DISCUSSION PAPER NO. 38

Seasonal Patterns in the Canadian Labour Force

by Donald A. Dawson
Frank T. Denton
Christine H. Feaver
A. Leslie Robb

September 1975

PREFACE

This study was commissioned by the Economic Council of Canada in the late summer of 1973. The project on which it is based commenced in the early fall of that year and concluded in July of 1974. During the course of the project we received assistance from various sources. In particular, we wish to acknowledge the help of staff members of the Economic Council of Canada, Statistics Canada, and Canadian Economic Services, Limited, in the provision of data and in other forms of assistance. We also wish to acknowledge helpful discussions with Dr. Cyril D. Hodgins of Canadian Economic Services, Limited. Mr. Michael Deakin assisted throughout the project in the capacity of research economist and made many valuable contributions. Miss Trudy Voortman typed all of the preliminary and final material for the study and assisted in other ways as well throughout the project.

Donald A. Dawson
Frank T. Denton
Christine H. Feaver
A. Leslie Robb

McMaster University
Department of Economics

SUMMARY

This paper is a study, primarily descriptive, of seasonal patterns in employment, unemployment and the labour force. Both recent patterns and changes in these patterns over time are considered, using special summary measures developed for the purpose. Some comparisons are also made between Canadian seasonal patterns and seasonal patterns in the United States and other countries.

A small decline in the seasonal variability of Canadian employment since the early 1960s is found, and a marked decline in the variability of unemployment. The latter is evident in every major region of the country and for a number of age-sex groups within the population. Consideration is given to whether changes in the composition of the Canadian labour force might account for these declines. It is found that some of the reduced variability of employment may be attributable to changes in industrial composition and some of the decline in unemployment variability to the increased participation of women.

Separate attention is given to the impact of student flows on the summer labour force and the contribution of these flows to summer unemployment levels. Attention is drawn to the high rates of unemployment, both among those looking for temporary work and those seeking permanent employment.

Relationships between seasonal variations in employment and output in the nonagricultural sector are then considered. It is found that overall labour productivity seems not to vary greatly for seasonal reasons, especially when allowance is made for the effects of changes in hours worked and for the summer influx of inexperienced student labour. Finally, there are presented some rough estimates of the costs of seasonality to the Canadian economy, in terms of aggregate output and employment.

RÉSUMÉ

Ce document constitue une étude, surtout descriptive, de l'évolution saisonnière de l'emploi, du chômage et de la population active. Nous tenons compte tant des tendances récentes que des modifications qu'elles ont subies avec le temps, et nous avons recours à certaines mesures sommaires qui ont été mises au point à cette fin. Nous faisons aussi quelques comparaisons entre la situation au Canada, aux États-Unis et ailleurs.

Nous avons trouvé une légère baisse de la variabilité saisonnière de l'emploi au Canada depuis le début des années 60, et un déclin prononcé de la variabilité du chômage, lequel se manifeste de façon évidente dans toutes les principales régions du pays et à l'égard d'un certain nombre de groupes d'âge des deux sexes au sein de la population. Nous nous demandons si ces baisses pourraient être imputables à des changements survenus dans la composition de la population active. Nous avons trouvé que la diminution de la variabilité de l'emploi peut être attribuable en partie aux changements survenus dans la composition des industries, et que la diminution de la variabilité du chômage peut être attribuable en partie à une plus grande participation des femmes au marché du travail.

Nous étudions séparément l'impact des flux des étudiants sur la population active durant l'été, et la contribution de ces mouvements aux niveaux de chômage d'été. Nous attirons l'attention sur les taux élevés de chômage, tant parmi ceux qui cherchent un emploi temporaire que parmi ceux qui cherchent un emploi permanent.

Nous examinons ensuite la relation qui existe entre les variations saisonnières de l'emploi et de la production dans le secteur non agricole. Nous avons trouvé que, dans l'ensemble, la productivité du travail ne semble pas beaucoup varier sous l'influence des saisons, surtout si l'on tient compte des changements qui interviennent dans le nombre d'heures passées au travail et de l'afflux, durant l'été, de la main-d'oeuvre étudiante sans expérience. Enfin, nous présentons quelques estimations grossières du coût du travail saisonnier pour l'économie canadienne, sous forme de production et d'emploi globaux.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF CHARTS

CHAPTER I

INTRODUCTION

Seasonality in economic activity has long been of interest to economists.* In the past two decades, the development of computer methods for seasonally adjusting and decomposing time series cheaply and quickly has made possible the routine extraction of seasonal patterns from thousands of series relating to the whole spectrum of measured economic phenomena. Nevertheless, it can be argued that seasonal fluctuations have been given less than the attention that their quantitative importance warrants. This argument has special force in a country such as Canada where climatically induced fluctuations are so obvious and pervasive.

The literature on seasonal fluctuations in Canada is not extensive.** It has been concerned almost entirely with fluctuations of employment and unemployment.*** The list of published studies includes a 1958 paper by Douglas Hartle [11], a major study published in three parts in 1960 by the federal Department of Labour [26,27,28], a study by David Smith [31] published in 1965, another study published by the federal Department of Labour [4] in the same year and, more recently, some work by Helen Hardy [8,9,10] relating to seasonal unemployment in the period

---

* See, for example, Kuznets [17].

** Indeed, the international literature is not extensive either. No attempt is made here to provide a comprehensive survey of the literature of other countries but it may be of interest to note that in the United States much of the published work is concerned with seasonality in the construction industry: see Meyers and Swerdleff [22], Russell and Pilot [24], Foster [6], and Nowenstein [14]. For other U.S. studies of seasonality, see Bonin [1], Bonin and Davis [2,3], and Perrella [23].

*** A minor exception is Denton [5].

1955-70. Mention should also be made of the fact that staff members of Statistics Canada and the Department of Manpower and Immigration have recently authored a number of articles on specific aspects of seasonality in the labour market [7,13,16,18,19,25,32,33,34]. In particular, much attention has been given in these latter studies to questions relating to seasonal unemployment among young people.

The present study falls into the same general category as the preceding ones. That is to say, it is a study of seasonality in the labour market in which attention is given to current seasonal patterns in employment, unemployment, and the labour force, and to changes in these patterns through time. It is also largely descriptive in nature, as have been the earlier ones: its basic aim is to describe rather than to explain the patterns.

The study is organized as follows. Chapter II is concerned with measurement of seasonality, in general, and with the specification of some particular summary measures to be used in subsequent chapters. Chapter III presents a description of seasonal patterns in the total labour force and in total employment and unemployment during the period 1971-73; it also provides some comparisons with aggregate seasonal patterns in other countries, insofar as data permit. In Chapter IV, the 1971-73 seasonal patterns for particular components of the labour force are examined, consideration being given to differences among age-sex groups, regions, industries, and other components. The changes in patterns that occurred in the 1960's and early 1970's are then considered in detail, in Chapter V. In Chapter VI, some separate attention is given

to seasonal variations associated with the summer flows of students into and out of the labour market. Chapter VII considers the relationships between seasonal patterns in employment and production in the nonagricultural sector of the economy and its major industrial divisions. Chapter VIII then goes on to provide some rough estimates of the cost of seasonality to the Canadian economy in terms of output lost because of seasonal underutilization of manpower resources. A summary and some conclusions are offered in Chapter IX. Throughout the study, the tables and charts relevant to each chapter appear at the end of the chapter.

CHAPTER II

MEASURES OF SEASONALITY

There are in common use two basic approaches to the problem of separating a time series into seasonal and nonseasonal components. One approach proceeds sequentially, first extracting an estimate of the so-called "trend-cycle" component, then an estimate of the seasonal component, and finally an estimate of the residual or "irregular" component. In many of the more complex versions, iterative procedures are incorporated, so that the first set of estimates of the components is used to initiate a second round of estimation, possibly the second set to initiate a third round, and so on. This approach typically involves extensive use of moving averages. It has a long history in the literature of economic statistics but many refinements and its embodiment in widely used computer programs had their origins in the 1950's. The refinement and popularization of the approach can be attributed in large measure to the work of Julius Shiskin and his associates at the United States Bureau of the Census in the 1950's and early 1960's.* It is this approach that is used at Statistics Canada for seasonally adjusting labour statistics and other economic time series. Thousands of series are now seasonally adjusted more or less routinely in Canada using "computerized" moving-average methods.

The second approach involves the estimation of all components of a time series simultaneously, typically by least squares, although

---

* See Shiskin [29] and Shiskin and Eisenpress [30].

other estimation procedures may be employed. Any method of seasonal adjustment which has certain desirable properties can be shown to be equivalent to regressing the series to be adjusted on an appropriate set of explanatory variables.* A commonly used procedure, in this case, is to regress the series on a set of dummy (zero-one) variables -- one for each month or quarter, as the case may be. Provision for changes in seasonal patterns through time can be incorporated by including in the set of explanatory variables appropriate combinations of dummy variables and trend polynomials.

It is not our intention here to debate the relative merits of these two approaches, or of particular variants of one or the other. For some purposes, the choice of method to be used for extracting the seasonal component of a series may be quite important. This may be true, in particular, if one is concerned with short-term economic analysis and forecasting. In that case, small differences in the estimates of the latest month-to-month or quarter-to-quarter changes in a seasonally adjusted series may be critical in determining one's view of current conditions or immediate prospects. For our purposes, though, the differences are likely to be much less important. The subject of our concern is the extent and timing of seasonal variations over the course of a year -- the overall "seasonal pattern", so to speak. It is a fact that for most economic time series the broad patterns of seasonality are relatively insensitive to the choice of method used to estimate them. This is

---

* See Lovell [20].

especially true of seasonal patterns for previous years, as distinguished from the patterns for a current year that emerge month by month as the latest values of the series are seasonally adjusted.

In short, then, we do not expect the findings of this study to depend in any significant way on the particular method of seasonal adjustment. If a seasonal pattern is constant through time, virtually any method that one might consider using will yield approximately the same results. If a pattern is changing, small changes are not likely to be of much interest, and can be interpreted with due caution, while large changes will be detected by whatever method is used. At least we consider this to be true of the types of data that we are interested in analysing here.

The method used at present by Statistics Canada in the seasonal adjustment of series from the Labour Force Survey is a moving-average method known as the X-11 version of the United States Bureau of the Census Method II.* We have made extensive use of monthly Labour Force Survey data in this study and, in doing so, have found it convenient to use the "official" X-11 seasonal factors published by Statistics Canada.** However, in Chapter V we have also employed dummy-variable regression analysis as a basis for carrying out tests of statistical significance of apparent changes in seasonal patterns.

We shall find it convenient throughout the study to make use of some particular summary measures of seasonality. These measures,

---

* See United States Bureau of the Census [36].

** The monthly series and the associated series of seasonal factors are contained in Statistics Canada [35].

which are based on the X-11 seasonal factors, will now be defined.

Let s_m be the percentage seasonal factor for some series in month m of a particular year (m=1 for January, m=2 for February, etc.). If x_m and x_m^a are the seasonally unadjusted and seasonally adjusted values of the series, respectively, s_m is equal to $100(x_m/x_m^a)$. The twelve monthly seasonal factors will then be distributed around 100 percent. The "mean seasonal factor variation", MSFV, is defined as the mean difference of the seasonal factors from 100 percent, ignoring signs:

$$(1) \qquad MSFV = 1/12 \sum_{m=1}^{12} | s_m - 100 |.$$

As a supplementary measure of the extent of seasonal variation, we consider also the "seasonal factor range", SFR, defined simply as the difference between the highest and the lowest monthly seasonal factors over the course of the year:

$$(2) \qquad SFR = \max(s_m) - \min(s_m).$$

The foregoing measures are defined in terms of monthly seasonal factors. In the event that quarterly series are being analysed, the measures can be computed in analogous fashion, based on four quarterly factors rather than twelve monthly ones.

