benefited from the comments of C. Beach, S. Kaliski, R. Jenness, and W. Simpson. The contents of the paper remain, however, the sole responsibility of the author and they do not, in particular, represent the views of the Economic Council of Canada. Comments and criticisms are welcome and may be addressed to the author, care of the Economic Council.

Introduction

If a single word were to be used to summarize the emerging priorities in the making of labour sector policy a prime candidate would surely be "adjustment." The fact that the labour sector is continually confronted with shocks of both a positive and an adverse nature, that these shocks are likely to be more frequent and more severe in the coming years, and that a premium should be placed upon policies that promote flexibility and "adjustment" has been emphasized by numerous observers, the federal government's Advisory Council on Adjustment being only the most recent. The single most cited summary measure of the state of the labour sector is the unemployment rate, but this measure is an ambiguous indicator of the nature of the adjustment process. For example, the unemployment rate may be high due to large inflows of individuals that end up spending very little time unemployed, a scenario that suggests adaptability, or it may be high because once they become unemployed individuals tend to spend very long periods without work, an indication of rigidity. It is, therefore, important to distinguish the role played by the incidence of unemployment from that played by the duration of unemployment. In fact, it is the length of time spent in unemployment, not merely the fact of being unemployed, that is important for an individual's welfare and for an appreciation of the way in which they respond to change. Accordingly, the purpose of the research reported in this paper is to examine the determinants of the duration of unemployment spells.

In fact, there is little systematic Canadian evidence on how the duration of unemployment varies across individuals and over the business cycle. One possible reason for this concerns the nature of the available data. Measures of the duration of unemployment from the Labour Force Survey are obtained by interviewing individuals that are currently unemployed. Thus, while it may be possible to determine when an individual's spell of unemployment began it is impossible to ascertain when it will end. As a result analyses on these truncated spell lengths as well as on the associated gross flows between labour force states are often conducted under a steady state assumption, an assumption that is manifestly false. Longitudinal information on individual labour force activity would in principle offer information on completed spell lengths and permit a non-steady state analysis but in actuality are either unavailable for very long time horizons or are not fully representative of the labour force.[1]

The data used in the present study are derived from the Annual Work Patterns Survey (AWPS) for the years 1978-80, 1982-85, a period of time long enough to contain both positive and negative shocks and to hopefully offer some evidence on the nature of the adjustment process. The AWPS is a retrospective data set containing information on the labour force status of individual respondents for each month of a given year, a different sample of individuals being interviewed each January. Thus, the seven years of available data represent a series of one year windows through which to view the dynamics of individual labour force activity.[2] For the purposes of this study an unemployment spell is defined to begin when a transition from employment to unemployment is made, and it is defined to end when a transition back to employment from either unemployment or not in the labour force occurs. Section 1 of the paper describes the data in greater detail and offers a justification for this particular definition of an unemployment spell.

The data are potentially subject to problems of truncation from both the left and the right. The former is dealt with by considering only unemployment spells that have begun during the year, while the latter is explicitly addressed by the estimation procedure. The methodology underlying this procedure and the results obtained are the subject of section 2. Each year of data is analysed separately by parametric models of spell duration. The validity of the results are limited by the use of explicit functional forms, but an attempt is made to assess their robustness by using as many different functions as possible. In particular, accelerated life-time models under the assumption that the errors take an exponential, Weibull, log-logistic, and log-normal distribution are all estimated, as in Cox's proportional hazards model which is a distribution free method.[3]

At least three major results are obtained. First, there is a systematic relationship between the duration of unemployment and age that is subject to change over the period under analysis. During the pre-1982 period spell duration and age are related by a U-shaped relationship in which the young and the old suffer significantly longer spells than the prime age groups, but during the post-1982 period the experience of the young is indistinguishable from the prime age groups while that of the old deteriorates substantially. Further, the "old" are found to be those individuals 55 to 69 years of age. The behaviour of individuals 45 to 54 years of age is not found to be significantly different than those 35 to 44 years of age. Second, spell durations do not appear to differ that greatly between the provinces. Quebec and to a slightly lesser extent Newfoundland are notable exceptions to this rule, but in general spell duration does not depend in a systematic way upon regional variables regardless of the cyclical state of the economy. Third, there is no simple relationship between education and unemployment spell duration: higher levels of education sometimes imply shorter spell durations, and sometimes longer durations, and sometimes do not influence spell durations at all.

The results also offer an indication of the cyclical movement of average spell durations. In general, spell durations appear to move counter-cyclically. However, this pattern does vary among the subgroups of the data. In particular, the average spell length of unemployed older workers increases during 1982, but also during each year of the subsequent recovery.

Section 3 discusses these results in the context of the existing literature and attempts, in a speculative manner, to piece together a picture of the way the labour sector responds to shocks. In particular, it has been suggested by Darby, Haltiwanger, and Plant (1985), (1986) that the focus of policy should be on the levels and distribution of the inflows into unemployment rather than on the duration of unemployment. The present analysis, while agreeing with some aspects of the analysis underlying this conclusion, suggests that adverse shocks are associated with a change in the structure of unemployment spell durations, not simply with the composition of the unemployed. Thus persistence of unemployment is at least in part due to longer unemployment spells per se, not simply to changes in the composition of the unemployed. As such policymakers should focus upon how individuals, particularly those aged 55 to 69 years, leave unemployment.

There is a need for more research to confirm or refute this inference. The present study is subject to several limitations and these, along with some topics for future analyses, are given attention in the concluding section of the paper.

Data Description and a Preliminary Analysis

The Annual Work Patterns Survey contains retrospective information on the timing and length of periods that an individual spends in unemployment (U), employment (E), and not in the labour force (N).

The Survey is administered to 5 of the 6 rotation groups in the January Labour Force Survey and addresses their labour force experience over the past year. Data are available for 1977-80 and 1982-85. The 1977 data are not included in this study because of a change in the questionnaire. Data are not available for 1981 and the Survey was replaced in 1986 by the Labour Market Activity Survey.

Individuals are assigned a labour force status for each month of the year and a particular algorithm is used to arrange these individual monthly statuses into a sequence for the entire year. The algorithm, which is described in Statistics Canada (1982), serves to maximize the length of time that an individual spends in employment. The basic unit of measure is a so-called "part-month," which may essentially be thought of as one-half month.

The analysis is conducted with the micro data types provided by Statistics Canada in which the individual records are survey respondents. A spell file was created from these tapes making the unit of observations an unemployment spell. Thus, information on whether an individual experienced multiple spells or not is discarded.[4] A spell is defined to begin with an *E-U* transition, and to continue until a transition is made back to employment. After the first period of unemployment any transitions between unemployment and not-in-the-labour-force are ignored so that spells may end with a *U-E* transition or with a *N-E* transition. Thus, the analysis applies strictly to those individuals leaving their jobs, for whatever reason.

The reasons for using this definition of spell duration are at least three in number. First, and most importantly, permitting an unemployment spell to end when an individual left the labour force would simply imply that the sequencing algorithm was being retraced. The resulting spell durations would be artificial constructions from this algorithm rather than reflections of the actual transitions undertaken. Second, the difference between unemployment and not-in-the-labour-force is very soft in this data set suggesting that there may not be a great behavioural distinction between the two states and that it is therefore appropriate to aggregate them into a single state. Job search at any one point during the month is sufficient to lead to an unemployment classification, an individual cannot by the definitions used in the Survey be both unemployed and out of the labour force during the same month even though most individuals are not likely to have searched for work continuously throughout the month.[5]

Further, the requirement in the constructed spell file that the individual have an unemployment classification immediately after the employment separation will have the effect of removing those individuals not able to work from the analysis, while the lack of distinction between subsequent periods of *U* and *N* will explicitly permit discouragement to be reflected in the data.[6] Finally, the definition of unemployment permits the analysis to be conducted as a two-state model. In fact, the aggregation of labour force states for this purpose is often done because the econometrics is made more tractable. If an unemployment spell is permitted to end with exit to employment or exit from the labour force a competing risks model would be necessary. Identification of the model parameters is much more difficult in such a case. In fact, employment has often been aggregated with not-in-the-labour-force: examples of such work include Darby, Haltiwanger, and Plant (1987) and much of the work of Hasan and deBroucker (1982), (1985). If the analysis must be restricted to a two-state model it seems preferable that unemployment and non-in-the-labour-force be aggregated together. Kiefer (1985), Dynarski and Shefferin (1987) and some of the work of Clark and Summers (1979) are examples of studies that have used such an aggregation.

A number of limitations in the data should be noted. First, the time horizon of the analysis is restricted to one year. Any projections of spell durations beyond this limit are therefore questionable. Second, the co-variates available are limited to demographic, educational, and regional variables. Potentially important determinants of spell duration such as reason for job separation, reservation wages, industry/occupation, and receipt of unemployment insurance payments are not available. Finally, the data may be subject to problems of recall.

