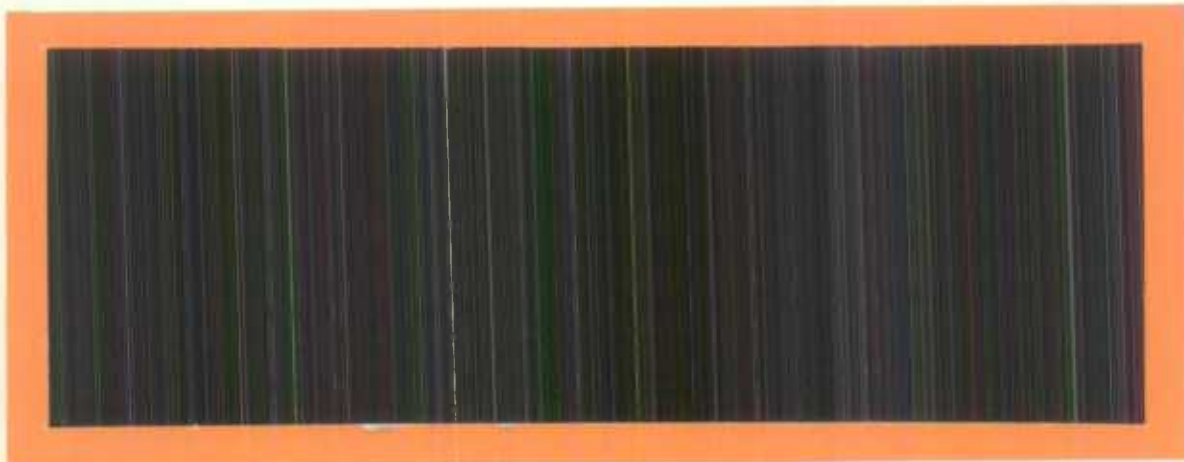# Methodology Branch

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RELATIONAL PATTERNS BETWEEN

UNEMPLOYMENT INSURANCE BENEFICIARIES & TOTAL UNEMPLOYMENT

IN CANADA

by

E.B. Dagum, Nazira Gait, Guy Huot

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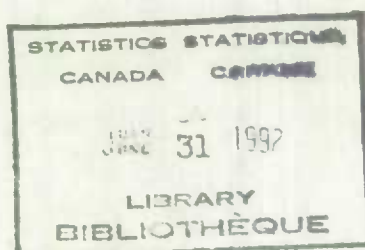
RELATIONAL PATTERNS BETWEEN*
UNEMPLOYMENT INSURANCE BENEFICIARIES AND
TOTAL UNEMPLOYMENT IN CANADA

by

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1. INTRODUCTION

Unemployment Insurance (UI) plays a key role in helping the national labour market adjust to trade and demand-induced changes in production and employment patterns. The main function of UI as part of labour market policy is to provide adequate financial protection during temporary unemployment, to facilitate adjustments. This is done either through financing the job search or providing income to people on temporary lay off. By removing the immediate threat from unemployment - financial hardship - UI relieves job seekers of the need to yield to economic pressures by accepting jobs unsuited to their skills or abilities. It permits a more systematic or wide-ranging job search contributing to the efficient reallocation of human resources.

Furthermore, when there are temporary plant layoffs, the objective of UI is met by providing income protection to laid-off workers, so the employer keeps an experienced labour force intact. This saves him/her the cost of recruiting and training new employees after a lay-off. It also saves the employee from going through extreme dislocation to prevent financial hardship.

In any situation, UI must have enough flexibility to take into account prevailing economic circumstances which may limit the availability of other jobs and extended jobseekers' unemployment. In the Canadian UI program, this flexibility is provided as longer benefit durations are triggered by rising regional unemployment rates. This permits the program to react quickly when sluggish business conditions increase jobless duration. In short, for plant closures and layoffs, UI also has the ability, for extended periods, to protect income from either cyclical changes in overall business activity or from more localized employment deterioration.

However, this positive role of UI in labour market adjustments can be contrasted with the potentially negative impact of UI provisions on work patterns: there is a conflict between paying benefits and the possibility that a generous UI program may be a disincentive to work.

The availability or an increase in benefits of UI may affect people's behaviour in two distinct ways:

a) the workers in the labour force will choose more leisure. This effect reduces the labour supply; and

b) people outside the labour force will enter it for at least long enough to qualify for benefits. This effect increases the labour supply.

Changes in both the composition and structure of the work force have gradually widened the gap between the sets of unemployed and beneficiaries: there was a gradual decline in the percentage of jobless workers who qualify for benefits, despite a marked increase in the number of jobs covered by UI. Two related factors are primarily responsible for this:

   a)   the dynamic increase in participation rates of women and
        teenagers has reduced the proportion of the unemployed protected
        by UI.

   b)   Employment has grown much more in the service-producing than the
        goods-producing industries, where workers are more likely to lose
        their jobs.

The gap between overall unemployment and the UI series tends to narrow
in recession and widen in recovery periods. Where business conditions
worsen and lay-offs occur, job losers become a greater proportion of
Total Unemployment. As most Unemployment Insurance claimants are in
fact job losers, increases the proportion of Unemployment Insurance
Beneficiaries related to Total Unemployment.

This study purports to assess whether there is a causal relationship
between the Unemployment Insurance Beneficiaries and Total Unemploy-
ment in Canada. The analysis is extended to Job Losers (JLo) and Job
Leavers (JLe) who can claim for benefits and are the two major groups
of Total Unemployment. Section 2 introduces the definition of each
of the four series discussed and analyses their main characteristics
from their spectra. Section 3 estimates the residual cross-correlation
values, for several time lags, of the whitened series to assess whether
there is or is not a causal relationship and the direction of the
causality, if present. The residuals are computed from ARIMA models
fitted to each series. Finally, section 5 gives the main conclusions
of this study.

2. THE MAIN CHARACTERISTICS OF THE ANALYSED SERIES

To understand the type of relationship between UIB and TU and its major components, JLo and JLe, we first introduce their definitions and analyse their main characteristics looking at their spectra.

2.1 Total Unemployment (TU)

The Labour Force Survey (LFS) Division of Statistics Canada obtains monthly information through a sample of 56,000 representative households across the country. Although developed since 1952, substantial revisions were introduced in LFS from 1976.

Estimates of employment, unemployment and non-labour-force activity refer to the specific week covered by the survey each month, normally the week containing the 15th day. The sample is designed to represent all persons in the population 15 years of age and over, residing in Canada, with the exception of:

- residents of Yukon and Northwest Territories

- persons living on Indian reserves

- inmates of institutions

- full-time members of the armed forces

(for details of LFS, see "Methodology of the Canadian Labour Force Survey" - Statistics Canada - Catalogue No. 71-526 - Ottawa, 1976).