Seasonal patterns may differ in timing from one series to another; not all series have their seasonal peaks and troughs at the same times. However, it is convenient to analyse the seasonal variations of

total employment, unemployment, and the labour force in terms of the contributions to these variations of particular regions, industries, age-sex groups, etc. With this in mind, we choose standard seasonal "high" and "low" periods and compute the seasonal changes for all series between these periods. Overall Canadian unemployment reaches its highest seasonal level in the period January-March and its lowest level in the period August-October. We choose these two periods as the standard reference periods and define the "seasonal factor difference", SFD, as the difference between the average of the factors for August-October and the average for January-March:

$$(5) \qquad SFD = 1/3 \sum_{m=8}^{10} s_m - 1/3 \sum_{m=1}^{3} s_m .$$

Consider next the division of a total into k groups -- for example, the division of total employment into five regional components. The seasonally unadjusted series for the groups sum to the total unadjusted series. Let x_{im} stand for the unadjusted value for the i^{th} group in month m and let x^a_{im} stand for the corresponding seasonally adjusted value. Let x_m and x^a_m be the total unadjusted and adjusted values. Noting that $s_{im} = 100(x_{im}/x^a_{im})$ and $s_m = 100(x_m/x^a_m)$, we can write

$$(4) \qquad x^a_m s_m = \sum_{i=1}^{k} x^a_{im} s_{im} .$$

Now let us abstract from nonseasonal variations and take the seasonally adjusted series to be constant at some levels x^a_i and x^a throughout the year. Letting SFD and SFD_i be the "seasonal factor differences", as defined above, for the total series and for the i^{th} component series,

respectively, we can then write

$$(5) \qquad 1/3 \sum_{m=8}^{10} \bar{x}_i^a s_{im} - 1/3 \sum_{m=1}^{3} \bar{x}_i^a s_{im} = \bar{x}_i^a (1/3 \sum_{m=8}^{10} s_{im} - 1/3 \sum_{m=1}^{3} s_{im})$$

$$= \bar{x}_i^a \, SFD_i$$

$$(6) \qquad 1/3 \sum_{m=8}^{10} \bar{x}^a s_m - 1/3 \sum_{m=1}^{3} \bar{x}^a s_m = \bar{x}^a (1/3 \sum_{m=8}^{10} s_m - 1/3 \sum_{m=1}^{3} s_m)$$

$$= \bar{x}^a \, SFD$$

$$(7) \qquad \bar{x}^a \, SFD = \sum_{i=1}^{k} \bar{x}_i^a \, SFD_i .$$

For convenience, we take $\bar{x}_i^a$ and $\bar{x}^a$ to be equal to the average annual levels of the respective series. Letting A_i and A stand for these average annual levels, we then define the "seasonal difference" as the product of the annual average and the "seasonal factor difference":

$$(8) \qquad SD_i = A_i(SFD_i)$$

$$(9) \qquad SD = A(SFD).$$

This allows us to write

$$(10) \qquad SD = \sum_{i=1}^{k} SD_i$$

and to use this relationship as a basis for computing the contribution of the i^{th} component series to the seasonal change in the total series between January-March and August-October. We are interested especially in comparing the average percentage that a particular group represents of the total (e.g., average employment in the Atlantic Provinces as a

percentage of total Canadian employment) with its percentage contribution to the seasonal changes in the total. That is to say, we are interested in comparing $100(A_i/A)$ with $100(SD_i/SD)$.

We shall use the measures defined above extensively in later chapters. In summary, the measures are the following:

MSFV -- "mean seasonal factor variation", representing the average departure of the percentage seasonal factors from 100;

SFR -- "seasonal factor range", representing the difference between the highest and lowest percentage seasonal factors;

SFD -- "seasonal factor difference", representing the difference between the average August-October and January-March seasonal factors;

A -- the average annual level of a series;

SD -- "seasonal difference", representing the change in a series between January-March and August-October under the assumption that the nonseasonal component of the series remains constant at the average annual level.

CHAPTER III

AGGREGATE SEASONAL PATTERNS

Nowhere do the effects of seasonality stand out more clearly than in the unemployment series. From September, when it reaches its lowest seasonal point, to January, when it reaches its highest, total Canadian unemployment rises by something of the order of 60 percent, in the absence of nonseasonal influences. The level starts in March to decline noticeably from its winter heights, falls substantially in April and even more in May, tends to rise a little in June, as large numbers of students move into the labour market, and then falls appreciably in each of July, August, and September. Thereafter it starts to climb again, moving steadily upward through the fall and into the winter. This is the typical pattern. It is clearly evident in Table III-1, which presents the average X-11 seasonal factors for the period 1971-73.

The calendar fluctuations of unemployment are a reflection, of course, of employment fluctuations, but by no means a perfect reflection. Employment has its seasonal trough in January, when unemployment has its seasonal peak. The seasonal peak for employment comes in July, though, rather than September, reflecting again the presence of students in the summer labour market. In percentage terms, the seasonal swings in employment are much less pronounced that those in unemployment because of the differences in the numbers involved; for example, with a 5 percent unemployment rate, a decline of 20 percent in unemployment would correspond, roughly speaking, to an increase of no more than 1 percent in employment. From trough to peak, total employment rises, for seasonal

reasons, by about 10 percent, and nonagricultural employment by slightly less.

Seasonal variations occur also in the labour force, as evidenced by Table III-1. The largest are the result of inflows of students, starting as early as May, and continuing through June and into July, and outflows, which occur between August and September. Variations result also from the reduction of the agricultural labour force during the winter and various other factors. Overall, seasonal influences are responsible for an increase of about 8 percent from the low point, which occurs in February, to the high point, which occurs in July.

It is of interest to compare seasonal patterns in Canada with those in other countries. Unfortunately, such comparisons are hindered by differences in the availability of data from country to country and in the definitions and measurement processes which underly the data. Comparisons between the United States and Canada can be made with some confidence because of rough consistency between the practices followed in the U.S. Current Population Survey and the Canadian Labour Force Survey, although even here a degree of caution is warranted. With respect to other countries, the difficulties are much more serious. Nevertheless, it is perhaps worthwhile to make the best of the available data and to try to put the Canadian seasonal patterns into some sort of international perspective. Chart III-1 offers a comparison of the average 1970-72 seasonal patterns for the United States and Canada for the total labour force, employment, nonagricultural employment, and unemployment, based on monthly data. Table III-2 offers a comparison of average 1970-72 seasonal unemployment patterns in Canada with those in 17 other OECD member countries, based on quarterly data published by the

OECD. In addition to the average seasonal factors themselves, the table provides an indication of the type of unemployment series that is available for each country and values of the MSFV and SFR measures defined in the previous chapter, as calculated from the quarterly factors.

The differences in seasonal patterns between Canada and the United States exhibited by Chart III-1 are of some interest. As climatic differences would lead one to expect, seasonal fluctuations in employment are more pronounced in Canada. This is true both of total employment and employment in the nonagricultural sector of the economy. The seasonal fluctuations in the labour force are also more pronounced in Canada. However, the most notable differences occur in the unemployment series. Canadian unemployment experiences wider seasonal swings than United States unemployment, again as one would expect, but in addition there are major differences in timing; the seasonal peaks and troughs occur in quite different periods of the year. Whereas Canadian unemployment reaches its seasonal trough in the early fall and its peak in the early winter, the U.S. trough occurs in May and the peak just one month later, in June. For anyone accustomed to thinking of seasonal unemployment in the Canadian context, this is a surprising pattern. It reflects the large numbers of young people in the labour force in the summer months and the very high rates of unemployment among young people. There is some increase in Canada between May and June too, but nothing like the big rise that occurs in the U.S.

The data assembled in Table III-2 suggest that Canada is certainly one of the countries with substantial seasonal fluctuations

in unemployment. At least in recent years, though, the fluctuations in many other countries have been greater; 9 countries exhibit larger fluctuations, based on the MSFV measures reported in the table, and 10 countries, based on the SFR measures. Although the problems associated with international comparisons referred to above should be kept in mind, it seems unlikely that more refined data would alter the general impression conveyed by the table.

We have described the Canadian seasonal variations in terms of percentage changes and differences in seasonal factors over the course of the year. The variations in terms of numbers of people depend on the average nonseasonal levels of the series. Table III-3 provides estimates of hypothetical changes from January-March to August-October, based on the assumption that the nonseasonal components of the series are constant at their average 1971-73 levels. The changes shown in the table thus represent the net numbers of people moving into or out of employment, unemployment, and the labour force* purely for reasons of seasonality, under average 1971-73 conditions.

On this basis, unemployment declined by about 216 thousand between January-March and August-October, for seasonal reasons. Employment increased by 495 thousand, with the nonagricultural sector accounting for about seven-tenths of the increase, agriculture for about three-tenths. The difference between the seasonal increase in

---

* Total employment, nonagricultural employment, and unemployment are calculated directly, for this table, while the labour force is calculated as the sum of employment and unemployment.

employment and the seasonal decrease in unemployment is reflected in a net addition of some 279 thousand to the labor force.

Table III-1: Seasonal Patterns in Employment, Unemployment, and the Labour Force: 1971-73 Average Seasonal Factors

Seasonal factor in -	Employment		Unemployment	Labour force
	Total	Nonagricultural		
January	96.0	96.8	122.8	97.5
February	96.1	97.0	121.0	97.4
March	96.3	97.0	117.7	97.5
April	97.7	97.8	112.6	98.4
May	100.9	100.4	99.0	100.7
June	103.3	102.9	101.0	103.2
July	105.6	104.4	94.5	105.1
August	105.0	104.0	85.2	103.8
September	100.5	99.8	75.8	99.1
October	100.6	100.6	81.7	99.6
November	99.4	99.9	90.7	99.0
December	98.6	99.4	99.6	98.7

Source: Based on data from the Statistics Canada Labour Force Survey, as tabulated in Historical Labour Force Statistics, Actual Data, Seasonal Factors, Seasonally Adjusted Data, 1973 (Catalogue 71-201) or available from associated computer tape provided by Statistics Canada for use in this study.

Table III-2: Comparison of Seasonal Patterns in Unemployment in Canada and 17 Other OECD Countries: 1970-72 Averages

Country	Nature of unemployment series	Average seasonal factor				MSFV	SFR
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter		
Canada	household sample survey	121.7	104.8	84.7	90.2	12.9	37.0
Australia	registered unemployed	120.3	95.6	81.9	103.5	11.6	38.4
Austria	registered applicants for work	154.9	75.9	63.5	105.7	30.3	91.4
Belgium	insured unemployed	109.5	95.6	92.7	102.1	5.8	16.8
Denmark	insured unemployed	179.3	68.8	50.8	107.4	41.8	128.5
Finland	household sample survey	129.2	101.3	81.6	88.4	15.1	47.6
France	unfilled applications for employment	109.8	91.9	90.4	107.7	8.8	19.4
Germany	registered unemployed	159.0	78.2	68.4	93.6	29.7	90.6
Greece	registered unemployed	149.0	97.4	59.0	89.7	25.7	90.0
Ireland	insured unemployed	110.4	100.8	93.3	96.2	5.4	17.1
Italy	household sample survey	114.1	90.1	97.2	99.0	7.0	24.0
Japan	unemployment insurance beneficiaries	134.5	104.7	88.1	72.1	19.8	62.4
Netherlands	registered unemployed	130.5	80.4	80.9	106.8	19.0	50.1
Norway	registered unemployed	167.3	70.0	59.6	120.3	39.5	107.7
Spain	registered unemployed	108.5	98.6	93.2	99.8	4.2	15.3
Sweden	insured unemployed	135.8	95.1	77.3	96.1	16.8	58.5
United Kingdom	registered unemployed	107.7	97.5	95.1	99.6	3.9	12.6
United States	household sample survey	106.9	98.3	101.1	92.9	4.2	14.0

Source: Canada - see source note to Table III-1.