Table 1 summarizes the number of completed and truncated spells in each year of the available data. Roughly 60 per cent of the spells are right truncated and there are, by construction, no left truncated spells. The large percentage of incomplete spells is due to the one year horizon of the survey. Most spells beginning in the latter part of the year will, unless they are rather short, be in progress at the time of the survey in January of the following year. Further, the one year horizon in conjunction with the definition of how a spell may be initiated makes it impossible to observe spells longer than 11.5 months. Table 2 presents the sample proportions for each of the available co-variates by year. The co-variates may be divided into four broad groups: demographic, educational, regional, and the date at which the spell started. The sample proportions are relatively stable throughout the period, but there are some notable exceptions. The fraction of household heads, of males, and of married individuals increases slightly in 1982 at the outset of the recession but returns rather quickly to pre-recession levels in the following years. The major change with respect to age concerns the fact that the proportion of spells incurred by prime aged individuals (those 25-44 years of age) increases over the years while that incurred by younger individuals (15 to 19 years of age) falls. These changes coincide with the 1982 recession. The proportion of spells due to individuals in the oldest age category stays relatively constant. This is also the case for the proportion of spells incurred by individuals that claimed to be students at some point during the year. There is, however, a tendency for a greater fraction of spells to be accounted for by the more educated over time. The proportion of spells due to those with none or elementary education falls from a high of 23.5 per cent in 1978 to a low of 15.1 per cent in 1985, while that due to those with some postsecondary education, postsecondary graduation, or some university rises.[7]

Table 1

Annual Work Patterns Survey Spell Data, 1978-80, 1982-85

Year	Total number of spells	Completed spells		Truncated spells	
1978	9,627	3,722	(38.7)	5,905	(61.3)
1979	9,522	3,592	(37.7)	5,930	(62.3)
1980	9,877	3,843	(38.9)	6,034	(61.1)
1982	14,265	5,789	(40.6)	8,476	(59.4)
1983	12,156	4,857	(40.0)	7,299	(60.0)
1984	12,168	4,593	(37.8)	7,575	(62.2)
1985	11,371	4,483	(39.4)	6,888	(60.6)

(.) Indicates row per cent.

Table 2

Sample Proportions of Co-Variates, AWPS Spell Data, 1978-80, 1982-85

	1978	1979	1980	1982	1983	1984	1985
Demographic							
Household head	50.2	51.0	51.5	52.8	51.1	50.5	50.7
Not head	49.8	49.0	48.5	47.2	48.9	49.5	49.3
Male	63.9	63.3	65.2	66.8	64.8	63.0	61.9
Female	36.1	36.7	34.8	33.2	35.2	37.0	38.1
Married	58.6	56.7	55.4	59.0	56.2	56.9	56.0
Single	36.5	38.0	39.0	35.4	37.7	36.8	37.2
Other	4.9	5.3	5.6	5.6	6.1	6.3	6.8
35-44 years	14.6	14.6	15.0	17.1	16.5	17.6	17.5
15-19 years	18.6	18.3	18.4	13.7	13.9	11.3	12.6
20-24 years	22.3	22.8	23.0	22.1	23.3	22.9	22.5
25-34 years	27.5	27.5	27.6	29.5	29.8	32.2	31.7
45-54 years	10.6	10.5	10.1	11.4	10.2	10.2	9.4
55-69 years	6.4	6.3	5.9	6.2	6.3	5.8	6.3
Educational							
Not student	86.4	87.2	87.5	88.7	87.9	88.2	87.5
Student	13.6	12.8	12.5	11.3	12.1	11.8	12.5
Some high school	57.2	59.3	58.6	59.1	58.7	58.0	58.8
None or elementary	23.5	21.9	21.6	18.8	17.1	15.5	15.1
Some postsecondary	6.9	6.5	6.9	7.7	8.6	9.2	8.9
Postsecondary grad	7.8	7.9	8.3	9.7	10.4	11.1	11.4
University	4.6	4.4	4.6	4.7	5.2	6.2	5.8
Regional							
Ontario	17.7	18.6	19.4	19.4	17.4	16.6	15.7
Newfoundland	8.8	7.5	7.2	6.6	7.8	7.4	8.2
Prince Edward Island	3.5	3.6	3.1	3.2	3.7	3.2	3.1
Nova Scotia	7.3	6.8	6.9	6.8	7.1	7.3	7.6
New Brunswick	9.3	9.8	9.9	8.5	9.9	9.5	9.2
Quebec	17.3	17.5	17.0	15.9	15.2	15.3	16.5
Manitoba	6.6	6.1	6.4	6.7	6.5	5.4	5.5
Saskatchewan	5.8	5.6	6.3	5.8	7.2	7.4	7.5
Alberta	9.6	10.4	10.5	11.9	11.8	15.2	14.1
British Columbia	14.1	14.1	13.3	15.2	13.4	12.7	12.6
Start Date							
3rd quarter	30.7	28.4	30.0	32.8	32.2	31.7	32.0
1st quarter	12.0	11.5	12.3	12.0	12.5	11.8	11.8
2nd quarter	19.0	19.1	20.7	21.3	20.1	19.2	20.8
4th quarter	38.3	41.0	37.0	33.9	35.2	37.3	35.4

(.) Indicates row per cent.

Corak (1989a) has examined this data set in a preliminary manner by calculating empirical hazard rates and survivor functions over all years but classified by gender, marital status, age, and province. The analysis is repeated here on a disaggregation by year. The derivation of the empirical hazard rates is performed by the life-table method with intervals defined by the one-half month intervals in which the data is measured. The procedure is outlined in Kalbfleisch and Prentice (1982, pp. 15-19) and may be briefly described as follows. If t indexes spell duration and j indexes the duration intervals then the number of individuals that face the possibility of ending their spell of unemployment at the jth interval is $n_j \equiv \Sigma_{t \geq j}(d_t + m_t)$ where d_t represents the number of completed spells of duration t and m_t represents the number of truncated spells of similar duration. The life-table estimator of the conditional probability that a spell will end during interval j is given as $\hat{h}_j = d_j/[n_j - m_j/2]$. This is simply the number of spells that actually end during the interval divided by the number of spells that could potentially have ended adjusted for the fact that not all of the n_j spells are at risk of ending for the entire interval, and is often referred to as the hazard rate.

Table 3 presents the results of such a derivation and Figure 1 plots the hazard rates by spell duration for the aggregate data set.[8] The hazard rises sharply during the first month of unemployment and then falls just as sharply during the second month. It continues to fall after two months but with a decreasing rate, and taking into account the standard errors of the estimates is pretty much constant after four or five months of unemployment. There is a tendency for it to fall after 10 months but it is likely that this is due to the fact that there are relatively few observations lasting that long. Although there are variations in the level of the hazard this general pattern holds for all of the years under analysis. The most likely explanation for the spike in the hazard during the 0.5 to 1.0 month interval concerns problems of recall. It is probable that respondents experiencing spells of unemployment that last less than one month report them as being one month in length.[9]

A more rigorous assessment of the shape of the hazard may be obtained by considering the survivor function and some explicit functional forms. The empirical survivor function is readily derived from knowledge of the hazard rates as $\hat{G}_t = \Pi^{j}_{t=1}(1-\hat{h}_j)$. If the hazard is a constant, say γ, then spell durations are distributed as