The Labour Force is composed of people who, during the reference week, were employed or unemployed. The employed includes persons who:

- did any work at all

- had a job but were not at work due to illness or disability,
  bad weather, labour dispute, vacation, personal or family
  responsibilities.

The unemployed includes persons who:

- were without work, had actively looked for work in the past
  four weeks and were available for work.

- had not actively looked for work in the past four weeks but had
  been on layoff for 26 weeks or less, and were available for work.

- had not actively looked for work in the past four weeks but had
  a new job to start in four weeks or less, and were available for
  work.

Total unemployment is composed as the sum of job losers (JLo), job leavers
(JLe), new entrants to the labour market, re-entrants after one year or less,
re-entrants after more than one year. Of these five components, the first
two are the most important for our study since they can claim for benefits and
they are 70% of TU.

Data on the flows into unemployment are not available prior to 1975. Thus,
all the series were observed for the period January 1975-December 1982.

Figure 1 shows the unadjusted Total Unemployment series which is characterized
by a peak in the winter months and a trough in the summer. Figure 2 shows
the spectrum of the Total Unemployment series. High power is observed at the
frequencies $\lambda \leq .05$ associated with the business-cycle ($\lambda = .05$ corresponds
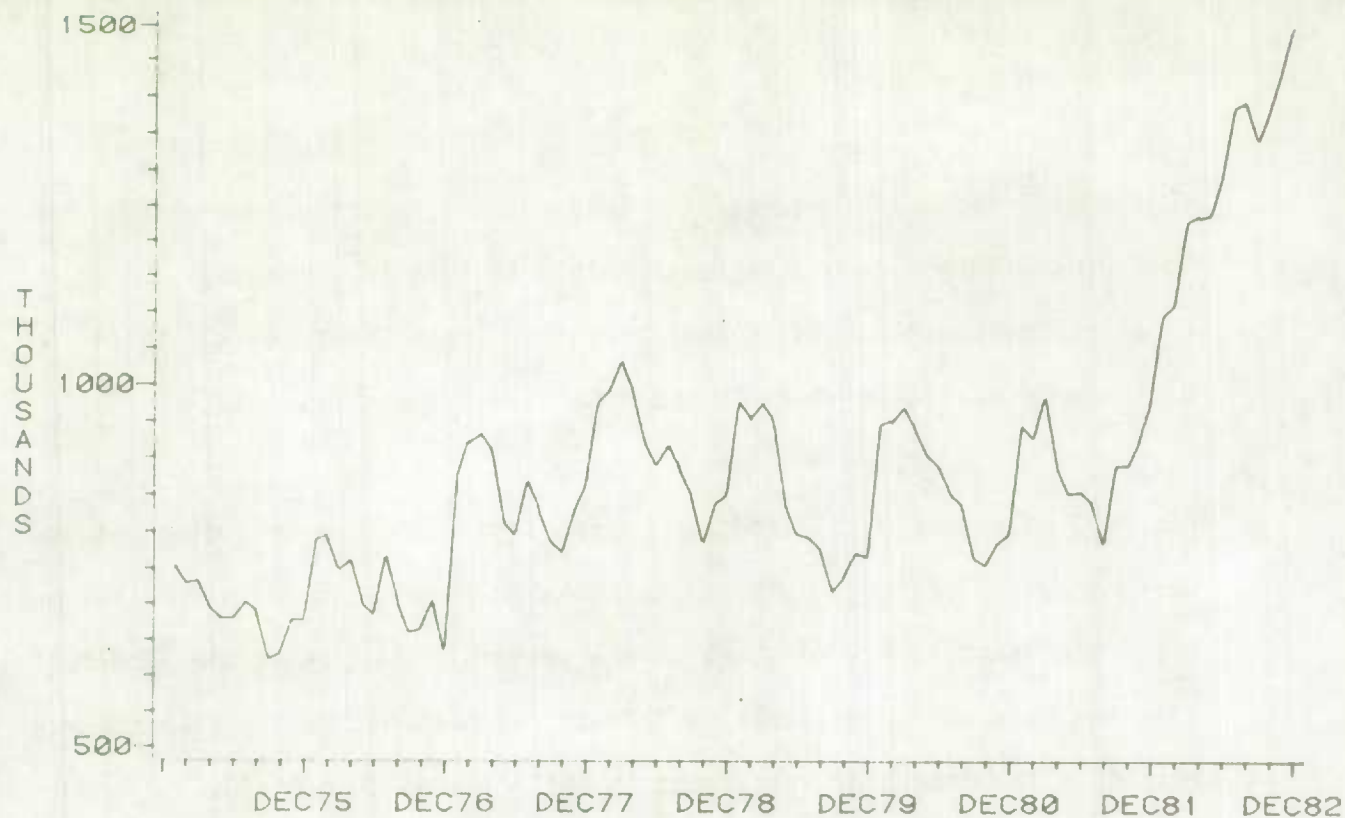to a 20 months cycle). Similarly, relatively high power is observed at the
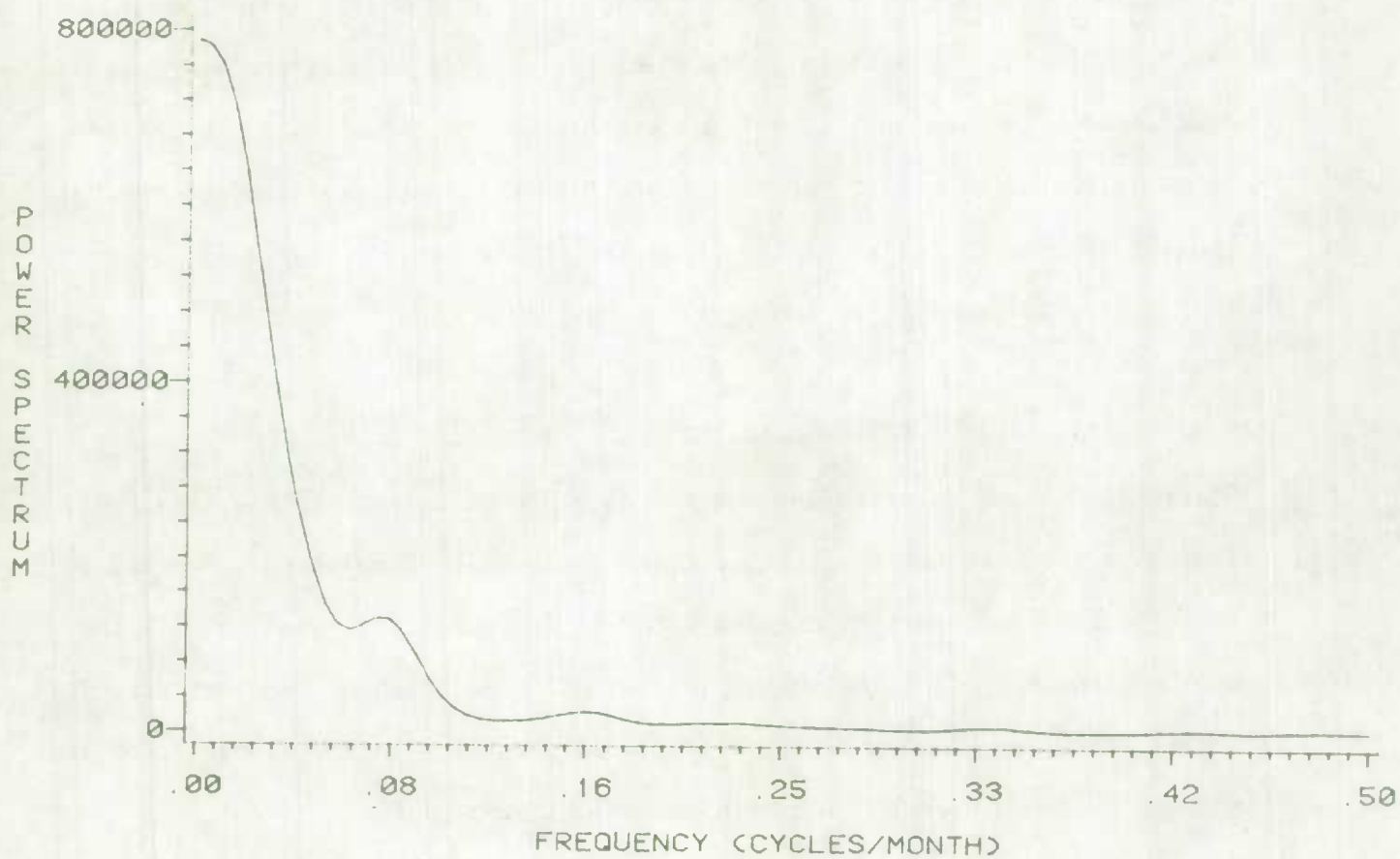
Figure 1. Total Unemployment Series