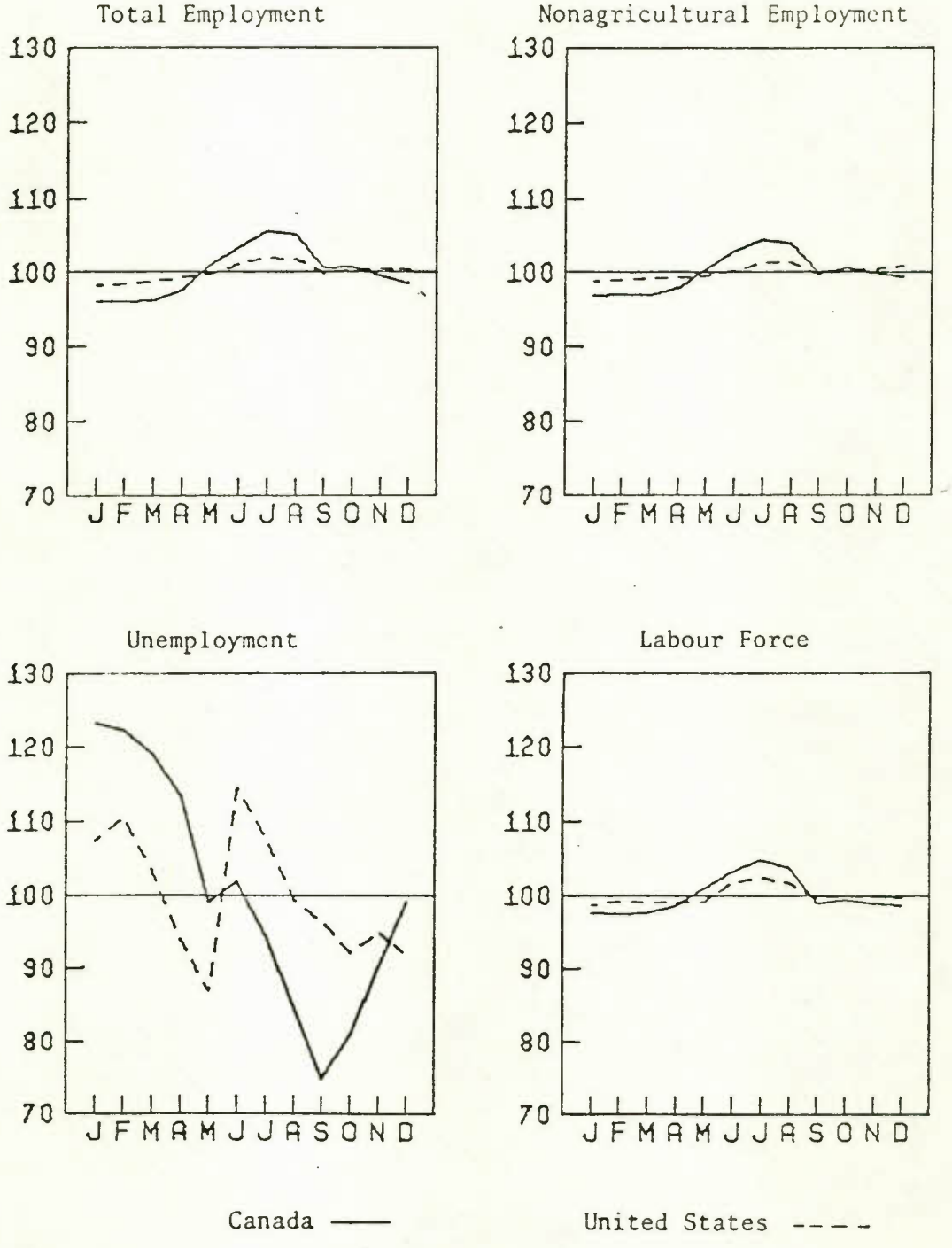
All other countries - OECD, Main Economic Indicators, Historical Statistics, 1955-1971, Paris, 1973; OECD, Main Economic Indicators, November 1973.

Table III-3: Pure Seasonal Changes from January-March to August-October in Numbers of Persons Employed, Unemployed, and in the Labour Force, Assuming the Average Seasonal Factors and Average Nonseasonal Levels of 1971-73

	Hypothetical number of persons, in thousands		
	January-March	August-October	Change
Employed - total	8,064	8,559	495
- nonagricultural	7,663	8,016	353
Unemployed	657	441	-216
Labour force	8,721	9,000	279

Source: See source note to Table III-1.

Chart III-1: Comparison of Seasonal Patterns in Employment, Unemployment, and the Labour Force in Canada and the United States: 1970-72 Average Seasonal Factors



Source: Canada - see source note to Table III-1.
United States - based on data in Bureau of Labor Statistics, Employment and Earnings, various issues.

CHAPTER IV

SEASONAL PATTERNS IN PARTICULAR LABOUR FORCE GROUPS

Seasonal fluctuations in various groups within the total population are analysed in Tables IV-1 - IV-4, again for the period 1971-73. In particular, attention is given to differences by sex, by age and sex, by region, by industry, and by class of worker (paid workers, as distinguished from self-employed persons). Tables IV-1 and IV-2 provide summary analyses of seasonal patterns in total employment and non-agricultural employment, respectively. Tables IV-3 and IV-4 provide similar analyses of patterns in unemployment and in the total labour force. In addition, the various seasonal patterns are displayed graphically in Charts IV-1 - IV-4.

The same format is used in all four of the tables. The months in which the seasonal peaks and troughs occur are indicated, together with the seasonal factors in those months. (As before, the seasonal factors on which the tables and charts are based are calculated from the X-11 factors supplied by Statistics Canada.) Average seasonal factors for January-March and August-October, our standard seasonal "high" and "low" periods, are presented in the tables. The MSFV, SFR, and SFD measures defined in Chapter II are also presented. Finally, the last two columns of each table afford a comparison of the percentage distribution of average employment, unemployment, etc., among the different groups, with the corresponding average contributions of the groups to total seasonal variations, i.e., a comparison of the

distributions of A with the distributions of SD, again as defined in Chapter II.*

Employment

Consider first Table IV-1. Seasonal variation of employment is substantially greater for men than for women -- roughly twice as great, on the basis of any of the relevant measures. In consequence, the last two columns of the table indicate that while men represented about 66 percent of total employment in the period 1971-73, they accounted for about 82 percent of the seasonal variation in total employment. Women, representing a third of the total, contributed less than a fifth of the seasonal variation.

An examination of the distributions by age indicates that the seasonal variability of male employment is attributable primarily to the variability among men under 25, and especially among those under 20. Although men under 20 represented less than 6 percent of average employment, they contributed 27 percent of the seasonal variability. Women under 20 also exhibit a high degree of seasonal variability. Considering all persons under the age of 25, men and women together, this group represented a quarter of total employment in the economy but

---

* It should be noted that there may be minor inconsistencies between the distributions of SD for different classifications in the tables. In particular, the sum of the percentages by age group for each sex may not be exactly equal to the percentage shown for the sex as a whole. This is due in part to the way in which the SD measure is defined and in part to inconsistencies in the published Statistics Canada seasonally adjusted series and associated seasonal factors. (Adding-up restrictions are not automatically satisfied by moving-average adjustment procedures such as X-11.) However, these inconsistencies are of negligible importance for our purposes.

three-fifths of its seasonal variability. In the main, this is attributable to the large numbers of secondary and post-secondary school students who take jobs each summer and relinquish them in the fall. This pattern is quite evident in the graphs of Chart IV-1.

The distribution of seasonal employment fluctuations among regions is also quite uneven. The Atlantic Region experiences the greatest seasonal swings, Ontario and British Columbia the smallest ones. The Prairie Region exhibits considerable variability in total employment, owing principally to the variability of employment in agriculture.

An analysis of seasonal variability by industry reveals that by far the largest fraction is accounted for by goods-producing industries and, more specifically, by primary goods-producing industries (other than mines, quarries, and oil wells) and the construction industry. Agriculture, forestry, fishing and trapping, and construction together accounted for only about 13 percent of total employment in 1971-73, on average, but 64 percent of the total seasonal variability of employment. The relatively large seasonal swings in employment in these industries are also illustrated by Chart IV-1. It is clear that seasonal fluctuations in the Canadian economy are associated predominantly with those industries which are subject directly to the influence of climate.

Paid workers, as distinguished from self-employed persons,* exhibit somewhat less seasonal variability than total employment. The

---

* The term "self-employed" is used here to represent the combination of those groups referred to in the Labour Force Survey as "employers", "own-account workers", and "unpaid family workers".

greater variability of the total is attributable mainly to the substantial variation of employment among self-employed farmers and working members of their families over the course of the year.

Table IV-2 provides some information about the distribution of seasonal fluctuations of employment in the nonagricultural sector of the economy. Here the disproportionately large contribution of male employment is even more in evidence: males, representing about 65 percent of total employment in 1971-73 accounted for about 89 percent of seasonal variability.

Seasonal variability is lower in nonagricultural employment than in total employment in every one of the five regions. However, the largest difference, by far, occurs in the Prairies. With agriculture removed, the Prairie Provinces contributed to Canadian seasonal employment variability roughly in proportion to their average 1971-73 employment level. Concomitantly, the relative contributions of the Atlantic Provinces, Quebec, and British Columbia were higher for nonagricultural employment than for total employment.

Seasonal variability among nonagricultural paid workers differs little from the variability of total nonagricultural employment. Thus, for example, both series yield an MSFV of 2.0, as recorded in Table IV-2.

Both total employment and nonagricultural employment reached their seasonal peak in July during the period 1971-73, and their seasonal trough in January. (This is also true of each of the three years in the period, taken separately.) However, there are departures from this pattern in individual groups. Of interest, in particular, are the

differences for women over 25 years of age, for whom the employment peaks occur in the fall or early winter, and the troughs in the late summer. Some differences in timing occur also in particular industries, most notably trade, where the seasonal high point in employment occurs in December, and the electric power, gas and water utilities group, where the seasonal low point is October. Among regions and other employment categories, the differences in the timing of peaks and troughs are much less pronounced.

Unemployment

The seasonal fluctuations of unemployment are proportionately much greater than those of employment. As Table IV-3 indicates, seasonal variation in unemployment is widespread among age groups and among regions. This picture also emerges clearly from the graphs of Chart IV-3.

There are notable differences in the seasonal unemployment patterns of men and women. For one thing, men contribute more than 95 percent of the seasonal variation in total unemployment between January-March and August-October, women less than 5 percent. For another, there are major differences in timing. Whereas male unemployment reaches a peak in January and a trough in September, female unemployment reaches a peak in June and a trough in December.

An examination of particular age groups indicates that for males over 20 the timing of peaks and troughs conforms with the overall pattern. For males under 20, though, the pattern is quite different; the effect of student entrants into the labour force produces a peak

unemployment level in June rather than in the winter months. Women under 20 also display a peak unemployment level in June while for those in the 20-24 age group the peak occurs in May. For older women, the peaks occur in the winter.

The timing of seasonal swings is roughly similar in all regions, although there are considerable differences in magnitude. As with employment, the Atlantic Provinces experience the greatest seasonal variation. At the other extreme, British Columbia experiences the least.

Labour Force

If all seasonal movements took the form of transfers between employment and unemployment, the labour force would be unaffected. However, this is not the case; the total labour force, and more especially some groups within the total, exhibit regular seasonal patterns. The most obvious patterns are those associated with student entries and exits in the summer but some variation is apparent in almost all labour force categories.

Seasonal patterns in the labour force are summarized in Table IV-4. The importance of student flows is evidenced by the fact that men and women under 25 account for about 84 percent of the total labour force variation, and those under 20 alone account for about 63 percent. Among regions, the distribution is roughly similar to the distribution of employment fluctuations, with the Atlantic and Prairie Provinces contributing disproportionately large shares and Ontario and British Columbia disproportionately small ones. That overall seasonal variation in the Canadian labour force is not negligible is apparent from the fact that

the MSFV for the labour force is 2.1, compared with 2.6 for total employment.