Table 3

Empirical Hazard Rates, AWPS Data, 1978-80, 1982-85

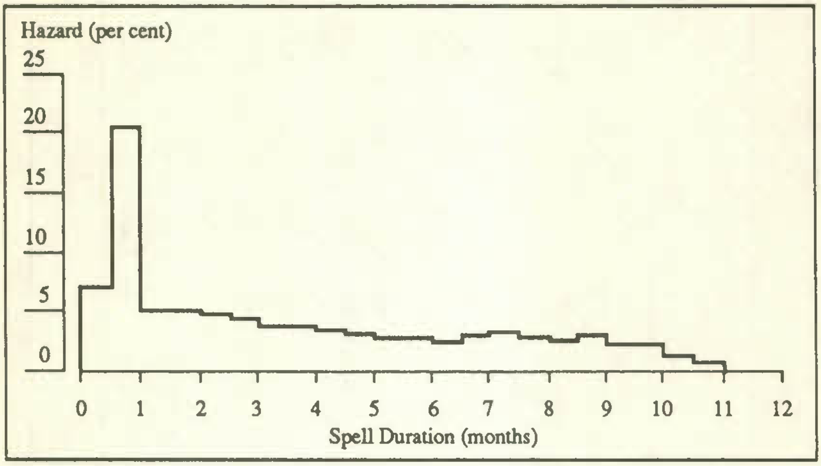
Duration interval (months)	All years	1978	1979	1980	1982	1983	1984	1985
0.0 to 0.5	0.0703 (0.0009)	0.0652 (0.0026)	0.0722 (0.0027)	0.0757 (0.0027)	0.0719 (0.0022)	0.0703 (0.0024)	0.0645 (0.0023)	0.0726 (0.0025)
0.5 to 1.0	0.2031 (0.0016)	0.2048 (0.0046)	0.2085 (0.0047)	0.2023 (0.0045)	0.2033 (0.0036)	0.2069 (0.0040)	0.1960 (0.0040)	0.2010 (0.0041)
1.0 to 1.5	0.0504 (0.0010)	0.0521 (0.0029)	0.0548 (0.0031)	0.0486 (0.0028)	0.0524 (0.0023)	0.0484 (0.0025)	0.0509 (0.0025)	0.0463 (0.0025)
1.5 to 2.0	0.0486 (0.0011)	0.0477 (0.0030)	0.0475 (0.0031)	0.0477 (0.0030)	0.0514 (0.0025)	0.0491 (0.0027)	0.0456 (0.0026)	0.0499 (0.0028)
2.0 to 2.5	0.0475 (0.0011)	0.0547 (0.0035)	0.0500 (0.0035)	0.0484 (0.0032)	0.0468 (0.0026)	0.0434 (0.0027)	0.0482 (0.0028)	0.0434 (0.0028)
2.5 to 3.0	0.0435 (0.0012)	0.0430 (0.0034)	0.0420 (0.0034)	0.0496 (0.0035)	0.0429 (0.0027)	0.0438 (0.0029)	0.0416 (0.0029)	0.0426 (0.0030)
3.0 to 3.5	0.0369 (0.0012)	0.0403 (0.0035)	0.0409 (0.0036)	0.0323 (0.0031)	0.0411 (0.0028)	0.0337 (0.0028)	0.0327 (0.0027)	0.0375 (0.0030)
3.5 to 4.0	0.0366 (0.0012)	0.0367 (0.0036)	0.0380 (0.0038)	0.0367 (0.0036)	0.0334 (0.0028)	0.0435 (0.0034)	0.0337 (0.0030)	0.0356 (0.0032)
4.0 to 4.5	0.0326 (0.0013)	0.0339 (0.0038)	0.0343 (0.0039)	0.0422 (0.0041)	0.0293 (0.0028)	0.0303 (0.0031)	0.0327 (0.0032)	0.0285 (0.0031)
4.5 to 5.0	0.0301 (0.0013)	0.0316 (0.0040)	0.0218 (0.0034)	0.0332 (0.0040)	0.0315 (0.0031)	0.0311 (0.0034)	0.0307 (0.0034)	0.0289 (0.0034)
5.0 to 5.5	0.0267 (0.0013)	0.0317 (0.0043)	0.0347 (0.0046)	0.0299 (0.0040)	0.0257 (0.0030)	0.0212 (0.0030)	0.0262 (0.0033)	0.0215 (0.0032)
5.5 to 6.0	0.0263 (0.0015)	0.0227 (0.0040)	0.0209 (0.0040)	0.0255 (0.0041)	0.0255 (0.0033)	0.0311 (0.0040)	0.0263 (0.0037)	0.0296 (0.0041)
6.0 to 6.5	0.0235 (0.0016)	0.0269 (0.0048)	0.0258 (0.0049)	0.0257 (0.0046)	0.0178 (0.0031)	0.0229 (0.0038)	0.0238 (0.0039)	0.0253 (0.0043)
6.5 to 7.0	0.0262 (0.0018)	0.0210 (0.0046)	0.0227 (0.0050)	0.0269 (0.0050)	0.0291 (0.0042)	0.0314 (0.0048)	0.0194 (0.0038)	0.0303 (0.0051)
7.0 to 7.5	0.0290 (0.0020)	0.0331 (0.0063)	0.0257 (0.0058)	0.0305 (0.0058)	0.0182 (0.0037)	0.0336 (0.0054)	0.0308 (0.0052)	0.0342 (0.0060)
7.5 to 8.0	0.0278 (0.0022)	0.0352 (0.0071)	0.0223 (0.0059)	0.0270 (0.0060)	0.0310 (0.0052)	0.0231 (0.0050)	0.0238 (0.0050)	0.0327 (0.0064)
8.0 to 8.5	0.0240 (0.0022)	0.0306 (0.0073)	0.0226 (0.0065)	0.0232 (0.0061)	0.0180 (0.0045)	0.0175 (0.0048)	0.0247 (0.0056)	0.0354 (0.0074)
8.5 to 9.0	0.0256 (0.0026)	0.0283 (0.0081)	0.0242 (0.0076)	0.0237 (0.0071)	0.0187 (0.0051)	0.0241 (0.0064)	0.0312 (0.0070)	0.0313 (0.0080)
9.0 to 9.5	0.0205 (0.0027)	0.0166 (0.0074)	0.0134 (0.0067)	0.0089 (0.0051)	0.0270 (0.0071)	0.0191 (0.0067)	0.0281 (0.0077)	0.0232 (0.0081)
9.5 to 10.0	0.0222 (0.0034)	0.0180 (0.0089)	0.0139 (0.0080)	0.0167 (0.0083)	0.0281 (0.0088)	0.0198 (0.0080)	0.0322 (0.0095)	0.0196 (0.0087)
10.0 to 10.5	0.0089 (0.0027)	0.0137 (0.0096)	0.0074 (0.0074)	0.0000 (..)	0.0095 (0.0067)	0.0050 (0.0050)	0.0183 (0.0091)	0.0056 (0.0056)
10.5 to 11.0	0.0044 (0.0025)	0.0000 (..)	0.0137 (0.0136)	0.0000 (..)	0.0086 (0.0086)	0.0000 (..)	0.0000 (..)	0.0097 (0.0097)
11.0 to 11.5	0.0000 (..)	0.0000 (..)	0.0000 (..)	0.0000 (..)	0.0000 (..)	0.0000 (..)	0.0000 (..)	0.0000 (..)

(.) Indicates standard error.

(..) Indicates undefined.

Chart 1

Empirical Hazard Rates, AWPS Data, 1978-80, 1982-85



an exponential distribution and therefore the survivor function takes the form $G_t = exp(-\gamma t)$. Taking natural logarithms of this expression yields the suggestion that a least squares regression of $-ln(\hat{G}_t)$ on t should yield a perfect fit through the origin with the coefficient on t representing an estimate of γ. The Weibull distribution, on the other hand, permits the hazard to monotonically increase or decrease with spell duration. In this case the hazard takes the form given by $h_t = \gamma\alpha t^{\alpha-1}$, rising if α is greater than 1, falling if it is less than 1, and constant when α is equal to 1. The associated survivor function is $G_t = exp(-\gamma t^{\alpha})$ which suggests that $ln(-lnG_t) = ln\gamma + \alpha lnt$, and the R^2 from a least squares regression will once again offer a test of the appropriateness of the assumed functional form.[10] Finally, the log logistic is a functional form that permits the hazard to both rise and fall with spell duration. In this case the hazard is given as $h_t = \gamma a t^{\alpha-1}/(1+\gamma t^{\alpha})$ and the survivor function is $G_t = 1/(1+\gamma t^{\alpha})$. The latter may be estimated by non-linear least squares.

The empirical survivor functions derived from the data in Table 3 are presented in Table 4, and the results from the regressions testing each of the above functional forms is presented in Table 5. The low values of the R^2 in panels 1 and 2 of this table suggest that both the exponential and the Weibull models are inappropriate, while the fit of the log logistic model is nearly perfect.[11] This confirms the visual impression obtained by a simple examination of the empirical hazard rates, and should not be taken to offer actual estimates of the parameters in question because of the heterogenous nature of the data. When the number of co-variates is small a reasonable means of proceeding is to sub-divide the data and conduct the analysis on each group separately. This is not feasible in the present case. The alternative of estimating fully parametric models of spell duration is pursued in the following section.

Methodology and Estimation Results

Accelerated failure time models are described by Cox and Oakes (1984, pp. 62-70, 85-87), and Kalbfleisch and Prentice (1980, pp. 33-35, 54-62), and have been employed in studies of unemployment spell durations by *inter alia* Addison and Portugal (1987). Proportional hazards models have, at least since the work of Lancaster (1979), been the preferred method for such studies, but the two methods are in fact equivalent when the exponential or Weibull distributions are assumed, which is more often than not the case.[12] Briefly, it is assumed that spell duration is influenced multiplicatively by the explanatory variables, or equivalently that the natural logarithm of spell duration is linearly related to them. If t indexes spell duration then

$$t = exp(X\beta)t_o^{\sigma}$$

$$lnt = X\beta + \sigma\epsilon \qquad (1)$$

where ϵ may be thought of as an error with probability density function $g(.)$, σ is a scale parameter, $t_o = exp(\epsilon)$, and X is a vector of co-variates the first element of which signifies a constant. The main concern in the present analysis is to obtain estimates of β, which, with a change of sign, may also be thought of as parameters of the hazard function. When the data set consists of truncated spell lengths least squares estimation of (1) will be biased and inefficient and resort must be made to maximum likelihood. In such cases the contribution to the likelihood of a completed unemployment spell will be the density $g((lnt\text{-}X\beta)/\sigma)$ while that of a truncated spell will be a probability given by the survivor function $G(.)$.[13] The above sources offer details on the estimation procedure. In what follows the estimation is conducted by year for the exponential, Weibull, log logistic,