Figure 2. Spectrum of Total Unemployment

fundamental seasonal frequency λ = .083 and neighbouring frequencies, but less at the harmonics of the fundamental, that is $\lambda=\frac{k}{12}$, k=2,3,...6. Finally, the contribution of the irregular fluctuations to the total variance is small, relative to the other two components.

Figure 3 shows the unadjusted Job Losers series and Figure 4 displays its corresponding spectrum. Similar to TU, high power is shown at the business-cycle frequencies, but now most of the seasonal power is at the fundamental seasonal band and very little is left at the harmonic bands. The contribution of the irregular variations is smaller than that of TU.

Figure 5 shows the Job Leavers series, characterized by two troughs, one in the winter months and the other during the summer. Its spectrum is given in Figure 6. This series has more cyclical variations than trend, as indicated by the high peak at λ= .022, which corresponds to a 45 months-cycle. Furthermore, the seasonal variations are highly concentrated around the first harmonic band, supporting the fact that this series has two seasonal troughs. Finally, the contribution of the irregular to the total variance is larger than that observed for the two previous series.

2.2 The Unemployment Insurance Beneficiaries (UIB)

Statistics Canada receives the monthly data for Unemployment Insurance Bene-ficiaries from the Canada Employment and Immigration Commission since May 1975. The data cover all persons drawing benefits for a specific week, namely the week of the LFS. It is not a sample, but all population of beneficiaries is registered. The UI covers virtually all paid workers in the labour force and members of Armed Forces. The main exceptions are:
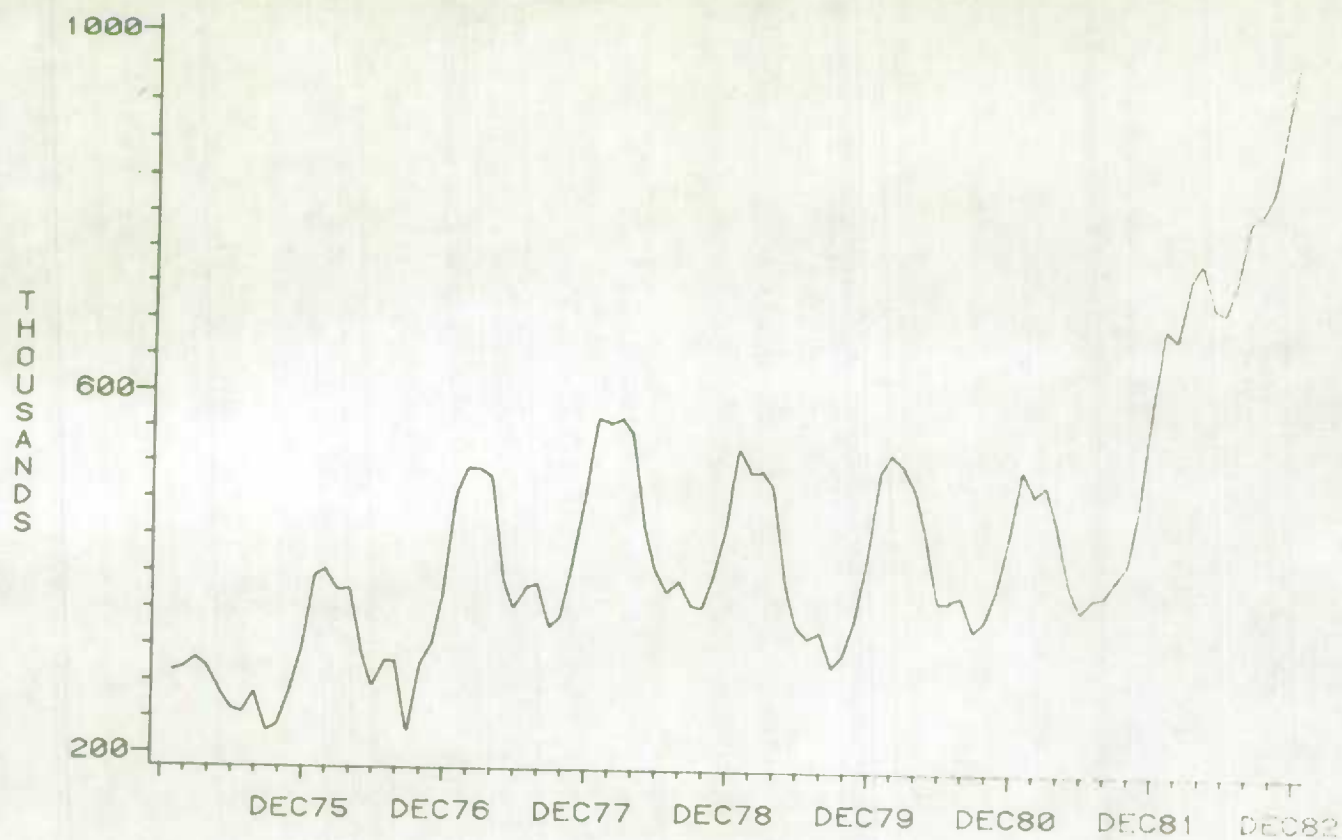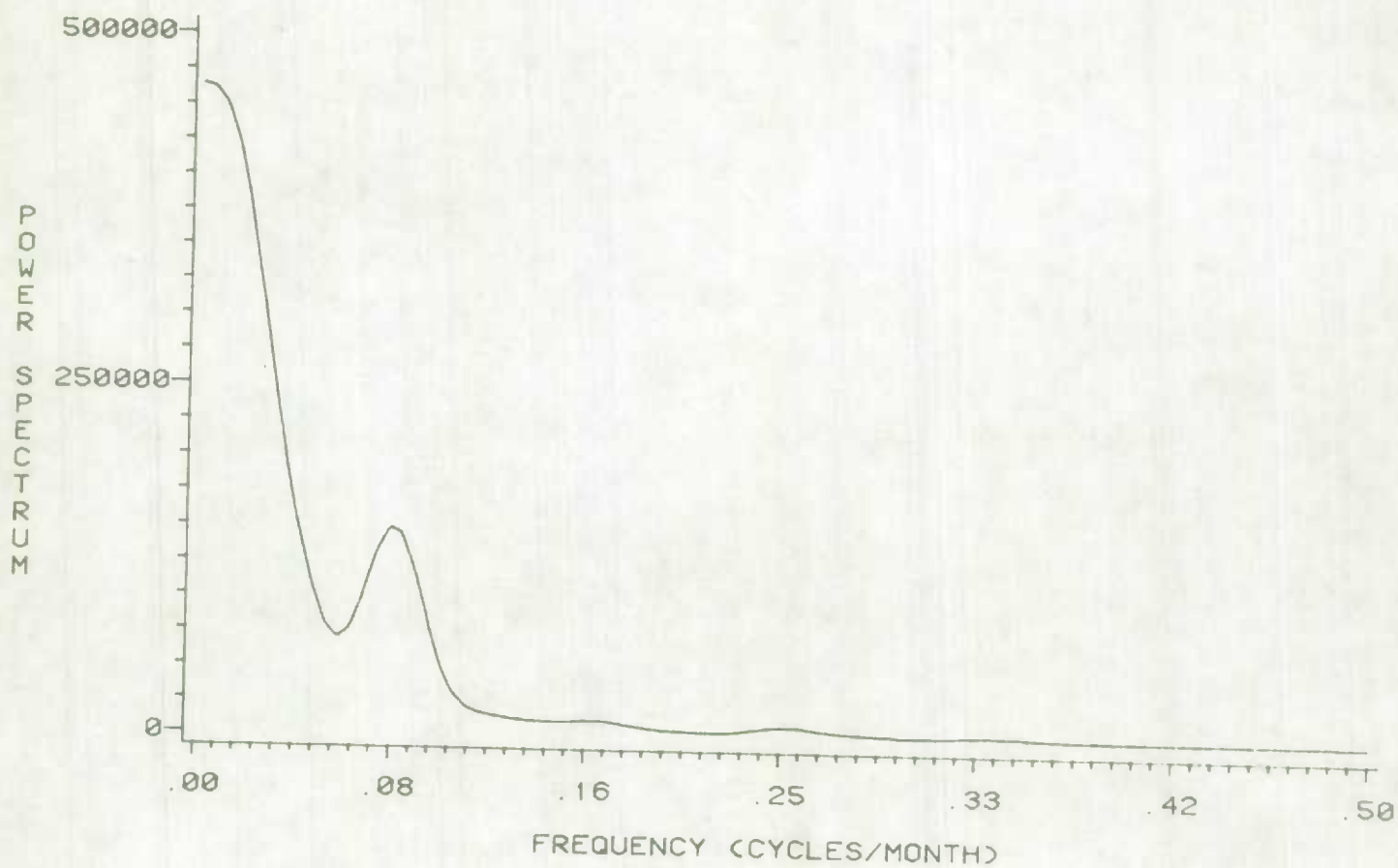
Figure 3. Job Losers Series