Table IV-1: Analysis of Seasonal Patterns in Employment by Sex, Age, Region, Industry, and Class of Worker: 1971-73 Averages

	Seasonal peak	Seasonal trough	Average seasonal factor		MSFV	SFR	SFD	A as percent of total	SD as percent of total
			Jan.-March	Aug.-Oct.					
Total employment	July(105.6)	Jan.(96.0)	96.1	102.0	2.6	9.5	5.9	100.0	100.0
Men	July(106.8)	Feb.(95.4)	95.4	102.7	3.3	11.4	7.2	66.3	81.8
Women	July(103.4)	Jan.(97.1)	97.6	100.7	1.5	6.3	3.2	33.7	18.2
Men 14-19	July(145.4)	Feb.(80.7)	81.4	109.6	17.3	64.6	28.2	5.6	27.0
Men 20-24	July(113.0)	Feb.(91.9)	92.0	103.4	6.7	21.2	11.4	8.8	17.1
Men 25-44	Aug.(102.0)	Jan.(97.5)	97.6	101.7	1.6	4.5	4.2	30.0	21.3
Men 45-64	June(101.8)	Mar.(97.3)	97.6	101.6	1.6	4.5	4.0	20.4	14.0
Men 65 and over	Sept.(105.4)	Feb.(91.1)	92.8	104.3	4.2	14.3	11.5	1.6	3.2
Women 14-19	July(134.6)	Mar.(87.8)	88.0	106.5	11.6	46.8	18.4	4.3	13.7
Women 20-24	June(104.9)	Jan.(97.1)	97.6	100.3	1.9	7.7	2.7	6.5	3.0
Women 25-44	Dec.(101.7)	Aug.(96.0)	99.6	99.4	1.4	5.8	-0.2	13.4	-0.5
Women 45-64	Sept.(101.6)	Aug.(96.9)	99.2	100.0	1.2	4.7	0.8	8.9	1.3
Women 65 and over	Dec.(104.6)	Aug.(94.2)	100.1	100.1	3.0	10.3	0.0	0.5	0.0
Atlantic Provinces	July(109.6)	Feb.(91.9)	92.4	104.9	5.3	17.6	12.5	7.7	16.5
Quebec	Aug.(105.9)	Feb.(95.8)	96.0	102.6	2.8	10.1	6.5	26.9	30.2
Ontario	July(104.7)	Feb.(97.1)	97.3	100.9	2.0	7.6	3.6	38.4	23.8
Prairie Provinces	July(105.6)	Jan.(94.8)	95.2	102.9	3.5	10.8	7.6	16.4	21.6
British Columbia	July(105.1)	Jan.(95.7)	97.0	101.2	2.1	9.4	4.3	10.6	7.8

Table IV-1 (Continued)

	Seasonal peak	Seasonal trough	Average seasonal factor		MSFV	SFR	SFD	A as percent of total	SD as percent of total
			Jan.-March	Aug.-Oct.					
Agriculture	Aug.(120.8)	Feb.(82.2)	83.6	111.6	12.1	38.5	28.0	5.8	28.8
Forestry	Aug.(121.8)	Apr.(71.8)	90.2	112.3	11.2	50.0	22.2	0.9	3.5
Fishing and trapping	June(147.5)	Feb.(57.8)	61.7	116.2	26.9	89.7	54.5	0.3	2.7
Mines, quarries, and oil wells	June(106.2)	Nov.(96.2)	98.2	99.9	3.0	10.0	1.8	1.5	0.5
Manufacturing	Aug.(104.5)	Jan.(96.5)	97.6	101.8	2.0	7.9	4.2	22.3	16.7
Construction	Aug.(116.1)	Feb.(82.9)	84.4	111.0	10.3	33.2	26.6	6.1	29.1
Transportation and communication	Aug.(104.5)	Feb.(97.1)	97.4	101.6	2.1	7.4	4.1	7.7	5.6
Electric power, gas, and water utilities	June(104.4)	Oct.(95.1)	99.9	97.4	2.4	9.4	-2.5	1.1	-0.5
Trade	Dec.(103.7)	Feb.(97.1)	97.4	100.4	2.1	6.6	3.0	16.8	8.9
Finance, insurance, and real estate	Aug.(103.1)	Dec.(97.8)	100.2	100.2	1.4	5.4	0.0	4.7	0.0
Community, business, and personal service	June(102.5)	Sept.(98.4)	99.0	99.6	1.0	4.1	0.6	26.2	2.9
Public administration	July(109.4)	Sept.(95.7)	98.2	99.8	3.4	13.6	1.6	6.6	1.9
Goods-producing industries	Aug.(109.7)	Jan.(92.2)	92.6	105.2	5.4	17.4	12.6	36.9	81.0
Service-producing industries	July(103.6)	Mar.(98.1)	98.3	100.0	1.4	5.4	1.7	63.1	19.0
Paid workers	July(105.1)	Jan.(96.6)	96.6	101.8	2.3	8.5	5.2	87.8	77.2

Source: See source note to Table III-1.

Table IV-2: Analysis of Seasonal Patterns in Nonagricultural Employment by Sex, Region, and Class of Worker: 1971-73 Averages

	Seasonal peak	Seasonal trough	Average Seasonal Factor		MSFV	SFR	SFD	A as percent of total	SD as percent of total
			Jan.-March	Aug.-Oct.					
Total nonagricultural employment	July(104.4)	Jan.(96.8)	97.0	101.4	2.0	7.5	4.5	100.0	100.0
Men	July(105.7)	Feb.(96.2)	96.2	102.1	2.7	9.5	5.9	65.2	88.8
Women	July(102.4)	Jan.(98.0)	98.5	99.9	1.2	4.4	1.4	34.8	11.2
Atlantic Provinces	July(108.8)	Feb.(92.6)	92.9	104.4	4.9	16.2	11.5	7.9	20.7
Quebec	Aug.(105.0)	March(96.3)	96.7	102.1	2.4	8.7	5.5	27.4	34.1
Ontario	July(104.0)	Feb.(97.7)	97.9	100.5	1.7	6.4	2.6	39.2	23.5
Prairie Provinces	July(104.0)	Jan.(96.9)	97.2	100.9	2.0	7.1	3.7	14.6	12.3
British Columbia	July(103.5)	Jan.(96.2)	97.4	101.2	1.8	7.3	3.8	10.9	9.5
Paid workers	July(104.4)	Jan.(97.0)	97.0	101.5	2.0	7.4	4.4	91.9	91.2

Source: See source note to Table III-1.

Table IV-3: Analysis of Seasonal Patterns in Unemployment by Sex, Age, and Region: 1971-73 Averages

	Seasonal peak	Seasonal trough	Average Seasonal Factor		MSFV	SFR	SFD	A as percent of total	SD as percent of total
			Jan.-March	Aug.-Oct.					
Total unemployment	Jan.(122.8)	Sept.(75.8)	120.5	80.9	12.4	47.0	-39.6	100.0	100.0
Men	Jan.(127.0)	Sept.(71.8)	126.1	79.7	16.4	55.2	-50.4	71.8	95.5
Women	June(112.4)	Dec.(88.9)	103.6	97.6	5.1	23.5	-6.0	28.2	4.5
Men 14-19	June(144.0)	Sept.(68.3)	105.4	77.0	16.9	75.7	-28.4	14.9	11.2
Men 20-24	Jan.(124.0)	Sept.(73.9)	122.5	77.7	16.3	50.1	-44.8	16.7	19.8
Men 25-44	Jan.(136.1)	Sept.(72.2)	134.5	73.4	22.3	63.9	-61.1	23.3	37.8
Men 45 and over	Jan.(134.8)	Sept.(73.6)	133.6	74.9	22.6	61.1	-58.7	16.9	26.3
Women 14-19	June(157.0)	Dec.(77.2)	87.1	100.8	18.5	79.8	13.7	8.7	-3.2
Women 20-24	May(114.1)	Dec.(83.4)	103.2	101.3	6.6	30.7	-1.9	6.9	0.3
Women 25-44	Jan.(120.6)	July(82.3)	114.2	93.5	9.8	38.3	-20.7	8.3	4.6
Women 45 and over	Feb.(127.7)	July(71.8)	121.8	94.6	14.5	56.0	-27.2	4.4	3.2
Atlantic Provinces	Feb.(136.0)	Sept.(70.9)	132.6	73.8	21.7	65.1	-58.8	11.4	17.3
Quebec	Jan.(120.8)	Sept.(77.3)	119.0	82.6	11.7	43.5	-36.3	35.9	33.5
Ontario	Feb.(119.1)	Sept.(80.2)	117.0	82.8	13.0	38.8	-34.2	29.0	25.5
Prairie Provinces	Jan.(132.5)	Sept.(73.1)	127.9	77.0	17.9	59.4	-50.9	11.5	14.8
British Columbia	Jan.(122.3)	Sept.(81.1)	112.9	84.7	8.7	41.1	-28.2	12.3	8.9

Source: See source note to Table III-1.

Table IV-4: Analysis of Seasonal Patterns in the Labour Force by Sex, Age, and Region: 1971-73 Averages

	Seasonal peak	Seasonal trough	Average Seasonal Factor		MSFV	SFR	SFD	A as percent of total	SD as percent of total
			Jan.-March	Aug.-Oct.					
Total labour force	July(105.1)	Feb.(97.4)	97.5	100.8	2.1	7.7	3.3	100.0	100.0
Men	July(105.7)	Feb.(97.3)	97.4	100.9	2.5	8.4	3.5	66.7	71.6
Women	July(103.5)	Jan.(97.8)	97.8	100.6	1.4	5.8	2.8	33.3	28.4
Men 14-19	July(144.9)	Feb.(83.6)	84.5	104.8	16.7	61.4	20.3	6.2	38.1
Men 20-24	July(110.4)	Feb.(94.9)	95.1	100.9	5.5	15.5	5.7	9.3	16.3
Men 25-44	June(100.7)	Jan.(99.3)	99.4	100.4	0.5	1.4	1.0	29.6	9.3
Men 45-64	May(100.6)	Feb.(99.3)	99.4	100.3	0.4	1.3	1.0	20.1	5.8
Men 65 and over	June(104.4)	Feb.(94.7)	94.8	102.8	3.2	9.7	8.0	1.6	3.9
Women 14-19	July(135.8)	Mar.(87.1)	87.8	105.3	12.3	48.7	17.6	4.6	24.8
Women 20-24	June(104.7)	Apr.(97.3)	98.0	100.5	1.8	7.4	2.4	6.5	4.9
Women 25-44	Nov.(101.8)	Aug.(95.7)	100.1	99.2	1.4	6.2	-0.9	13.1	-3.6
Women 45-64	Oct.(101.5)	Aug.(97.4)	99.8	100.0	1.0	4.1	0.2	8.6	0.5
Women 65 and over	Oct.(105.0)	Aug.(93.3)	100.2	100.0	3.2	11.7	-0.3	0.5	0.0
Atlantic Provinces	July(107.9)	Feb.(95.2)	95.6	102.4	3.3	12.8	6.8	7.9	16.3
Quebec	July(105.2)	Feb.(97.5)	97.7	101.0	2.0	7.7	3.3	27.5	27.6
Ontario	July(104.4)	Feb.(98.0)	98.1	100.2	1.9	6.4	2.1	37.8	24.0
Prairie Provinces	July(105.1)	Feb.(96.3)	96.5	101.7	2.7	8.8	5.2	16.1	25.5
British Columbia	July(104.5)	Jan.(97.6)	98.1	100.1	1.8	6.9	2.0	10.7	5.6

Source: See source note to Table III-1.