Table 4

Empirical Survivor Functions, AWPS Data, 1978-80, 1982-85

Duration interval (months)	All years	1978	1979	1980	1982	1983	1984	1985
0.0 to 0.5	1.0000 (0.0000)	1.0000 (0.0000)	1.0000 (0.0000)	1.0000 (0.0000)	1.0000 (0.0000)	1.0000 (0.0000)	1.0000 (0.0000)	1.0000 (0.0000)
0.5 to 1.0	0.9297 (0.0009)	0.9348 (0.0026)	0.9278 (0.0027)	0.9243 (0.0027)	0.9282 (0.0022)	0.9297 (0.0024)	0.9355 (0.0023)	0.9274 (0.0025)
1.0 to 1.5	0.7409 (0.0016)	0.7434 (0.0047)	0.7344 (0.0049)	0.7373 (0.0047)	0.7394 (0.0038)	0.7373 (0.0042)	0.7521 (0.0041)	0.7410 (0.0043)
1.5 to 2.0	0.7036 (0.0017)	0.7047 (0.0050)	0.6942 (0.0051)	0.7015 (0.0049)	0.7007 (0.0040)	0.7017 (0.0043)	0.7138 (0.0044)	0.7067 (0.0045)
2.0 to 2.5	0.6694 (0.0018)	0.6711 (0.0052)	0.6612 (0.0053)	0.6680 (0.0051)	0.6647 (0.0042)	0.6672 (0.0045)	0.6813 (0.0046)	0.6714 (0.0047)
2.5 to 3.0	0.6376 (0.0019)	0.6344 (0.0054)	0.6281 (0.0056)	0.6357 (0.0054)	0.6336 (0.0043)	0.6385 (0.0047)	0.6484 (0.0048)	0.6422 (0.0049)
3.0 to 3.5	0.6099 (0.0019)	0.6071 (0.0056)	0.6018 (0.0058)	0.6042 (0.0056)	0.6065 (0.0045)	0.6103 (0.0049)	0.6214 (0.0049)	0.6149 (0.0050)
3.5 to 4.0	0.5874 (0.0020)	0.5827 (0.0058)	0.5772 (0.0059)	0.5847 (0.0057)	0.5816 (0.0046)	0.5897 (0.0050)	0.6011 (0.0051)	0.5918 (0.0052)
4.0 to 4.5	0.5658 (0.0021)	0.5613 (0.0060)	0.5552 (0.0061)	0.5633 (0.0059)	0.5621 (0.0047)	0.5641 (0.0052)	0.5809 (0.0052)	0.5708 (0.0054)
4.5 to 5.0	0.5474 (0.0021)	0.5423 (0.0061)	0.5362 (0.0063)	0.5395 (0.0061)	0.5457 (0.0049)	0.5470 (0.0053)	0.5619 (0.0054)	0.5545 (0.0055)
5.0 to 5.5	0.5310 (0.0022)	0.5252 (0.0063)	0.5245 (0.0064)	0.5216 (0.0062)	0.5285 (0.0050)	0.5300 (0.0055)	0.5447 (0.0055)	0.5385 (0.0057)
5.5 to 6.0	0.5168 (0.0022)	0.5085 (0.0065)	0.5063 (0.0066)	0.5061 (0.0064)	0.5149 (0.0051)	0.5187 (0.0056)	0.5304 (0.0057)	0.5269 (0.0058)
6.0 to 6.5	0.5032 (0.0023)	0.4970 (0.0067)	0.4957 (0.0068)	0.4932 (0.0066)	0.5018 (0.0053)	0.5026 (0.0058)	0.5165 (0.0059)	0.5113 (0.0060)
6.5 to 7.0	0.4914 (0.0024)	0.4836 (0.0069)	0.4830 (0.0071)	0.4805 (0.0068)	0.4928 (0.0054)	0.4911 (0.0060)	0.5042 (0.0061)	0.4984 (0.0063)
7.0 to 7.5	0.4785 (0.0025)	0.4735 (0.0072)	0.4720 (0.0073)	0.4675 (0.0070)	0.4785 (0.0057)	0.4756 (0.0063)	0.4945 (0.0063)	0.4833 (0.0066)
7.5 to 8.0	0.4646 (0.0026)	0.4578 (0.0075)	0.4599 (0.0076)	0.4533 (0.0073)	0.4698 (0.0058)	0.4597 (0.0066)	0.4792 (0.0066)	0.4667 (0.0070)
8.0 to 8.5	0.4517 (0.0027)	0.4417 (0.0080)	0.4496 (0.0079)	0.4410 (0.0076)	0.4552 (0.0062)	0.4490 (0.0068)	0.4678 (0.0069)	0.4515 (0.0074)
8.5 to 9.0	0.4409 (0.0028)	0.4281 (0.0084)	0.4394 (0.0083)	0.4308 (0.0079)	0.4470 (0.0064)	0.4412 (0.0071)	0.4563 (0.0072)	0.4355 (0.0079)
9.0 to 9.5	0.4296 (0.0030)	0.4160 (0.0088)	0.4288 (0.0087)	0.4206 (0.0083)	0.4387 (0.0067)	0.4306 (0.0074)	0.4420 (0.0077)	0.4219 (0.0084)
9.5 to 10.0	0.4208 (0.0032)	0.4091 (0.0092)	0.4231 (0.0091)	0.4169 (0.0085)	0.4268 (0.0072)	0.4224 (0.0078)	0.4297 (0.0082)	0.4121 (0.0089)
10.0 to 10.5	0.4114 (0.0034)	0.4017 (0.0097)	0.4172 (0.0096)	0.4099 (0.0091)	0.4148 (0.0079)	0.4140 (0.0084)	0.4158 (0.0089)	0.4040 (0.0094)
10.5 to 11.0	0.4077 (0.0035)	0.3963 (0.0104)	0.4141 (0.0100)	0.4099 (0.0091)	0.4109 (0.0083)	0.4120 (0.0086)	0.4082 (0.0095)	0.4017 (0.0096)
11.0 to 11.5	0.4060 (0.0037)	0.3963 (0.0104)	0.4094 (0.0114)	0.4099 (0.0091)	0.4073 (0.0090)	0.4120 (0.0086)	0.4082 (0.0095)	0.3978 (0.0103)

(.) Indicates standard error.

Table 5

Summary Least Squares Regressions on Empirical Survival Density Functions, AWPS Spells Data, 1978-80, 1982-85

Model	All years	1978	1979	1980	1982	1983	1984	1985
Dependent variable: -*ln*(Survival)								
gamma	0.0942	0.0967	0.0949	0.0958	0.0937	0.0941	0.0915	0.0946
	(26.4)	(27.7)	(24.2)	(25.6)	(25.2)	(25.6)	(28.2)	(28.7)
R^2	0.7861	0.8106	0.7363	0.7708	0.7582	0.7729	0.8166	0.8245
Dependent variable: *ln*(-*ln*[Survival])								
alpha	0.7532	0.7841	0.7356	0.7442	0.7379	0.7481	0.7721	0.7575
	(10.5)	(10.5)	(10.0)	(10.9)	(10.3)	(10.3)	(10.6)	(11.2)
*ln*gamma	-1.800	-1.838	-1.752	-1.766	-1.774	-1.791	-1.870	-1.810
	(14.1)	(13.7)	(13.4)	(14.6)	(13.8)	(13.9)	(14.4)	(15.0)
R^2	0.8398	0.8375	0.8252	0.8496	0.8323	0.8347	0.8404	0.8556
Dependent variable: Survival								
alpha	0.8629	0.8905	0.8426	0.8661	0.8450	0.8568	0.8695	0.8792
	(16.1)	(16.6)	(14.8)	(16.1)	(15.3)	(15.7)	(16.6)	(16.9)
gamma	0.1963	0.9123	0.2076	0.2002	0.2023	0.1984	0.1848	0.1898
	(10.0)	(10.1)	(9.54)	(10.1)	(9.77)	(9.89)	(10.2)	(10.4)
R^2	0.9530	0.9563	0.9448	0.9532	0.9480	0.9507	0.9562	0.9579

(.) Indicates absolute value of t-statistic.
ln Indicates natural logarithm.
R^2 Indicates the degrees of freedom adjusted R^2.

Panels 1 and 2 are results from a least squares regression, while Panel 3 are results from non-linear least squares.

and log normal distributions. Characteristics of these distributions and their representation in log-linear models of spell duration are catalogued in Kalbfleisch and Prentice (1980, pp. 21-301). Cox's proportional hazards linear regression model is also employed (1972). This is a distribution free method based upon the ranking of spell durations.[14]

For the sake of brevity the results for each of the five models for 1980 are summarized in Table 6. The results for all distributions over all of the years are available from the author. The omitted categories in these models are given by the variables listed first in each of the groupings of Table 2, thus the reference category is: household head, male, married, 35-44 years of age, not currently a student, some high school education, Ontario resident, with an unemployment spell that began in the third quarter of the year. The parameter estimates, whenever they prove to be significant, are robust over the distributions, the exceptions being the intercept term and the dummy variables associated with the quarter in which the spell started. This suggests that the models will yield different estimates of location. All of the other significant variables have the same sign and are within one standard deviation of each other in magnitude.[15] This result is in contrast with those obtained by Addison and Portugal (1987) in a study of unemployment durations from a U.S. survey of displaced workers drawn from the Current Population Survey, but in broad agreement with those of Dynarski and Sheffrin (1987).

For the purposes of summarizing the results over the seven years under study attention may be focused upon a single distribution. On the basis of the results reported in the previous section the log logistic distribution is chosen. Table 7 presents the results of the estimation of this model for each year. Many of the parameters are subject to change in their significance levels and even their sign. In some years individuals that were not household heads suffered shorter spells than household heads, sometimes longer spells, and sometimes spells that were not significantly different. In this data set gender does not appear to play a significant role in determining spell duration, except perhaps in 1978 when females experienced longer spells and 1982 when they experienced shorter spells. This result is perhaps not too surprising if one recalls that the definition of unemployment being used likely incorporates periods of withdrawal from the labour force. There are also no simple statements to be made about the role of marital status except for the fact that during

1982 at the height of the recession married individuals tended to have shorter spell durations than their counterparts.

However, one of the most significant results presented in this table concerns the importance of age in determining spell duration. Before and during 1982 both the young and the old, the 15 and 24 and the 55-69 year old groups, had significantly longer unemployment spells than the prime age group, the 35-44 year olds. The coefficients for 15-19 year olds and 20-24 year olds rivals and often is larger than that of the 55-69 year old group. After 1982 this pattern changes. The young no longer experience spells any different in length than the prime age group, while the situation of the old becomes worse as their coefficient values rise to reach the highest levels for all age groups over all years. Indeed, this is the only group, with the exception of 25-34 year olds in 1983, for which age plays a significant role at all during the post-1982 period.