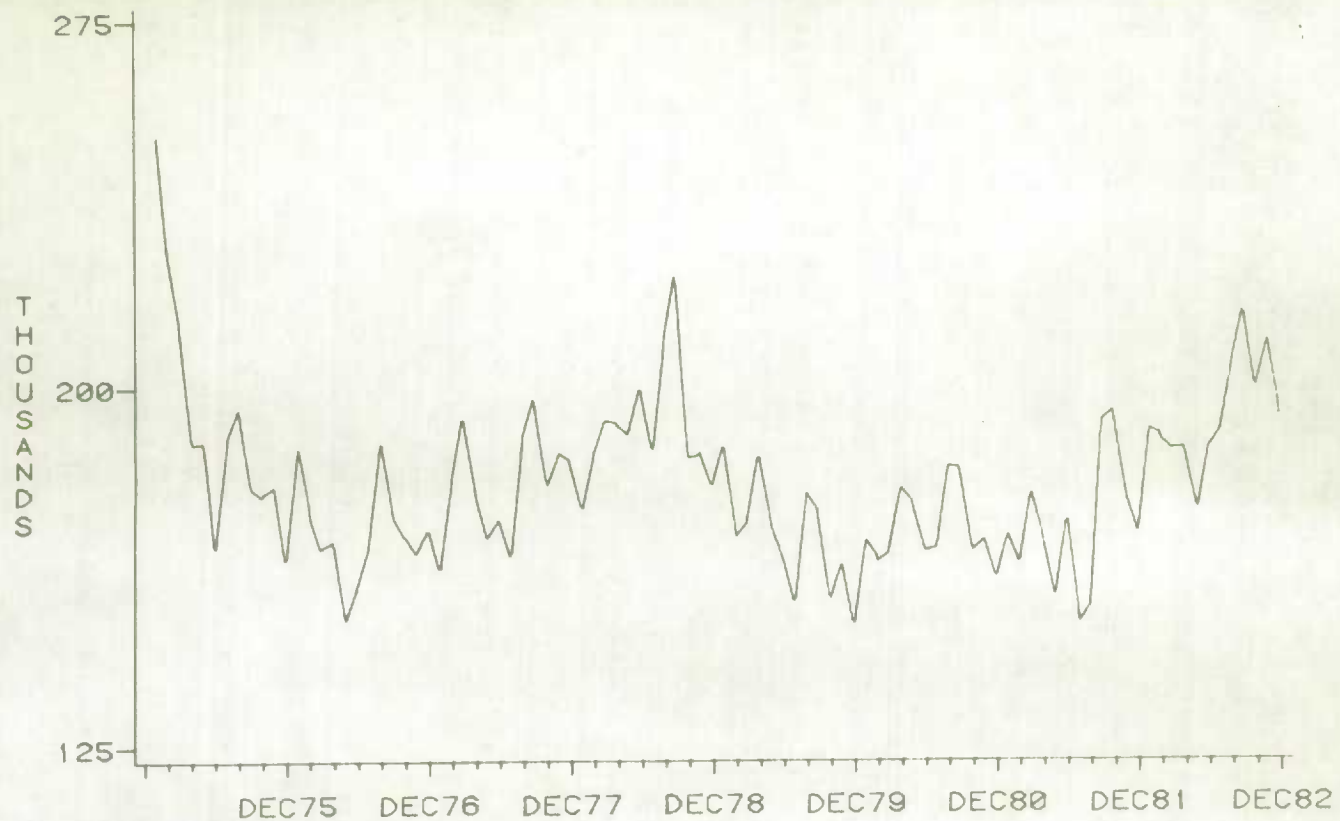

Figure 4. Spectrum of Job Losers

Figure 5. Job Leavers Series
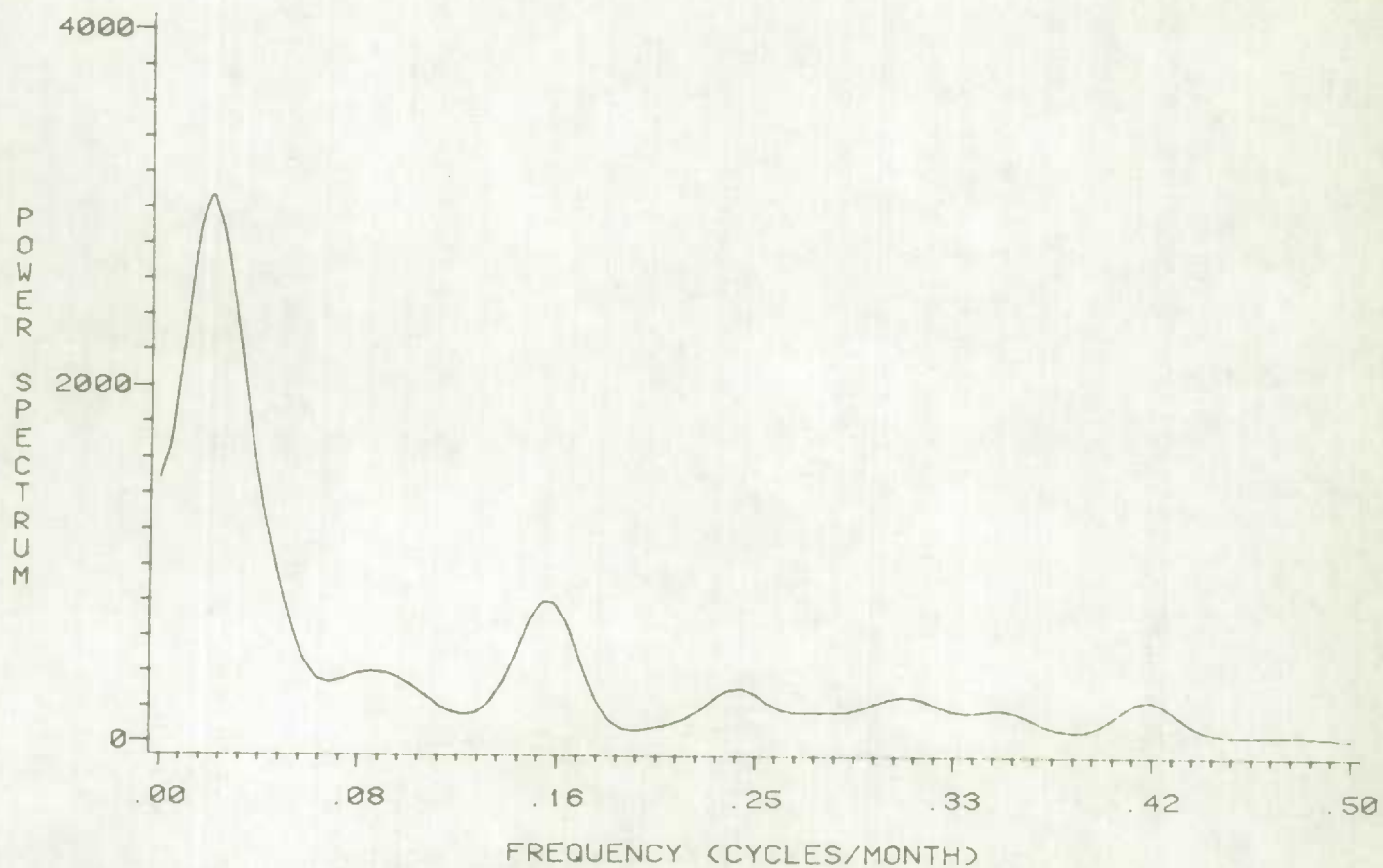

FREQUENCY (CYCLES/MONTH)

Figure 6. Spectrum of Job Leavers

- People 65 years of age and over.

- People working fewer than 15 hours weekly.

- People earning less than 20% of the maximum weekly insurable earnings(in 1982, it was $70, that is, 20% of $350).

In order to qualify for benefits, a claimant must be available for and capable of work, unable to find suitable employment and have the necessary qualifying requirements. Previously eight weeks of work was the minimum required to qualify for benefits but from December 1977 this number varied between 10 and 14 weeks, in the qualifying period of up to 52 weeks and it relates to the rate of unemployment prevailing in the province of residence of the claimant (see Table 1). Benefits are paid after a two-week waiting period has been served.

TABLE 1

Regional Rate of Unemployment	Weeks of Insurable Employment Required
6% and under	14
Over 6% to 7%	13
Over 7% to 8%	12
Over 8% to 9%	11
Over 9%	10

Claimants who have received benefits from an earlier claim during the qualifying period are program repeaters; they require additional weeks of insurable employment, based on the number of weeks of benefits they received in the

period and the unemployment rate in the UI economic region where they live. This provision does not apply in regions with unemployment rates over 11.5%.