Chart IV-1: Seasonal Patterns in Employment by Sex, Age, Region, Industry, and Class of Worker: 1971-73
Average Seasonal Factors

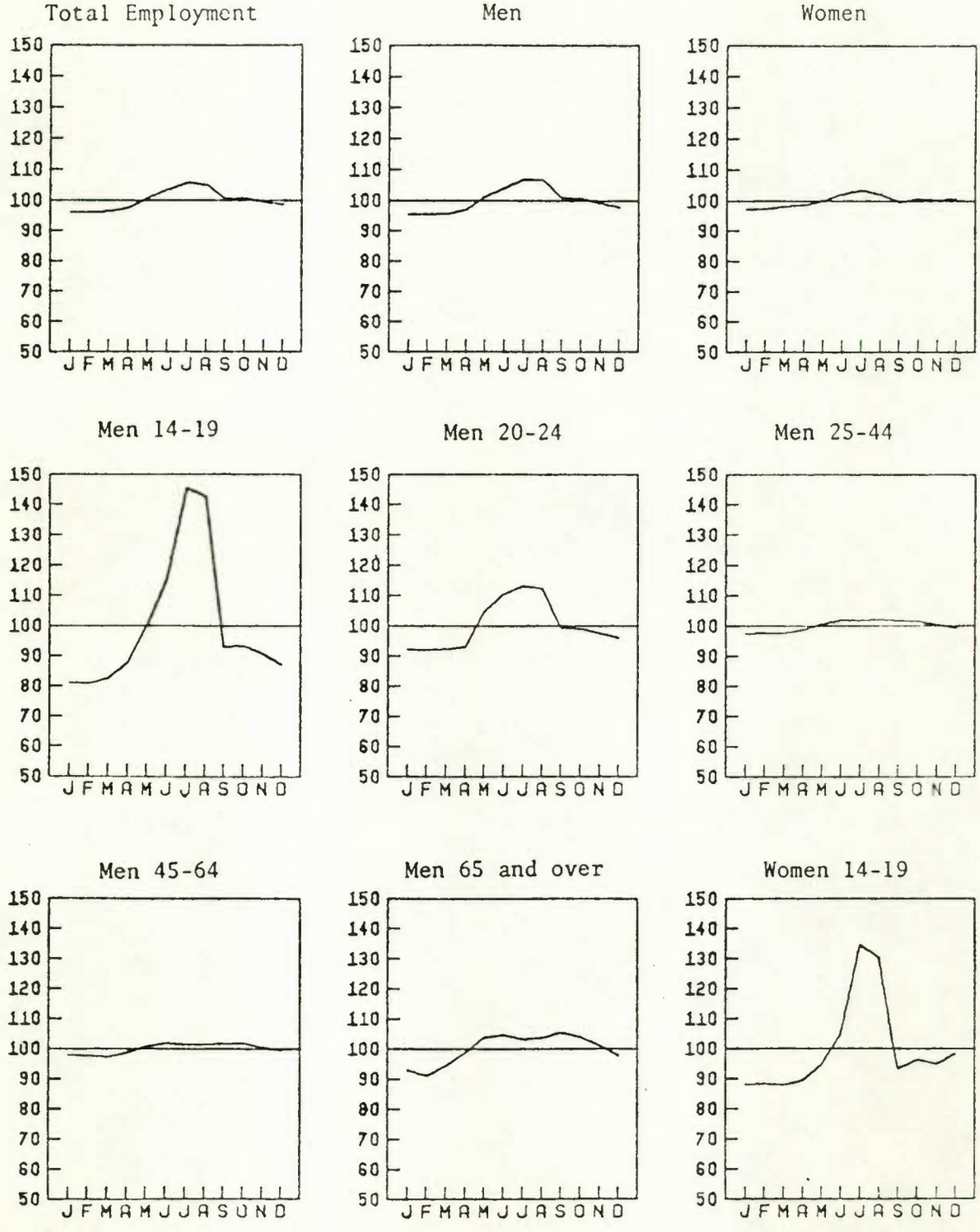
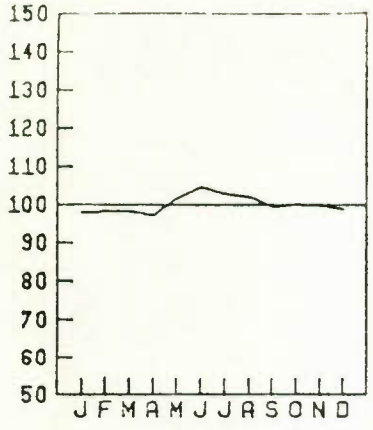
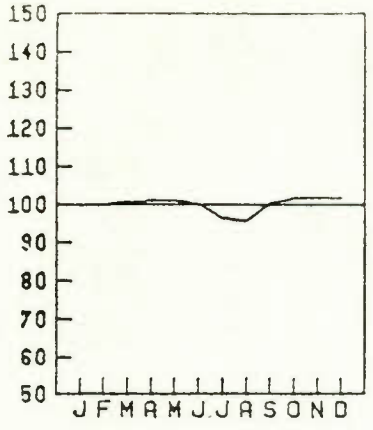


Chart IV-1 (Continued)

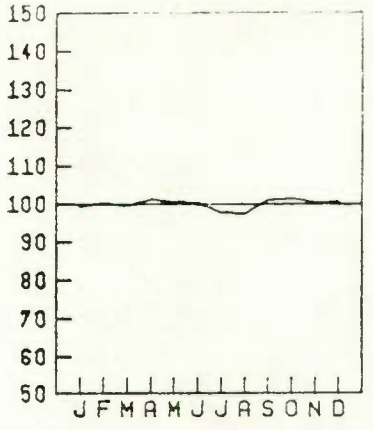
Women 20-24



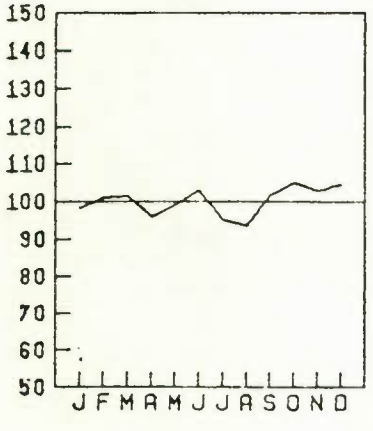
Women 25-44



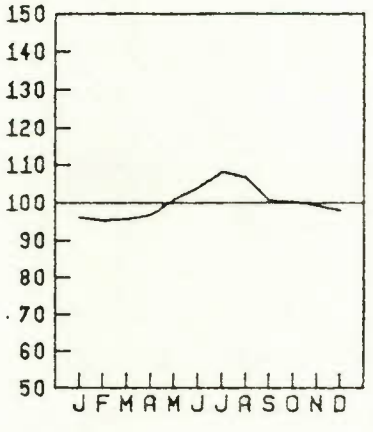
Women 45-64



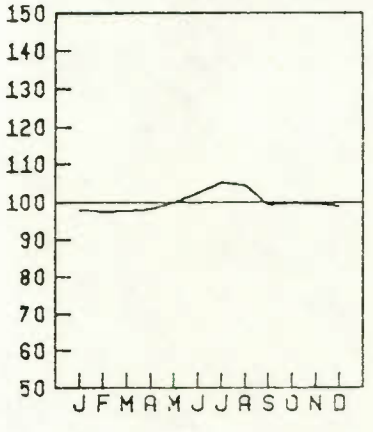
Women
65 and over



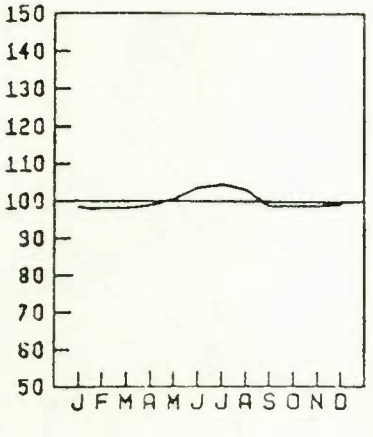
Atlantic
Provinces



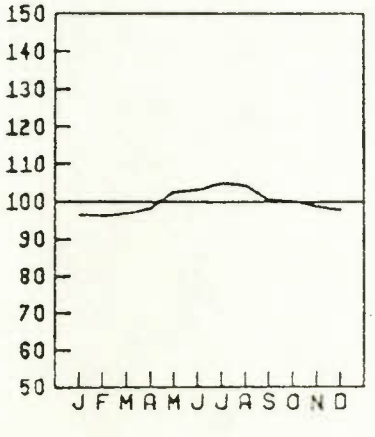
Quebec



Ontario



Prairie
Provinces



British Columbia

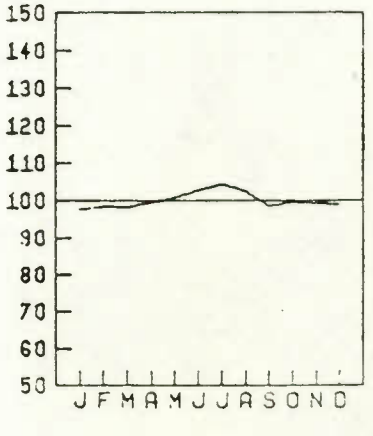
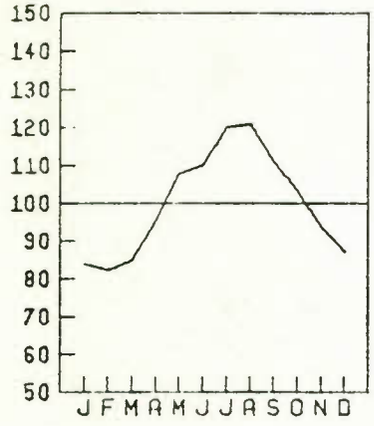
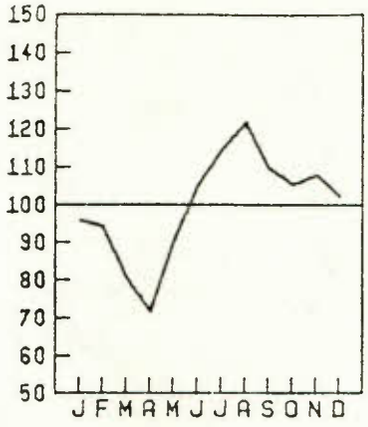


Chart IV-1 (Continued)