In one sense the fact that the 55-69 year olds experience significantly longer spells throughout the period under study should not come as too great a surprise. The definition of unemployment that is being used would permit retirement to be captured as a part of the unemployment spell. However, this retirement comes only after the individual spent some time searching for another job after the initial job separation so that in one sense it might be thought of as the result of discouragement or involuntary in nature rather than of disability or voluntary. Further, this possibility applies mostly to the individuals approaching or older than 65 years of age, a group that represents a very small fraction of the data set. What is important is the change in the environment faced by this group over the course of the sample period. The probability of exit from unemployment for this group fell sharply vis-à-vis other groups after the 1982 recession. This suggests that one mode of adjustment to the shocks that took place at this time involved the displacement of high tenure workers that were then forced into permanent or semi-permanent retirement. The subsequent recovery did little to change this serving only to reduce the exit rates of the more adaptable younger cohorts. Finally, it should be stressed that this discussion refers only to the oldest of the age categories, the behaviour of those 45 to 54 years old, a group often cited as requiring targeted assistance, is never significantly different from the 35-44 year old group.[16]

Education, like age, has been the subject of much recent concern

Table 6

Maximum Likelihood Estimates, AWPS Spell Data, 1980

	Functional form				
Model	Exponential	Weibull	Log-logistic	Log normal	Proportional hazards
Intercept	1.933* (0.06209)	2.030* (0.07243)	1.499* (0.07269)	1.556* (0.06957)	
Not head	0.1296* (0.04174)	0.1453* (0.04832)	0.1898* (0.04989)	0.1652* (0.04681)	-0.1203* (0.04191)
Female	0.04472 (0.03999)	0.04834 (0.04625)	0.05021 (0.04741)	0.04267 (0.04438)	-0.03416 (0.04012)
Single	-0.1188* (0.04497)	-0.1319* (0.05200)	-0.1137* (0.05371)	-0.09098* (0.05025)	0.08933* (0.04505)
Other marital	-0.005861 (0.07135)	-0.005751 (0.08254)	0.02791 (0.08578)	0.02287 (0.08118)	-0.0005781 (0.07162)
15-19 years	0.2368* (0.07475)	0.2676* (0.08653)	0.2895* (0.08892)	0.2413* (0.08352)	-0.2053* (0.07501)
20-24 years	0.2247* (0.05988)	0.2483* (0.06927)	0.2258* (0.07155)	0.1787* (0.06680)	-0.1704* (0.05996)
25-34 years	0.04584 (0.05114)	0.05359 (0.05914)	0.07983 (0.06161)	0.05980 (0.05815)	-0.04801 (0.05122)
45-54 years	-0.03448 (0.06479)	-0.03471 (0.07488)	0.01219 (0.07722)	0.004673 (0.07326)	0.01165 (0.06474)
55-69 years	0.1587* (0.08074)	0.1742* (0.09337)	0.1762* (0.09598)	0.1513* (0.08954)	-0.1300* (0.08082)
Student	-0.1701* (0.05893)	-0.1879* (0.06824)	-0.2263* (0.06993)	-0.1974* (0.06595)	0.1314* (0.05924)
Elementary	-0.03841 (0.04550)	-0.04163 (0.05263)	-0.05819 (0.05393)	-0.05563 (0.05062)	0.02592 (0.04558)
Postsecondary	0.004935 (0.06524)	0.006982 (0.07543)	-0.02360 (0.07812)	-0.02117 (0.07296)	-0.002043 (0.06528)
Postsecondary grad	-0.1547* (0.05824)	-0.1700* (0.06735)	-0.1459* (0.06982)	-0.1283* (0.06658)	0.1133* (0.05826)
University	0.003110 (0.07542)	0.0007567 (0.08720)	-0.05768 (0.09169)	-0.04973 (0.08579)	0.01211 (0.07545)
Newfoundland	0.1945* (0.07104)	0.2089* (0.08213)	0.1877* (0.08436)	0.1624* (0.07847)	-0.1460* (0.07103)
Prince Edward Island	0.1438 (0.1020)	0.1527 (0.1180)	0.1292 (0.1200)	0.1180 (0.1117)	-0.1138 (0.1021)
Nova Scotia	0.2703* (0.07471)	0.29720* (0.08641)	0.3062* (0.08748)	0.2612* (0.08117)	-0.2151* (0.07473)
New Brunswick	0.03548 (0.06190)	0.03522 (0.07155)	0.04092 (0.07351)	0.03404 (0.06946)	-0.03182 (0.06186)

Table 6 (Cont'd.)

Model	Functional form				
	Exponential	Weibull	Log-logistic	Log normal	Proportional hazards
Quebec	0.4137* (0.05634)	0.4598* (0.06528)	0.4954* (0.06572)	0.4329* (0.06135)	-0.3464* (0.05634)
Manitoba	0.01701 (0.07207)	0.01381 (0.08331)	-0.001669 (0.08601)	-0.0006485 (0.08103)	0.0005766 (0.07205)
Saskatchewan	0.02256 (0.07540)	0.02380 (0.08717)	0.03412 (0.08830)	0.03811 (0.08344)	-0.02231 (0.07543)
Alberta	0.01390 (0.05314)	0.01239 (0.06973)	0.003927 (0.07198)	-0.001020 (0.06791)	0.005222 (0.06034)
British Columbia	-0.04343 (0.05459)	-0.05284 (0.06311)	-0.07245 (0.06569)	-0.06799 (0.06223)	0.04784 (0.05458)
1st quarter	-0.2849* (0.04563)	-0.4096* (0.05421)	-0.6558* (0.05720)	-0.5720* (0.05448)	0.5764* (0.04630)
2nd quarter	-0.2394* (0.04074)	-0.3310* (0.04799)	-0.4640* (0.04924)	-0.4333* (0.04684)	0.4448* (0.04112)
4th quarter	0.2021* (0.05389)	0.3721* (0.06476)	0.3063* (0.05622)	0.2961* (0.05120)	-0.5691* (0.05468)
Scale parameter	1.0	1.156 (0.01614)	0.8859 (0.01194)	1.457 (0.01827)	
ln likelihood	-10,364.8	-10,307.5	-9,966.73	-9,752.94	

(.) Indicates standard error.
* Indicates that parameter differs from zero with at least 10 per cent significance.

with regard to the way in which the labour sector adjusts. In general, the results suggest that there is no simple relationship between education levels and unemployment spell durations. Individuals that claim to be students at some point during the year experience, as expected, significantly shorter unemployment spells, the only exception to this tendency occurring in 1985. However, educational levels per se are for the most part not significant during 1978 through 1980. During 1982 the results suggest that the greater the educational level the longer the unemployment spell. Individuals with none or elementary education experienced shorter spells than those with some high school, while those with some postsecondary and some university experienced longer spells. Postsecondary graduates had spells that were not significantly different than individuals with some high school. With the beginning of recovery in 1983 this pattern reverses itself: the

Table 7

Maximum Likelihood Estimates, Log Logistic Model,1978-80,1982-85

Model	1978	1979	1980	1982	1983	1984	1985
Intercept	1.607*	1.664*	1.499*	1.524*	1.591*	1.844*	1.747*
	(0.07471)	(0.07783)	(0.07269)	(0.05853)	(0.06656)	(0.06877)	(0.07230)
Not head	-0.1173*	-0.03724	0.1898*	0.1886*	0.1751*	0.01406	0.03627
	(0.04989)	(0.05111)	(0.04989)	(0.04194)	(0.04453)	(0.04363)	(0.04503)
Female	0.1475*	0.02967	0.05021	-0.07841*	-0.03649	0.04091	0.04648
	(0.04715)	(0.04825)	(0.04741)	(0.04057)	(0.04205)	(0.04196)	(0.04300)
Single	-0.01811	0.03956	-0.1137*	0.1487*	0.01440	0.04284	0.04784
	(0.05427)	(0.05531)	(0.05371)	(0.04557)	(0.04855)	(0.04823)	(0.05005)
Other marital	-0.02837	0.1579*	0.02791	0.1245*	0.1758*	-0.1358*	0.08942
	(0.09031)	(0.09156)	(0.08578)	(0.07095)	(0.07599)	(0.07365)	(0.07466)
15-19 years	0.2524*	0.05216	0.2895*	0.1349*	0.03012	0.03680	-0.08601
	(0.08810)	(0.09141)	(0.08892)	(0.07593)	(0.08440)	(0.08685)	(0.08825)
20-24 years	0.2246*	0.1376*	0.2258*	0.07352	0.07084	0.07224	0.007955
	(0.07096)	(0.07329)	(0.07155)	(0.0709)	(0.06341)	(0.06336)	(0.06484)
25-34 years	0.04289	0.06628	0.07983	-0.01093	0.1317*	0.03328	0.05798
	(0.06165)	(0.06455)	(0.06161)	(0.04787)	(0.05281)	(0.05234)	(0.05395)
45-54 years	-0.02613	0.002554	0.01219	-0.05294	0.05730	-0.1083	0.001885
	(0.07673)	(0.07763)	(0.07722)	(0.05924)	(0.06763)	(0.06814)	(0.07291)
55-69 years	0.1762*	0.1823*	0.1762*	0.1406*	0.2911*	0.3143*	0.2376*
	(0.09278)	(0.09589)	(0.09598)	(0.07475)	(0.08283)	(0.08875)	(0.08532)
Student	-0.1935*	-0.1369*	-0.2263*	-0.2755*	-0.09540	-0.1984*	0.04347
	(0.06764)	(0.06994)	(0.06993)	(0.05970)	(0.06401)	(0.06417)	(0.06852)
None or elem	0.06431	-0.03977	-0.05819	-0.1004*	-0.05882	0.03773	0.06243
	(0.05205)	(0.05469)	(0.05393)	(0.04540)	(0.05148)	(0.05483)	(0.05707)
Some postsec	0.01356	-0.04100	-0.02360	0.1461*	-0.1483*	-0.03597	-0.04780
	(0.07515)	(0.07932)	(0.07812)	(0.06176)	(0.06173)	(0.06181)	(0.06494)
Postsec grad	-0.003029	0.08298	-0.1459*	-0.08538	-0.1661*	-0.1060*	-0.07444
	(0.07204)	(0.07602)	(0.06982)	(0.05412)	(0.05684)	(0.05670)	(0.05822)
University	-0.08036	0.08504	-0.05768	0.1744*	-0.16997*	-0.06818	-0.05280
	(0.09048)	(0.09557)	(0.09169)	(0.07698)	(0.07683)	(0.07309)	(0.07689)
Newfoundland	0.3673*	0.3282*	0.1877*	0.3235*	0.06881	0.2798*	-0.04625
	(0.08199)	(0.08901)	(0.08436)	(0.07527)	(0.07569)	(0.08178)	(0.07916)
P.E.I.	-0.09498	0.06242	0.1292	-0.006061	-0.03612	0.02187	0.07766
	(0.1073)	(0.1121)	(0.1200)	(0.09519)	(0.1004)	(0.1065)	(0.1144)
Nova Scotia	0.1597*	0.08813	0.3062*	0.1220*	-0.05432	-0.04829	-0.05082
	(0.08356)	(0.08825)	(0.08748)	(0.07083)	(0.7720)	(0.07814)	(0.07885)
New Brunswick	0.1441	0.06534	0.04092	-0.07926	-0.2526*	-0.1794*	-0.04815
	(0.07836)	(0.07624)	(0.07351)	(0.06359)	(0.06682)	(0.06964)	(0.07423)
Quebec	0.2874*	0.3253*	0.4954*	0.1485*	0.1964*	0.1720*	0.1554*
	(0.06481)	(0.06650)	(0.06573)	(0.05368)	(0.06159)	(0.06373)	(0.06398)
Manitoba	-0.1264	-0.06674	-0.001669	0.05103	-0.05797	0.08482	-0.02158
	(0.08456)	(0.08815)	(0.08601)	(0.07074)	(0.07872)	(0.08794)	(0.08814)

Table 7 (Cont'd.)