Claimants who had less than a combined total of 14 weeks of insurable employment, UI benefits or other weeks prescribed by regulation in the 52-week period preceding the qualifying period, are new-entrants or re-entrants to the labour force; they are required to have 20 weeks of insurable employment in the qualifying period.

In addition, to be entitled to special benefits (sickness, maternity or retirement), claimants must have 20 weeks of insurable employment in the qualifying period.

For more details, see "Statistical Report on the Operation of Unemployment Insurance Act" (Stat. Can 1981 - Catalogue 73-001) and "Unemployment Insurance in the 1980's" (Employment and Immigration Canada 1981).

The unadjusted Unemployment Insurance Beneficiaries series, as shown in Figure 7, displays large seasonal fluctuation, with a peak during the winter months, when bad weather curtails outdoor work in such industries as construction and lumber, bringing a sharp rise in claims filed by affected workers.
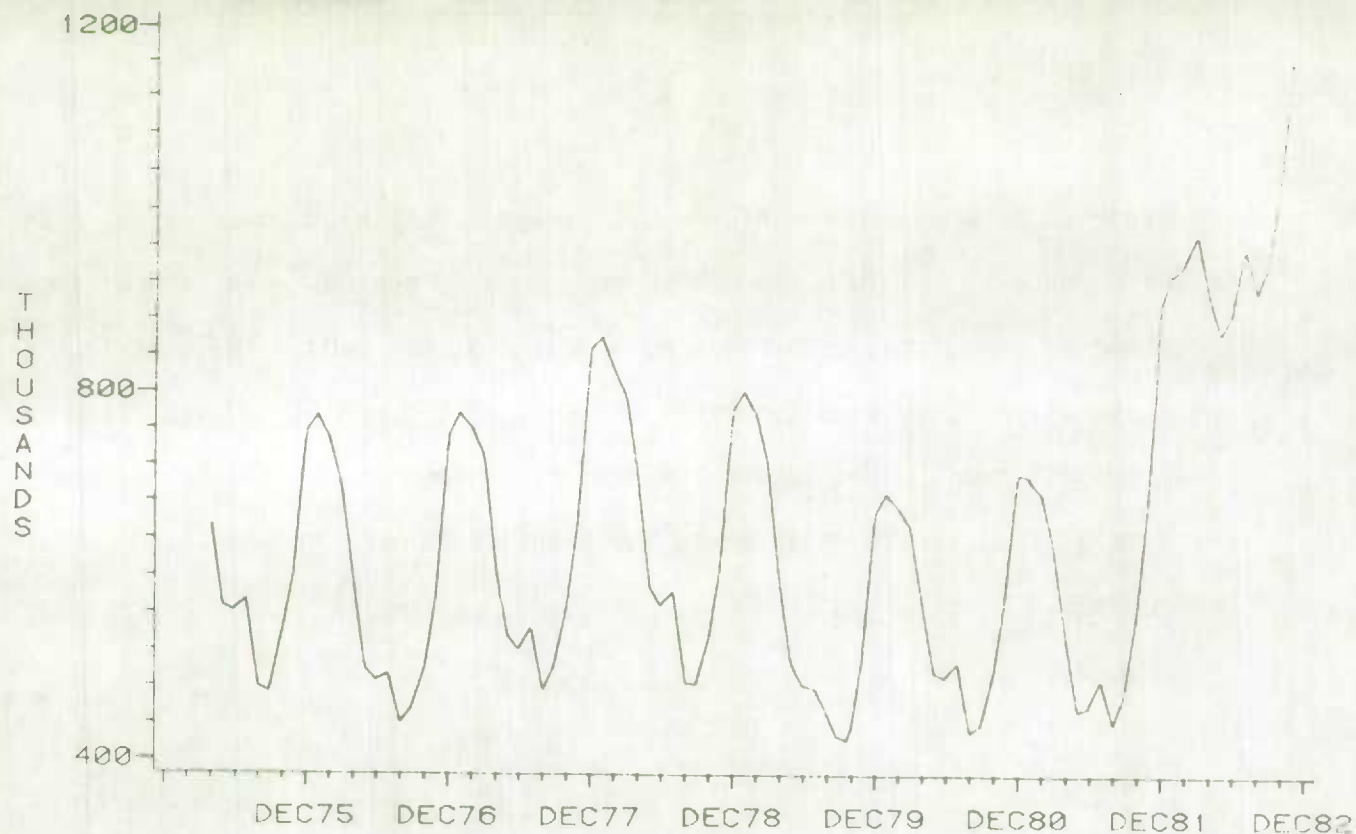
Figure 7. Unemployment Insurance Beneficiaries Series

FREQUENCY (CYCLES/MONTH)
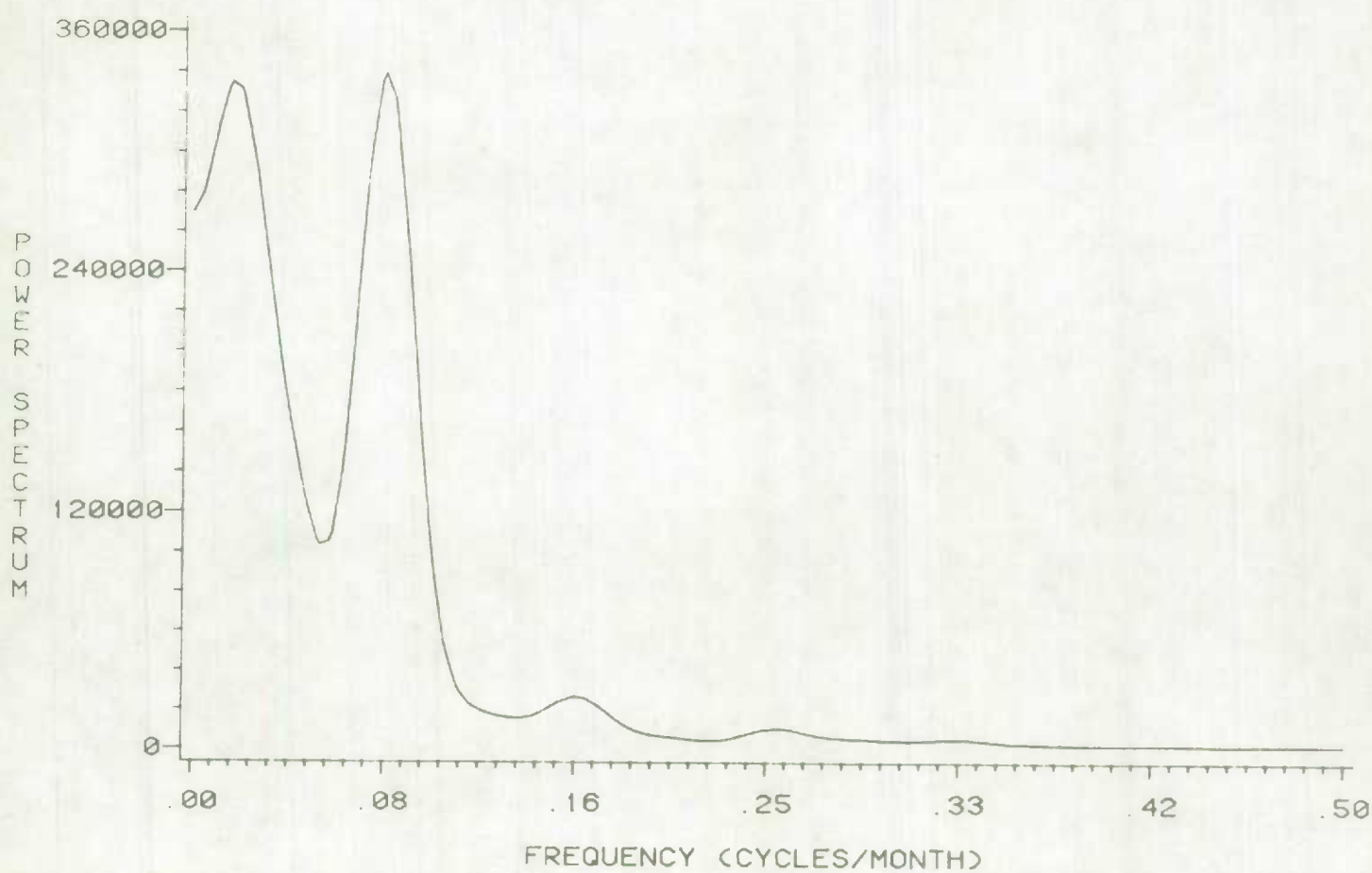
Figure 8. Spectrum of Unemployment Insurance Beneficiaries