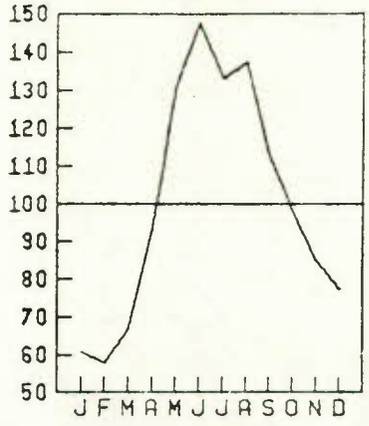
Agriculture



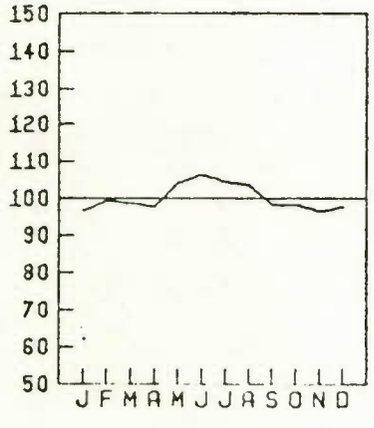
Forestry



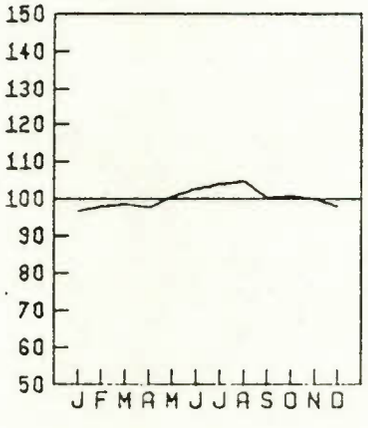
Fishing and trapping



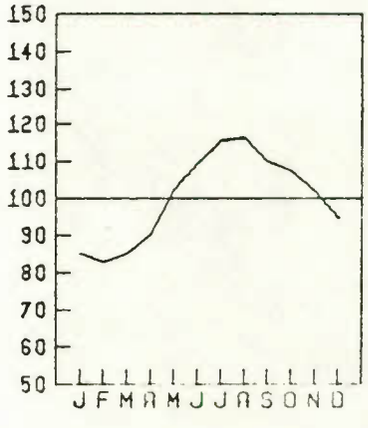
Mines, quarries, and oil wells



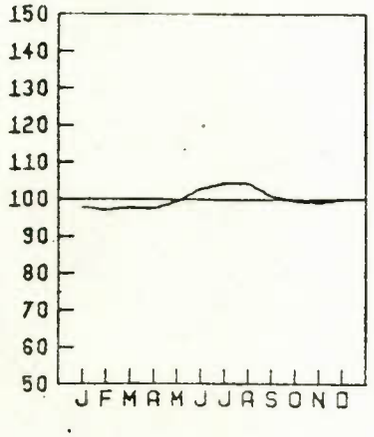
Manufacturing



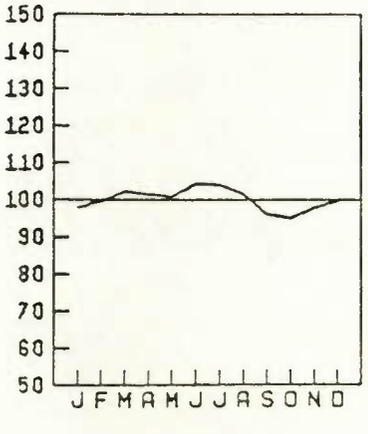
Construction



Transportation and communication



Electric power, gas, and water utilities



Trade

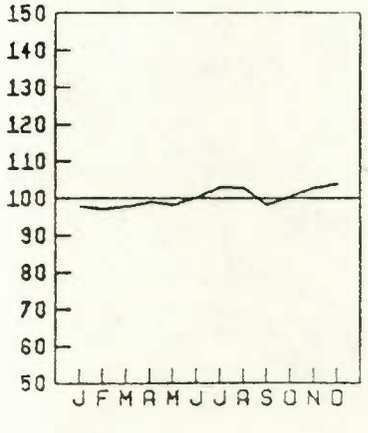
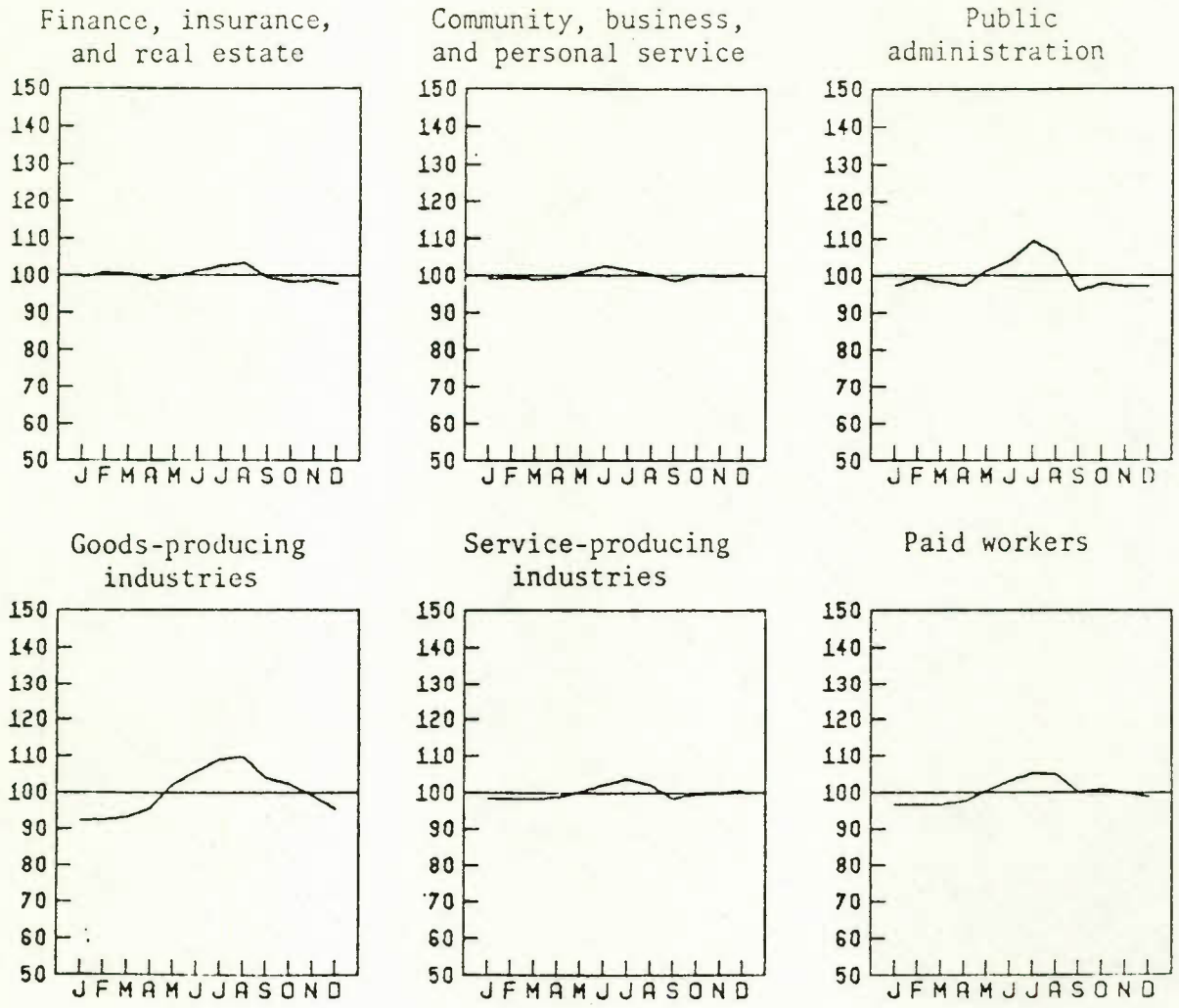
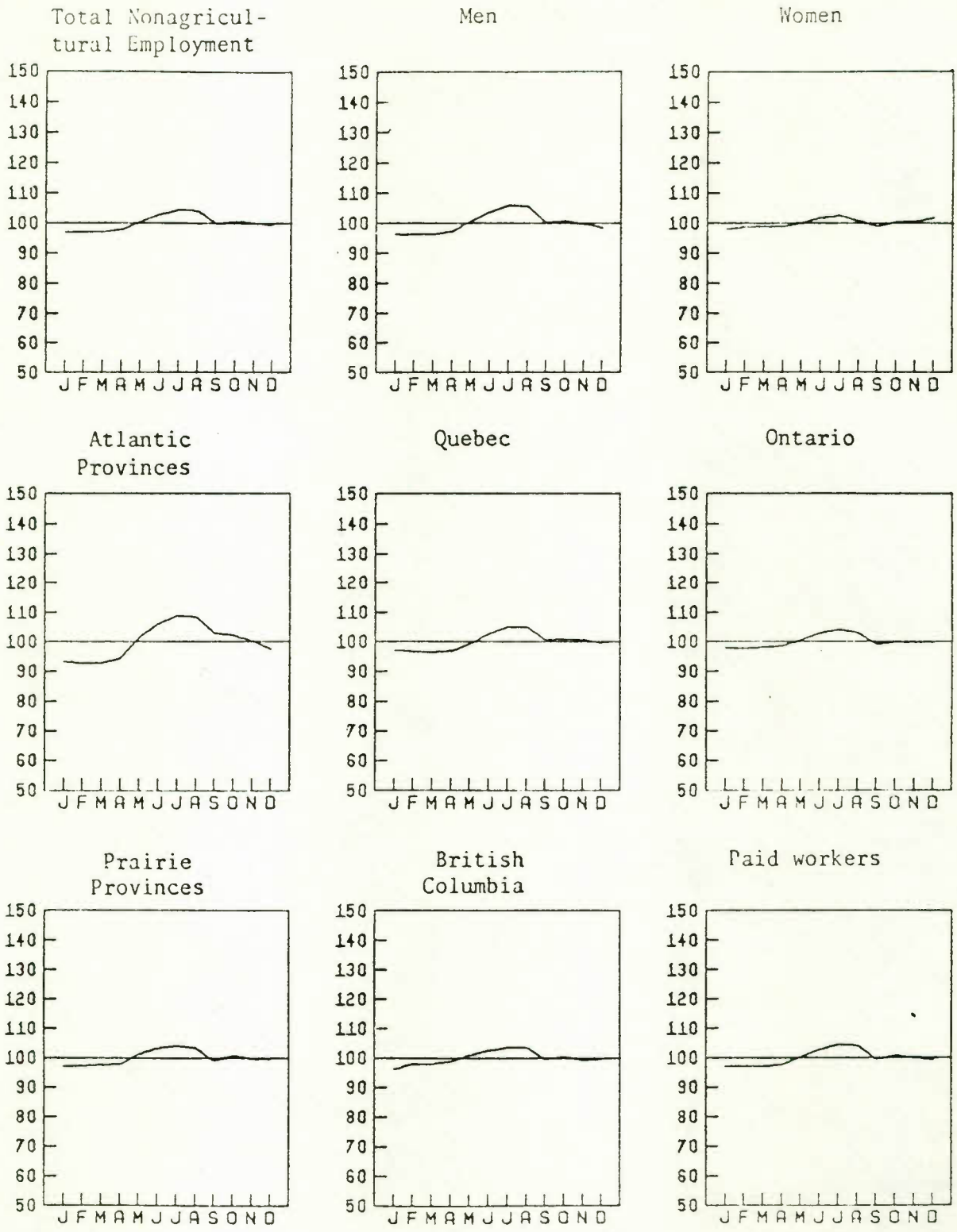


Chart IV-1 (Continued)



Source: See source note to Table III-1.

Chart IV-2: Seasonal Patterns in Nonagricultural Employment by Sex, Region, and Class of Worker: 1971-73 Average Seasonal Factors



Source: See source note to Table III-1.