Model	1978	1979	1980	1982	1983	1984	1985
Saskatchewan	-0.02554 (0.09125)	-0.1904* (0.09187)	0.03412 (0.08830)	0.1330* (0.7666)	-0.07496 (0.07572)	-0.08029 (0.07710)	0.05643 (0.08012)
Alberta	-0.07286 (0.07438)	-0.07142 (0.07378)	0.003927 (0.07198)	0.04433 (0.05806)	0.1079* (0.06511)	-0.03890 (0.06174)	-0.007412 (0.06522)
British Columbia	-0.1783* (0.06430)	-0.05206 (0.06721)	-0.07245 (0.06569)	-0.1195* (0.05219)	-0.1558* (0.06092)	-0.2491* (0.06289)	-0.08841 (0.06663)
1st quarter	-0.7297* (0.05698)	-0.8521* (0.05959)	-0.6558* (0.05720)	-0.4391* (0.04798)	-0.5078* (0.05131)	-0.6058* (0.05316)	-0.7645* (0.05427)
2nd quarter	-0.3695* (0.04966)	-0.5466* (0.05140)	-0.4640* (0.04924)	-0.2405* (0.04006)	-0.2561* (0.04444)	-0.4311* (0.04560)	-0.5358* (0.04601)
4th quarter	0.1904* (0.05308)	0.1586* (0.05423)	0.3063* (0.05622)	0.2621* (0.04437)	0.3256* (0.04886)	0.08533* (0.04820)	0.2165* (0.05113)
Scale	0.8648 (0.01187)	0.8735 (0.01217)	0.8858 (0.01194)	0.9005 (0.009967)	0.8994 (0.01086)	0.8950 (0.01109)	0.9014 (0.01132)
ln likelihood	-9,628.45	-9,352.76	-9,966.73	-15,251	-12,781.3	-12,234.2	-11,811.5

(.) Indicates standard error.

* Indicates that parameter differs from zero with at least 10 per cent significance.

Table 8

Estimated Log Logistic Survivor Functions, 1978-80, 1982-85, Sample Average and by Selected Age Groups

Survival quantile	1978	1979	1980	1982	1983	1984	1985
Sample average							
0.90	0.63	0.65	0.62	0.66	0.64	0.61	0.68
0.75	1.63	1.70	1.63	1.78	1.72	1.63	1.84
0.50	4.22	4.43	4.31	4.78	4.61	4.37	4.96
0.25	10.90	11.60	11.40	12.90	12.40	11.70	13.40
0.10	28.20	30.20	30.20	34.60	33.30	31.20	36.00
15-19 years							
0.90	0.73	0.64	0.72	0.72	0.60	0.60	0.61
0.75	1.88	1.66	1.91	1.94	1.61	1.60	1.63
0.50	4.85	4.33	5.05	5.22	4.32	4.28	4.39
0.25	12.60	11.30	13.40	14.00	11.60	11.40	11.80
0.10	32.50	29.50	35.30	37.70	31.10	30.60	31.80
35-44 years							
0.90	0.56	0.60	0.54	0.63	0.58	0.58	0.66
0.75	1.46	1.58	1.43	1.70	1.56	1.54	1.78
0.50	3.77	4.11	3.78	4.56	4.19	4.12	4.78
0.25	9.75	10.70	10.00	12.30	11.30	11.00	12.90
0.10	25.20	28.00	26.50	33.00	30.20	29.50	34.70
55-69 years							
0.90	0.67	0.72	0.64	0.73	0.78	0.79	0.84
0.75	1.74	1.89	1.70	1.95	2.09	2.11	2.25
0.50	4.50	4.94	4.51	5.25	5.60	5.64	6.07
0.25	11.60	12.90	11.90	14.10	15.10	15.10	16.30
0.10	30.10	33.70	31.60	38.00	40.40	40.30	44.00

Table entries are months of unemployment.

greater the educational level the shorter the unemployment spell. After 1983 the significance of the education variables essentially disappears. Thus, except for periods of severe shocks the difference in unemployment rates by education must be based upon differences in spell incidence and not spell duration. This is in accord with the results obtained by Kiefer (1985, pp. 149-50) and others, but it does suggest that such findings depend upon the cyclical state of the economy.

Provincial differences in spell durations are also rather weak. The most notable pattern concerns the fact that regardless of the year individuals from Quebec tend to have longer spells than their Ontario counterparts. To a slightly less extent this is also true for those from Newfoundland, while there is a tendency for residents of British Columbia to have shorter spells. These exceptions aside, it would appear that the duration of unemployment does not vary greatly between the provinces. Furthermore, there is a slight tendency for the Quebec and Newfoundland coefficients to decrease in magnitude during the post-1982 period. To the extent that diversity in the provincial patterns of labour sector recovery became apparent during this period, these results suggest that the incidence of unemployment rather than spell duration is the major cause. The fact that the British Columbia coefficient becomes slightly greater in absolute value lends further support to this possibility since this province was among the most disadvantaged over this period. At the same time the alternative definition of unemployment used in this data may limit the validity of the comparison to the aggregate unemployment rate.

The coefficients associated with the dummy variables indicating the quarter in which the unemployment spell began are as a group the most significant in magnitude, and indicate that spell length increases the later the start date. This appears to be so for all specifications over all years. Dynarski and Shefferin (1987) also report such a finding. The most likely explanation is that these variables capture the influence of uncontrolled heterogeneity possibly associated with industry effects, reason for job separation, and seasonality. Heterogeneity has been an important theme in the analysis of unemployment spell durations and, if left uncontrolled, has potentially serious consequences for the properties of the estimates and their standard errors, and biases the results toward a finding of negative duration dependence ([Kiefer, 1988, pp. 671-73], [Lancaster, 1979, 1985]). As a result the estimates of the scale parameter may not be entirely dependable, but in spite of the fact that unobserved heterogeneity is not explicitly controlled for a certain confidence can be expressed in the parameter estimates themselves since they are similar across the functional forms, including Cox's non-parametric procedure.[17]

Such, however, is not the case for the estimates obtained of the conditional location of the distribution. Table 8 presents the estimates of the survivor function implied by the results of Table 7. These are calculated by first employing the method of Suits (1984) to transform the dummy variables so as to represent an average member of the sample rather than the arbitrary reference category and then by making use of the functional form for the log logistic survivor function.[18] For this distribution the median and the mean are the same and are therefore both given by the 50th percentile. For the average member of the sample mean spell duration lies between four and five months, which is considerably longer than that reported elsewhere in the literature. Beach and Kaliski (1987, p. 263), for example, report a mean duration of about 2.5 months for the 1978 AWPS. The difference stems from the alternative definition of an unemployment spell used in the present study. In fact, the estimates presented in Table 8 lie closer to the average annual unemployment experience of individuals than to previously reported average spell durations. Corak (1989b, p. 20) reports estimates that vary from 3.3 to 4.6 months for the average annual unemployment experience of the unemployed. The fact that the present figures tend to be slightly above those estimates is exactly as expected since the underlying definition of an unemployment spell will in many cases cause instances of multiple spells for an individual to be added together along with the intervening time spent out of the labour force. However, similar estimates derived from the results of the Weibull distribution are even longer since this distribution has a much greater part of the density in the outer tail. For example, the estimate for the median for 1978 is 5.12 months, almost a month longer than the estimate of 4.2 months of the log logistic distribution.[19] Thus, the estimates of Table 8 are not robust across functional forms.

The movements that they display over the period may nonetheless be suggestive. The variation in spell durations over the business cycle has been the subject of some dispute. Beach and Kaliski (1986) speculate on the matter, as do Dynarski and Shefferin (1987).[20] The estimates in Table 8 offer evidence that, controlling for the characteristics of individuals, suggests that spell durations move counter-cyclically. Mean spell duration is roughly constant during 1978 to 1980. However, spells that began in 1982 are estimated to be roughly one half month longer than those that began in 1980. This figure then falls with the course of recovery, except for 1985 when it increases again. The 1985 results are consistent with a pause in the economic recovery that occurred in that year. The results presented in Table 7 reveal that many of the co-variates lose significance for this year.

The survivor functions for 15-19, 35-44, and 55-69 year olds are also presented. These results control for all other characteristics of these groups. The counter-cyclical movement in average spell durations is evident for the two younger groups, but not for the older age category. For this category average spell durations increased between 1980 and 1982, but also for every year afterward. This is an attendant consequence of the movement in the parameters reported in Table 7.