Figure 8 shows the spectrum of the UIB series. Very high power is shown at the frequency $\lambda = .0167$, which corresponds to a 60 months-cycle, and at those frequencies associated with the fundamental seasonal band. The contribution of seasonal variations to the total variance of the series is much larger than the observed in the TU and its two major components. Finally, there is little irregularity relative to the trend cycle and the seasonal components.

3. TESTING CAUSALITY BETWEEN UNEMPLOYMENT INSURANCE BENEFICIARIES AND
   TOTAL UNEMPLOYMENT AND ITS MAJOR COMPONENTS

Several early Canadian studies (e.g. Grubel et als, 1975; Green and
Cousineau, 1976; Jump and Rea, 1975; and Siedule et als, 1976) support the
general conclusion that unemployment has tended to shift upward with the
increased availability of unemployment insurance in 1971. Lazar (1978)
shows that the 1971 changes increased the unemployment duration and induced
higher rates of job leaving, especially of young persons and adult women.

These studies were made before the changes of 1975 that aimed at strengthen-
ing work incentives. It was expected that the changes introduced after 1975
would reverse the effects of the program on total unemployment.

In this section, we are mainly concerned with testing the existence of
causality and its direction, between UIB and TU and its two major sub-
components JLo and JLe. It has been argued with good reasons that
causality cannot be detected from empirical evidences only but must be
supported by economic theory (see e.g. Zellner, 1979;and Conway, Swamy
and Yanagida, 1983). In this study we take into account both measure-
ment and economic theory including other subject matter considerations.

The pairwise relationships between TU, UIB, JLo and JLe are calculated
using the cross-correlations of the residuals or "innovations" from ARIMA
models (Box and Jenkins, 1970) that fitted well the data. Table 2 shows
the ARIMA models fitted to each series, their parameter values and the
results of the portmanteau test (Ljung and Box, 1978).

TABLE 2: UNIVARIATE ARIMA MODELS

Series	ARIMA Model	Q Statistic	Degrees of Freedom	σ_a
Unemployment Insurance Beneficiaries (UIB)	$\nabla\nabla_{12} \log(UIB)_t = (1+.55B+.28B^2)(1-.70B^{12})a_t$	14.3	21	21.86
Total Unemployment (TU)	$\nabla\nabla_{12} \log(TU)_t = (1-.10B)(1-.78B^{12})a_t$	16.8	22	43.27
Job Losers (JLo)	$\nabla^2\nabla_{12} \log(JLo)_t = (1-1.15B+.30B^2)(1-.61B^{12})a_t$	23.6	21	23.53
Job Leavers (JLe)	$\nabla\nabla_{12} \log(JLe)_t = (1-.41B)(1-.41B^{12})a_t$	19.4	22	12,14

The Q statistic values accept the null hypothesis of randomness of the residuals in each case. However, since this test is applied to a set of auto-correlations of residuals for various lags, it is possible to have significant auto-correlation for some time lag k that will not be detected by this test.

To assess whether there is or is not auto-correlation of the residuals for each time lag, we use a more accurate approximation for small samples than 1/N to the variance of the auto-correlation, that is, $[N-|k|]/N^2$ as given by Haugh (1976).

Denoting by $r_{xy}(k)$ the cross-correlation between the series X_t and Y_t at lag k, and following the approach of Granger (1969), Haugh (1976) and Pierce (1977), we shall conclude that:

a) X_t causes Y_t if $r_{xy}(k) \neq 0$ for some $k>0$; (symbolized by $X \rightarrow Y$)

b) Y_t causes X_t if $r_{xy}(k) \neq 0$ for some $k<0$; ($Y \rightarrow X$)

c) There is instantaneous causality if $r_{xy}(o) \neq 0$

d) There is a feedback if $r_{xy}(k) \neq 0$ for some $k>0$ <u>and</u> for some $k<0$

   ($X \leftrightarrow Y$)

e) X_t and Y_t are independent if $r_{xy}(k)=0$ $\forall k$ (X-Y).

Under the assumption that the residuals are normally distributed with
$E[r_{xy}(k)]=0$ and $Var[r_{xy}(k)]=\frac{N-|k|}{N^2}$, the statistic S_M^* (Haugh, 1976),

$$S_M^* = N^2 \sum_{k=-M}^{M} (N-|k|)^{-1} r_{xy}(k)^2 \qquad (3.1)$$

follows a χ^2 - distribution with $2M+1$ degrees of freedom.

The S_M^* statistic is applied here to test the independence between the series.

In order to assess the direction of the causality (if present), the S_M^*
statistic (3.1) is calculated either for positive or negative k only,
excluding zero.

Since the cross-correlation values at lags around zero are the most important
for us, the S_M^* is calculated for $k=\pm7$ and $k=\pm3$ to test for independence, and
for $k=1,2,3$ and k -1,-2,-3 to test for unidirectional causality. The results
of these tests, however, were not invalidated when calculated for $k=\pm30$; for each
of the remaining cross-correlation estimates accepted the null hypothesis.