Chart IV-3: Seasonal Patterns in Unemployment
by Sex, Age, and Region: 1971-73 Average
Seasonal Factors

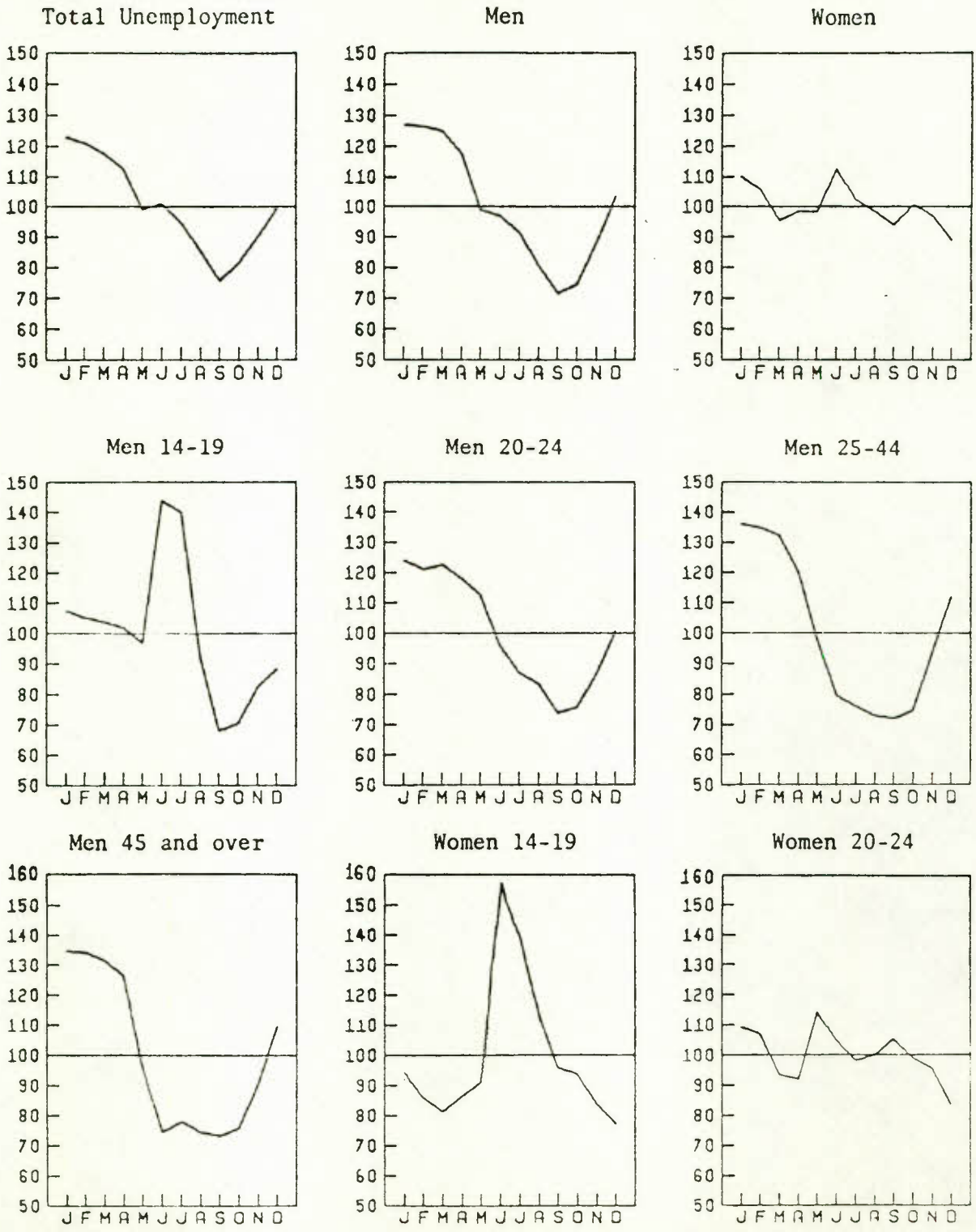
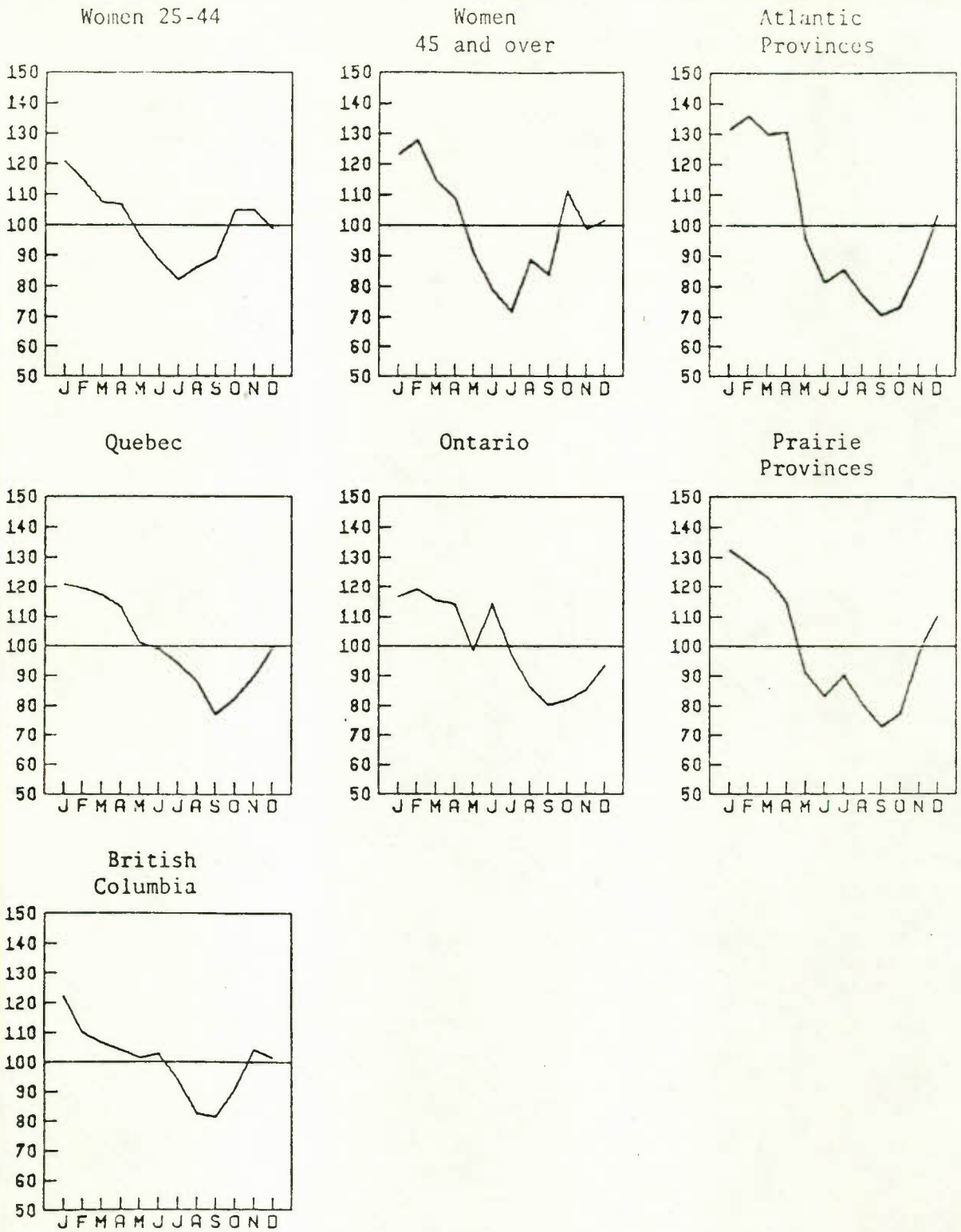
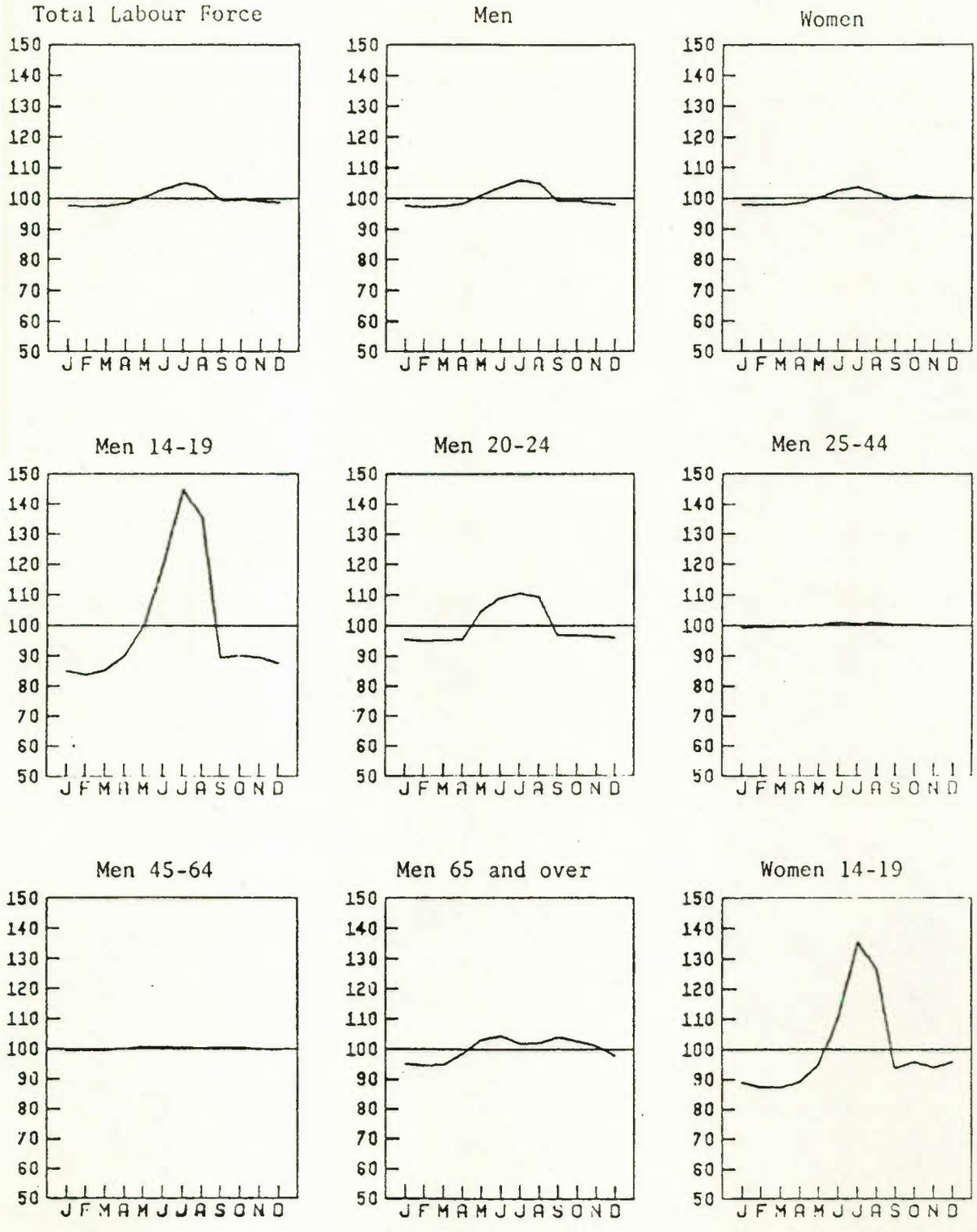