Finally, it should be noted that all of these patterns appear to hold for the entire survivor function, not just the 50th percentile. Overall about 25 per cent of an incoming cohort of unemployed individuals can be expected to spend about one year unemployed before finding another job, while 10 per cent may be expected to stay unemployed for 28 to 36 months. This latter figure, however, is questionable. The horizon of the data is limited to one year and it is therefore not strictly valid to entertain projections outside of this sample limit. Even so the movement in the entire distribution and particularly its outer tail is, like the mean spell duration, counter-cyclical. The oldest group is also an exception to this pattern.

Inferences and Policy Implications

The most notable results of the previous section concern those related to the provincial, educational, and age variables. The provincial results probably reflect factors of industrial diversity and barriers to mobility, either geographic or cultural. The fact that residents of Quebec consistently experience longer spell durations than individuals residing anywhere else in the country may, for example, be due to lower mobility of francophones. The Newfoundland results may also be explained by the peculiarities of industry and geography. However, behavioural and institutional factors should not be downplayed. The unemployment insurance system, particularly with respect to eligibility criteria and maximum benefit duration, is regionally differentiated and may influence incentives. The lack of information on industry and unemployment insurance receipt in the data set employed, limits the inferences that can be made in this regard, and calls for further study.

The relationship between education and spell duration is not a simple one. In particular, more education will not simply lead to shorter spell durations. During periods that are not subject to severe shocks education does not appear to be a significant determinate of duration. However, the role of this variable is not insensitive to the business cycle. The 1983 results suggest that during periods of recovery a negative relationship between duration and education may assert itself: the more educated are the first to find re-employment. The matter is not so simple during severe negative shocks such as that experienced in 1982.

The results associated with the age variable shed the most light upon the way in which the labour sector adjusts. Murphy and Topel (1987) have argued that the adjustment process might be characterized as an evolutionary process. Simple substitution of workers from declining sectors to employment in the expanding sectors is only of second order importance. Rather, the growing sectors receive a greater proportion of new entrants to the labour force than do the declining sectors. Their analysis is focused upon long-run patterns, but they do suggest that the structural changes that underlie these patterns are not independent of cyclical developments, and are probably concentrated during cyclical troughs when the opportunity cost of reallocating labour and capital are lower. It might be reasonable to suggest that the present results reflect such a process. The environment faced by older workers was altered by the 1982 recession. Older workers experiencing an *E-U* transition after 1982 had spells of unemployment that were on average longer than they experienced before 1982, but also longer relative to all of their younger counterparts. This might be taken to suggest that the recession of 1982 entailed structural changes and that the reallocation of labour involved a shedding of older high tenure workers that went on to permanent or semi-permanent retirement, combined with increased hiring of younger workers in the areas of growth. Thus, policy must be addressed to the way in which older workers leave unemployment.

The work of Darby, Haltiwanger, and Plant (1985), (1986) challenges such an interpretation. They also believe that structural change and cyclical movements are not necessarily distinct phenomena, but their analysis leads them to suggest that the focus of policy should be directed to the level and distribution of the inflows into unemployment, not to the exit rates. The focus of their analysis is on the persistence of unemployment in the face of adverse shocks, and their attention is directed towards two competing explanations. Persistence may be due to increased inflows of individuals who normally experience long spells once they are unemployed, or it may be due to all individuals experiencing longer spells. On the basis of an examination of U.S. net flow data the authors side for the former explanation. The results of the present paper suggest, however, that the rate of outflow has a role to play in understanding the dynamics of the Canadian unemployment rate. For example, Table 2 reveals that the proportion of the sample accounted for by older workers has not changed appreciably.[21] Further, likelihood ratio tests for parameter constancy across all of the sample years were conducted and strongly rejected.[22] Thus, the exit probabilities themselves have changed and persistence in unemployment is not just due to changes in the nature of the inflows, but to an actual change in the structure of spell durations. Further this change is not neutral across all groups: older workers have experienced a relatively larger deterioration in their probability of finding re-employment.

Policymakers should therefore be concerned with the way in which individuals, particularly older individuals, leave unemployment, that is with the hiring decisions of firms and the search behaviour of the unemployed. If the above inference that the labour sector adjusts through evolution rather than substitution is correct then policy should be directed to some appropriate mix of assistance for adjustment and compensation for loss. In particular, there is a need to ensure that severance and pension provisions are adequate and portable. Some of the suggestions that have been made by the Advisory Council on Adjustment may be interpreted in such a way (Corak, 1989c). However, the results are not conclusive and they raise further questions.

Conclusion

The present study summarizes the results of research on the determinants of unemployment spell durations of individuals experiencing job separations in each year between 1978 to 1980 and 1982 to 1985. Accelerated failure time models that incorporate explicit assumptions concerning the functional form of the baseline hazard are estimated for each year and for a variety of functional forms. Cox's proportional hazards procedure which does not involve parametric assumptions is also employed. The main contribution of the paper lies in the use of seven years of data that cover a period of both positive and negative shocks. Most previous studies of spell durations are restricted to limited points on the business cycle. The results obtained are robust to the functional form assumed, but not necessarily over the year of data used. Most notable in this regard is the change in the relationship between age and spell duration. Before the 1982 recession both the young and the old were subject to longer unemployment spells than the prime aged groups. During the subsequent recovery age no longer played a role for the young but it became more significant for the old. Thus, the often stated assertion that older workers have a low incidence of unemployment, but a longer duration is too simplistic: their spells are longer and increasingly so over time.

This result permits some inferences as to the nature of the adjustment process in the labour sector. Persistence in unemployment, for example, is not simply due to increased inflows of individuals that normally experience long spells. To some degree it reflects the fact that spell durations have increased for the typical individual, and most notably for the old. The finding of a counter-cyclical movement in average spell durations is one reflection of this tendency, as is the failure of average duration of older workers to fall during the post-1982 recovery. Further, adjustment to severe negative shocks might reasonably be characterized as an evolutionary process in which older workers have, in one way or another, been moved into semi-permanent or permanent retirement, while younger workers have been rehired at increasing rates. This suggests that policy should be directed to some mixture of assistance for adjustment and compensation for loss depending upon the circumstances of older workers.

More detailed enquiries are required along these lines. There is a need for an examination of the retirement decision, the adequacy of provisions for retirement, and an assessment of the search behaviour of the old. The present results also call for continued analysis of spell durations for more recent data, and with more extensive co-variates. Reason for separation, unemployment insurance eligibility, and industry and occupation all suggest themselves as important influences of spell durations. In particular, some attention should be paid to the relationship between industrial diversity, province, and spell duration. Future research should also attempt to recognize that search unemployment may end by employment or by withdrawal from the labour force so that a competing risks model of spell duration is most appropriate.

Notes

1 The so-called "Long File" derived from administrative data on the unemployment insurance system has been used by Ham and Rea (1987) to model the length of time in receipt of unemployment insurance benefits of a sample of Canadian males. Sider (1985) is an example of a non-steady-state study applied to gross flow data, while Hasan and deBroucker (1985) present a steady-state analysis of the Canadian data.

2 Beach and Kaliski (1987) have made use of such data, but their analysis is restricted to only three selected years, and is concerned primarily with the distribution of time spent unemployed by spell lengths. A full review of the studies using the Annual Work Patterns Survey is offered in Corak (1989b).

3 Cox and Oakes (1984), Kalbfleisch and Prentice (1980), and Lawless (1982) are standard references that describe these procedures.

4 The program used to generate the spell file from the original tapes is available from the author upon request.

5 The possibility that the distinction between *U* and *N* is soft is also supported by the fact that gross flows data from the Labour Force Survey, which uses a definition of unemployment broadly similar to the AWPS, reveal significant flows from *N* to *E*. If one subscribed strictly to a search theoretic interpretation of unemployment such movements are not theoretically possible. Their prevalence in reality suggests that there is little value in restricting the definition of unemployment in these terms.

6 In effect this definition of unemployment accepts the claim by Clark and Summers (1979) that many of the transitions between *U* and *N* are spurious and do not reflect changes in behaviour. It should be noted, however, that Flinn and Heckman (1983) challenge this view.

7 The data used throughout this study are assumed to be a random sample from the unemployed population. In fact, the Statistics Canada sampling procedure is not entirely random and sampling weights are made available with the individual records

to correct for this. The potential for biased results is therefore present. On this point see Chesher and Lancaster (1983).

8 Similar plots by year are available upon request from the author.

9 Some of the results presents in Beach and Kaliski (1987) also suggest that there is a spike in the number of spells reported to be one month in length. In particular, see their Table 1 in which decile levels for each of the 2nd, 3rd and 4th deciles are reported to be 4.33 weeks.

10 Thus, the Weibull functional form nests the exponential and the first regression procedure is not strictly necessary if the second is undertaken.

11 The Gauss-Newton regression for this model was run for each non-linear least squares regression undertaken to confirm that a maximum had been attained. Further, the actual scope of the preliminary analysis was much more detailed than described in the text. Breakdowns of the data by year and by each of the co-variates listed in Table 2 were also performed in the following manner. The text suggests that plots of $ln(-ln(G_t))$ versus t should be linear if the Weibull model is appropriate, and the discussion in Kalbfleisch and Prentice (1982) suggests that they should be parallel to each other for the sub-groupings under examination if a proportional hazards model is appropriate. In fact, all of the plots were piece-wise linear with a change in slope during the 1.0-1.5 month interval and in many cases the plots were not parallel suggesting that an accelerated life time model is preferred.

12 Cox and Oakes (1984, p. 71) prove that with constant explanatory variables accelerated failure time models and proportional hazards models coincide under the assumption of a Weibull distribution for the baseline hazard.

13 By definition the survivor function is simply 1 minus the related cumulative distribution function. Corak (1988) offers a review of the relationship between all of these concepts.