Table 3 presents the estimates of the cross-correlations between Unemployment
Insurance Beneficiaries (UIB) and Total Unemployment (TU) and its two major
components, Job Losers (JLo) and Job Leavers (JLe).   Table 4 presents the
results of the S_M^* test for the cross-correlations of Table 3.

TABLE 3 - CROSS-CORRELATIONS BETWEEN UNEMPLOYMENT INSURANCE BENEFICIARIES AND TOTAL UNEMPLOYMENT AND ITS TWO MAJOR COMPONENTS, JOB LOSERS AND JOB LEAVERS

LAGS	UIB-TU r(k)	UIB-JLo r(k)	UIB-JLe r(k)	JLo-TU r(k)
-7	.07	.23*	.16	-.06
-6	.19	-.09	.18	.24*
-5	.07	.07	-.12	-.05
-4	.21*	.17	.11	-.11
-3	.03	-.07	.01	.06
-2	.10	.07	.03	-.20
-1	.28*	.39**	.15	.07
0	.27*	-.01	.19	.51**
1	.24*	.11	-.03	.11
2	.30**	.27*	.24*	-.04
3	.25	-.01	.22*	.43**
4	.07	-.04	-.12	.04
5	.13	-.11	.07	-.04
6	.03	-.06	.12	.13
7	.14	.05	-.15	.02

* = 5% significant level
**= 1%   "   "

TABLE 4: RESULTS OF THE S_M^* TEST FOR THE CROSS-CORRELATION ESTIMATES OF TABLE 3

LAGS k		UIB-TU	UIB-JLo	UIB-JLe	JLo-TU
-7	+7	38,6**	27,5*	22,9	47,8**
-3	+3	28,5**	18,8*	12,5	40,2**
-1	-7	13,6	19,5**	8,1	10,0
+1	+7	19,2**	8,0	12,1	17,3*
-1	-3	7,0	12,3**	1,8	3,9
+1	+3	16,0**	6.5	8.0*	15.7**

* = 5% significant level
**= 1%   "   "

The values from Tables 3 and 4 conform to the conclusions drawn in the earlier Canadian studies mentioned before. They contradict the expectations that program reviews and legislative changes after 1975 would ensure a more positive labour market impact. In fact, the estimates from Tables 3 and 4 show that:

(a) There is causality between UIB and TU. The cross-correlation estimates at lags k=-4, -1, 0, 1, 2 and 3 reject the null hypothesis of randomness suggesting the existence of a feedback relationship between these two series. However, looking at the results of the S_M^* statistic to assess whether the causal relationship is unidirectional, instantaneous or of feedback, only for positive lags k=1, 2, 3 the null hypothesis is rejected indicating that the causality between UIB and TU is mainly unidirectional; from UIB to TU.

(b) There is a causal relationship between UIB and JLo. The highest cross-correlation estimate occurs at lag k=-1 suggesting that Job Losers leads UIB by one month. This unidirectional causality is confirmed by the S_M^* statistic which rejects the null hypothesis of randomness for the negative values of k.

(c) There is a causal relationship between UIB and JLe. The highest cross-correlation estimates that reject the null hypothesis occur at the positive lags k=+2, and +3. This unidirectional causality from UIB to JLe is confirmed by the S_M^* statistic that rejects the null hypothesis for k=1,2, and 3.

(d) Since JLo leads UIB and UIB leads TU, we wanted to verify if JLo would still lead when cross-correlated with TU. Table 4 indicates that the two

highest cross-correlation values occur at k=o and k=+3 suggesting an instantaneous causality and/or a unidirectional causality, from JLo to UIB respectively. The latter is confirmed by the S_M^* statistic that rejects the null hypothesis of randomness for k=1,2, and 3. Taking into consideration this relationship, and looking at only the highest cross-correlation values for the other pairs of series, we obtain the following causality diagram,
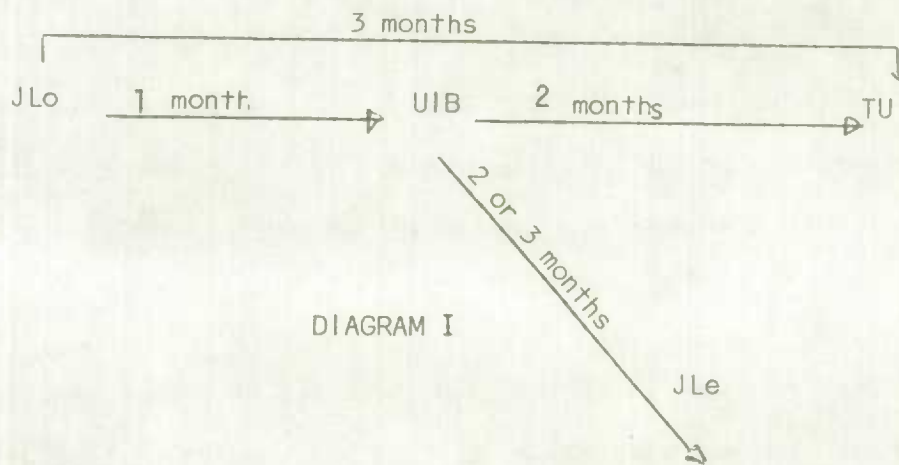

DIAGRAM I

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4.CONCLUSIONS

This study has been mainly concerned with testing the existence of causal relationships between Unemployment Insurance Beneficiaries (UIB) and total Unemployment (TU) and its two major components, Job Losers (JLo) and Job Leavers (JLe).

The approach followed consisted of investigating lead-lag relationships on the basis of empirical evidences from 1975 and economic theory. Empirical evidences were obtained by analysing the residuals cross correlation values of the whitened series. The residuals were estimated from ARIMA models fitted to each series.

The results indicated a strong unidirectional causality among the series discussed as follows: (1) The Unemployment Insurance Beneficiaries series leads Total Unemployment by 2 months; (2) the Unemployment Insurance Beneficiaries series leads Job Leavers by 2 to 3 months; (3) the Job Losers series leads Unemployment Insurance Beneficiaries by one month and (4) the Job Losers series leads total Unemployment by 3 months.

These results conform to those from earlier Canadian studies, based on data prior to 1975, which supported the general conclusions that the increased availability of unemployment

insurance induced higher rates of job leaving, especially of young persons and adult women and increased levels of unemployment.

It was expected that the changes introduced to the unemployment insurance legislation after 1975 would reverse the effects of the program on total unemployment and would lead to a more positive labour market impact. Our empirical results for 1975-1982, however, do not support the above expectations.

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