14 The parameters were established by maximum likelihood using a Newton-Raphson algorithm by the S.A.S. version 5 procedure

LIFEREG. Standard errors are given by the inverse of the observed information matrix. In actual fact the estimation procedure was much broader than indicated in the text and included the estimation of fully interactive models by gender for each of the distributions. The likelihood values for these models were not substantially greater with the result that the Akaike Information Criterion suggested the choice of the models with no interactions. An attempt was also made to estimate fully interactive models by province but convergence was never attained regardless of the year or distribution used. Finally, the gamma and generalized gamma distributions were also employed but convergence was much more difficult and for the majority of years under study not attained in spite of the fact that several different starting values for the estimates were used. Lawless (1982) suggests that such difficulties are often the case because of the flatness of the likelihood function. The results for these distributions are not reported in the present paper. Cox's proportional hazards model is estimated by the S.A.S. procedure PHGLM.

15 It should be noted that t-tests of parameter significance are not appropriate. Wald statistics which are distributed χ^2 with 1 degree of freedom are provided in an appendix available from the author along with the marginal significance levels. These are derived as the square of the quotient of the parameter and its standard error. Further the important test concerning the scale parameter in the Weibull and log logistic is whether it differs from one, since a Weibull model with scale equal to one reduces to an exponential and a log logistic model with a scale greater than one indicates that the hazard is non-monotonic, first rising and then falling. Finally, for the Weibull model the scale parameter, σ, is equivalent to $1/\alpha$ of earlier parlance so that the results suggest that the hazard is declining with spell duration.

16 These results also suggest that researchers should pay particular attention to the manner in which the age variable is entered into their models. If actual data on age, as opposed to categories, is available a non-linear function such as the quadratic or a step function is preferable. In much of his work Kiefer, for example, is careful to permit such a non-linear relationship between age and spell duration, many other researchers, however, are not.

17 Lancaster (1985, p. 162-63) shows that the estimates of elasticities of mean spell duration are correct even if heterogeneity is not controlled for. Strictly speaking, however, his result applies to the Weibull model in which there are no truncated data.

18 Using the earlier notation, since $G_t = 1/(1+\gamma t^{\alpha})$ is the survivor function for the log logistic distribution then $\hat{t}$ may be found for given values of G_t by recognizing that $\hat{\gamma} = exp(-X\hat{\beta})$ and $\hat{\alpha} = 1/\hat{\sigma}$ where $\hat{\beta}$ represents the estimated parameters of Table 7 and $\hat{\sigma}$ the estimate for the scale parameter. The calculations from this procedure and from the transformations of Suits (1984) are available from the author.

19 The Weibull estimate of the mean is even longer since the mean and the median do not coincide for this distribution, the mean being the 63.2 percentile.

20 Economic theory does not lead to an unambiguous prediction on the cyclical movement of unemployment spell durations. Both the level and the distribution of the inflows as well as the actual structure of spell durations must be considered. When the aggregate unemployment rate rises there may be an increased inflow of individuals that normally spend a short time unemployed, such as those that experience temporary lay-offs, or an increased inflow of individuals that normally spend long periods unemployed, such as older workers and those permanently laid off. Further, the duration of a spell may increase for all groups as the rate of job offer arrivals and hence the exit probability falls.

21 Other characteristics associated with longer spells, such as residence in Quebec and a 4th quarter start date, actually decline in proportion between 1980 and 1982 and in general over the course of the sample period.

22 The proper way to proceed in this regard is to obtain the log likelihood value from an estimation of the model over all the available data without distinguishing the year. This forms the restricted model while the models estimated for each year separately, which together are equivalent to a fully interactive model by year, form the unrestricted model. Unfortunately, convergence could not be attained for a model estimated on the

aggregate data for the exponential distribution, which is the simplest distribution of those entertained. This avenue was not therefore pursued. Each year of data was used to estimate a log logistic model in which the parameters were restricted to those of 1980 and a likelihood ratio test was conducted in which the unrestricted models are given by the results of Table 6. The likelihood ratio test statistics for 1978 through 1985 were: 104, 116, 232, 155, 184, 151. This statistic is distributed as χ^2 with 28 degrees of freedom. The critical χ^2 value at 1 per cent significance is 48.3, thus the null that the parameters are the same as those for 1980 may be rejected. A more complete analysis might consider employing the estimates of each year in turn as the basis for the null hypothesis.

Bibliography

Addison, J. T. and P. Portugal, "On the Distributional Shape of Unemployment Duration," *Review of Economics and Statistics*, vol. LXIX, pp. 520-26, 1987.

Advisory Council on Adjustment, *Adjusting to Win: Report of the Advisory Council on Adjustment*, Ottawa, Minister of Supply and Services Canada, 1989.

Beach, C. M. and S. F. Kaliski, "The Impact of Recession on the Distribution of Annual Unemployment," *Relations Industrielles*, vol. XLI, no. 2, pp. 317-28, 1986.

_____, "The Distribution of Unemployment Spells: Canada, 1978-1982," *Industrial and Labour Relations Review*, vol. XL, no. 2, pp. 254-67, 1987.

Chesher, A. and T. Lancaster, "The Estimation of Models of Labour Market Behaviour," *Review of Economic Studies*, vol. L, pp. 609-24, 1983

Clark, K. B. and L. H. Summers, "Labor Market Dynamics and Unemployment: A Reconsideration," *Brookings Papers on Economic Activity*, no. 1, pp. 13-60, 1979.

Corak, Miles, "The Empirical Analysis of Unemployment Dynamics: An Exposition of Method, Issues and Results," Mimeo, Economic Council of Canada, 1988.

_____, "The Analysis of Labour Sector Dynamics with Recall Data: An Overview of the Special Surveys," Mimeo, Economic Council of Canada, 1988a.

_____, "Eligibility Rules in the Canadian Jobs Strategy: Shifting the Burden or Targeting the Assistance?" Mimeo, Economic Council of Canada, 1989a.

_____, "Canadian Unemployment in Retrospect: 1977-1987," Mimeo, Economic Council of Canada, 1989b.

_____, "Policy in an Era of Free Trade: Some Comments on the de Grandpré Report," *Canadian Public Policy*, vol. XV, no. 3, pp. 335-38, 1989b.

Cox, D. R., "Regression Models and Life Tables," *Journal of the Royal Statistical Society*, Series B, vol. XXXIV, pp. 187-220, 1972.

Cox, D. R. and D. Oakes, *Analysis of Survival Data*, London: Chapman and Hall, 1984.

Darby, M. R., J. C. Haltiwanger, and M. W. Plant, "Unemployment Rate Dynamics and Persistent Unemployment under Rational Expectations," *American Economic Review*, vol. LXXV, no. 4, pp. 614-37, 1985.

_____, "The Ins and Outs of Unemployment: The Ins Win," NBER Working Paper no. 1997, 1986.

_____, "Alternative Measures of Slackness in the Labor Market and Their Relationship to Wage and Price Inflation," in K. Lang and J. S. Leonard (eds.), *Unemployment and the Structure of Labor Markets*, New York, B. Blackwell, 1987.

Dynarski, M. and S. M. Sheffin, "New Evidence on the Cyclical Behavior of Unemployment Durations," in K. Lang and J. S. Leonard (eds.), *Unemployment and the Structure of Labor Markets*, New York, B. Blackwell, 1987.

Ham, J. C. and S. Rea Jr., "Unemployment Insurance and Male Unemployment Duration in Canada," *Journal of Labor Economics*, vol. V, no. 3, pp. 325-53, 1987.

Hasan, A. and P. deBroucker, "Duration and Concentration of Unemployment," *Canadian Journal of Economics*, vol. XV, no. 4, pp. 735-56, 1982.

_____, *Unemployment, Employment, and Non-Participation in Canadian Labour Markets*, Ottawa, Economic Council of Canada, 1985.

Kalbfleisch, J. D. and R. L. Prentice, *The Statistical Analysis of Failure Time Data*, New York, Wiley, 1980.

Kiefer, N. M., "Specification Diagnostics Based on Laguerre Alternatives for Econometric Models of Duration." *Journal of Econometrics*, Annals 1985-1, vol. XXVIII, no. 1, pp. 135-54, 1985.

_____, "Economic Duration Data and Hazard Functions," *Journal of Economic Literature*, vol. XXVI, no. 2, pp. 646-79, 1988.

Lancaster, T., "Econometric Methods for the Duration of Unemployment, *Econometrica*, vol. XLVII, no. 4, pp. 939-56, 1979.

_____, "Generalised Residuals and Heterogeneous Duration Models: With application to the Weibull Model," *Journal of Econometrics*, Annal 1985-1, no. 1, pp. 155-69, 1985.

Lawless, J. F., *Statistical Models and Methods for Lifetime Data*, New York, Wiley, 1982.

Murphy, K. M. and R. H. Topel, "The Evolution of Unemployment in the United States," *NBER Macroeconomics Annual*, vol. II, pp. 11-68, 1987.

Perry, G., "Unemployment Flows in the U.S. Labor Market," *Brookings Papers on Economic Activity*, no. 2, pp. 245-92, 1972.

Sider, H., "Unemployment Duration and Incidence: 1968-82," *American Economic Review*, vol. LXXV, no. 3, pp. 461-72, 1985.

Statistics Canada, *Patterns of Full- and Part-Year Unemployment: Results of the Annual Work Patterns Surveys, 1977-1980*, Ottawa, Ministry of Supply and Services, 1982.

Steinberg, D. and F. A. Monforte, "Estimating the Effects of Job Search Assistance and Training Programs on the Unemployment Durations of Displaced Workers." In K. Lang and J. S. Leonard (eds.), *Unemployment and the Structure of Labor Markets*, New York, B. Blackwell, 1987.

Suits, D. B., "Dummy Variables: Mechanics vs. Interpretation." *Review of Economics and Statistics*, vol. LXVI, no. 1, pp. 177-80, 1984.