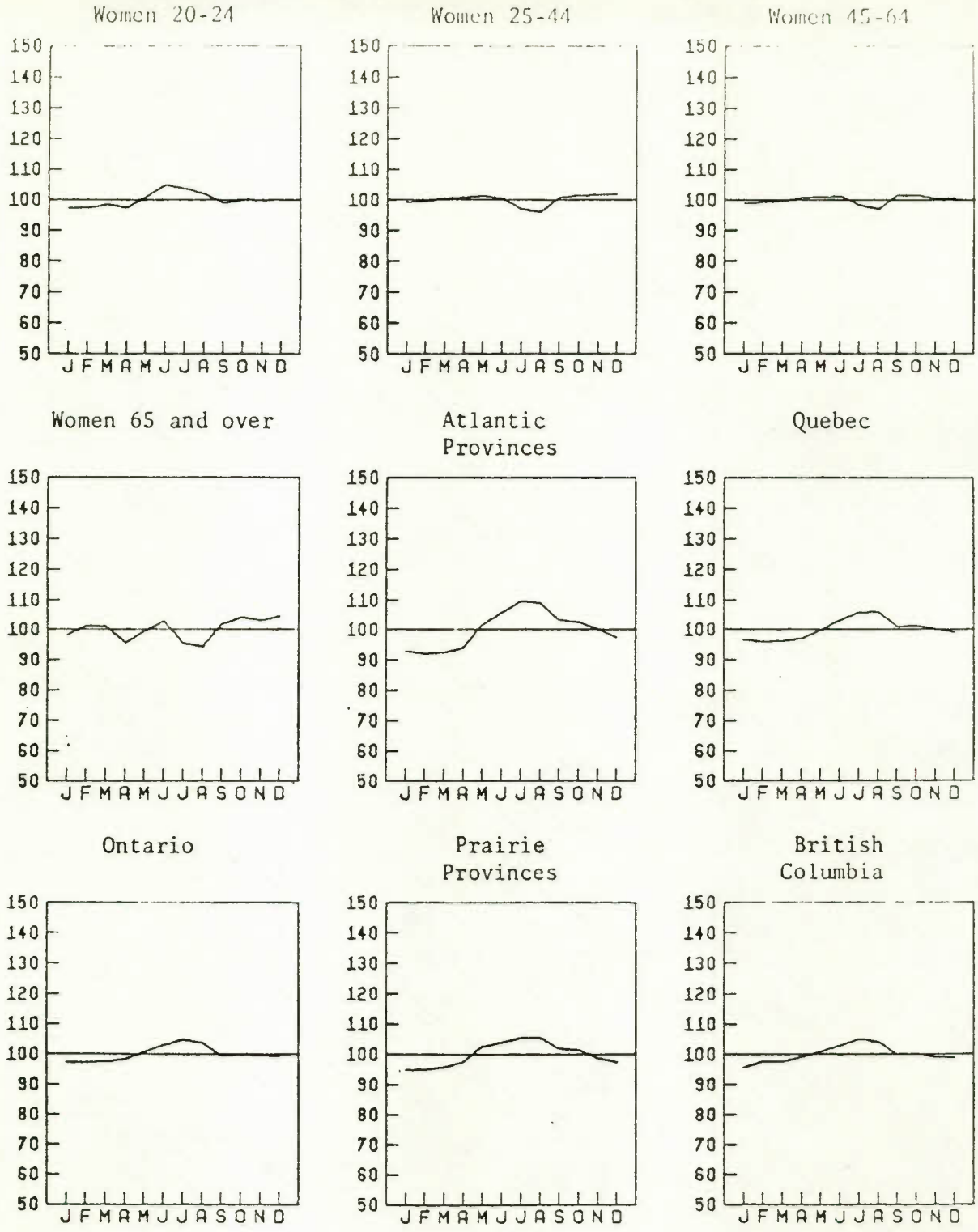
Chart IV-3: (Continued)



Source: See source note to Table III-1.

Chart IV-4: Seasonal Patterns in the Labour Force by Sex, Age, and Region: 1971-73 Average Seasonal Factors





Source: See source note to Table III-1.

CHAPTER V

CHANGES IN SEASONAL PATTERNS

We turn now to a consideration of changes in seasonal patterns between the early 1960's and the early 1970's. Specifically, we focus attention on the period 1961-73. Most of the Labour Force Survey series of interest are available for the whole of this period. In the case of the industrial distribution of employment, though, the series are available in convenient form only back to 1966, and so we consider the shorter period, 1966-73.

A summary of changes in seasonal patterns, based on the changes in the published X-11 seasonal factors, is provided by Tables V-1 - V-5. Table V-1 presents a year-by-year history of the seasonal peaks and troughs, average seasonal factors in the January-March and August-October periods, and MSFV, SFR, and SFD measures, for total employment, nonagricultural employment, total unemployment, and the total labour force. Tables V-2 - V-5 present additional information on the changes that have taken place in particular age and sex categories, regions, and industries. In order to conserve space, the information in these latter tables is somewhat less detailed and is presented only for three 3-year periods, 1961-63, 1966-68, and 1971-73 (in the case of industries, only for 1966-68 and 1971-73). The distribution of seasonal variations among categories (i.e., the distribution of SD) is included in Tables V-2 - V-5.

Changes in the Aggregates

Table V-1 suggests that there have been some quite substantial changes in the extent of aggregate seasonal variation. This shows up in the declines in the MSFV, SFR, and SFD measures for employment. These declines were greater in the earlier part of the 1961-73 period and greater for total employment than for nonagricultural employment, a reflection, in large measure, of the decrease in relative size of the highly seasonal farm sector. There has been little or no decline in the overall seasonal variability of nonagricultural employment since about 1967, judging by the MSFV and SFR measures.

The timing of seasonal employment variations seems not to have changed much. The seasonal peak occurred in July in every year of the 1961-73 period. The data suggest that in recent years the trough may have occurred a little earlier but the nature of the seasonal adjustment process underlying the X-11 seasonal factors makes it advisable to treat this evidence with caution until additional time-series observations can be incorporated in future years. In general, it seems best to conclude that the timing of peaks and troughs has changed little for both total employment and nonagricultural employment.

The changes in the seasonal variability of unemployment are more spectacular. No matter what measure is used, it is clear that seasonal fluctuations in total unemployment have declined markedly. In every year since 1961, the MSFV, SFR, and SFD measures have fallen. On the basis of the MSFV measure, the average annual variation was reduced by more than half over the period. The seasonal peak has fallen, year by year, while the seasonal trough has risen.

Changes in the seasonal pattern of the labour force are the net result of changes in the employment and unemployment patterns. As Table V-1 indicates, there appears to have been some increase in overall labour force variability, as evidenced by increases in the MSFV and SFR measures. However, the increase appears to have been concentrated in the earlier part of the 1961-73 period. Moreover, the SFD measure indicates that if one considers only the standard January-March and August-October periods, there has actually been a decline in seasonality in recent years.

Changes in the Components

Changes in the employment patterns of particular groups and regions are summarized in Table V-2. While overall seasonal variability has declined, as noted above, there has been considerable diversity among the components of the total. Of note is the substantially increased contribution of young people to total seasonal employment fluctuations: in the period 1961-63, people under 25 accounted for some 43 percent of total seasonal variation in employment; in 1971-73, they accounted for about 61 percent.

The overall reduction of employment seasonality was shared among the regions. Every region exhibits MSFV and SFR measures for 1971-73 which are lower than those for 1961-63. For some regions, most notably the Atlantic Provinces, the reduction of variability was considerable. For Ontario, though, it was barely observable. The reductions that occurred in the Atlantic Provinces, Quebec, and the Prairie Provinces

were concentrated in the early or mid-1960's. In British Columbia, on the other hand, there appears to have been a substantial reduction in the later period, as well. In spite of these various movements, though, the last three columns of Table V-2 suggest that the overall regional percentage distribution of seasonal employment variations differed only slightly in the early 1970's from what it had been a decade earlier.

Table V-2 suggests that there may have been some changes in seasonality in particular industries, based on the comparison of 1971-73 with 1966-68. Thus, a substantial reduction is indicated by the MSFV and SFR measures for forestry, while an increase is indicated for the construction industry. The presence of sampling error in the underlying Labour Force Survey estimates and the shortness of the period for which comparisons are possible dictate a cautious interpretation of the other results. The apparent increase in seasonality in construction is of considerable interest, it may be noted, inasmuch as it suggests that whatever changes may have occurred in the structure and technology of this industry in recent years have not resulted in a reduction of seasonal variability and may, in fact, have been accompanied by some increase.*

The overall concentration of seasonal employment fluctuations in those industries directly affected by climate was noted in the previous chapter. The degree of concentration in these industries

---

* For a discussion of changes in the construction industry and seasonal fluctuations in that industry over a longer period, see Haythorne [12].

appears to have changed very little in recent years. Agriculture's contribution seems to have declined somewhat but construction's seems to have increased. In both 1966-68 and 1971-73, construction and the primary industries (other than mines, quarries, and oil wells) together contributed about 64 percent of the total variation, based on the distributions of SD reported in the last two columns of the table.

Table V-3 presents results for the nonagricultural sector, by sex, by region, and for paid workers as well as total employment. In general terms, these results differ little from those of the previous table; the overall picture of changes in seasonal patterns is not altered much by excluding agriculture, and it is therefore unnecessary to comment on this table in detail.

Table V-4 reports results for unemployment. As noted above, the seasonal variability of total unemployment has declined greatly since the early 1960's. What Table V-4 reveals is that this decline was widespread. It is evident in every region, for men and for women, and for a number of individual age groups.

The reduction of unemployment seasonality had its greatest and most consistent effect on men over the age of 20 or 25. Teenage males have not shared in the reduction and, in fact, have experienced slightly increased rather than diminished seasonality, if one compares 1971-73 with 1961-63. The seasonal peak for teenage male unemployment shifted from February, in 1961-63, to June, in the later periods, thus reflecting the increased impact of students on the summer labour market and the

concomitantly higher unemployment rates for this age group. Teenage women also experienced much more seasonality in unemployment in 1971-73 than in 1961-63. (For teenagers of both sexes, there appears to have been some reduction of seasonality between 1966-68 and 1971-73, but seasonal variation still exceeds what it was a decade earlier.) Among women over 20, there appear to have been substantial reductions of seasonality in the earlier years but either some increase or a much smaller reduction in the later ones.

The changes that have taken place in the employment and unemployment seasonal patterns have been accompanied by changes in the labour force participation of particular groups over the course of the year. Some increase in seasonal variability is evident for men and women under the age of 25, if one compares 1971-73 with 1961-63. This is true also of the male labour force as a whole, though not of the female labour force. Persons under 25 accounted for about 74 percent of the total seasonal variation in the Canadian labour force in 1971-73, compared with 66 percent a decade earlier.

The increased seasonality of the total labour force is reflected, in varying degree, in the five regions. In the Atlantic Provinces and Quebec there appear to have been appreciable increases. This is true also of Ontario, if one compares 1971-73 with 1961-63, although since 1966-68 there appears to have been some movement in the opposite direction. The changes in the Prairie Provinces and in British Columbia appear to have been a good deal less pronounced.

Regression Analysis: Statistical Tests for Changes in Seasonal Patterns

In the previous sections of this chapter we have been concerned with the changes in patterns indicated by changes in the seasonal factors generated by the X-11 seasonal adjustment procedures. The use of the X-11 seasonal factors, while convenient, does not provide a basis for formal statistical testing. With this in mind, we seek confirmation of the changes discussed above, and any evidence that may come to light regarding other changes, by employing an alternative approach based on regression methods.*

Regression analysis is used to provide a basis for statistical tests of the significance of changes in seasonal patterns over the period 1961-73 for all series except the industrial employment series, and over the period 1966-73 for the latter series. The starting point for the analysis is the following equation in which some variable of interest, x (e.g., total unemployment), is regarded as a function of monthly dummy variables with allowance for both seasonal and nonseasonal trends:

$$(1) \qquad \log x = \sum_{j=0}^{5} \alpha_j t^j + \sum_{m=1}^{12} \left(\sum_{j=0}^{2} \beta_{jm} t^j \right) D_m + u.$$

The equation incorporates a polynomial of the 5th degree to represent "trend-cycle" type movements over the thirteen-year period and allows for quadratic trends in the monthly seasonal coefficients. The dummy variable D_m takes on value 1 in month m and 0 in all other months; the variable t is a trend variable which increases by 1 each month; u is

---

* For a description of seasonal analysis by regression methods, see Lovell [20].

a residual component representing nonseasonal variations other than those captured by the "trend-cycle" polynomial.

In order to avoid matrix singularity in the estimation of equation (1), one of the dummy variables was dropped. Moreover, preliminary experimentation indicated a high degree of positive serial correlation in the regression residuals obtained by fitting the equation and, in order to reduce the consequences of this, the equation was converted into first-difference form. By and large, the results of the statistical tests derived from the first-difference form are quite similar to those derived from the original form. However, the first-difference form seems preferable on theoretical grounds and the results reported here are based on it. The equation, modified by taking first differences and by dropping terms involving the December dummy variable, has the form

$$(2) \qquad \Delta \log x = \sum_{j=0}^{4} \pi_j t^j + \sum_{m=1}^{11} \left(\sum_{j=0}^{2} \theta_{jm} t^j \right) D_m + v.$$

This equation involves the same variables as before except that t^5 is eliminated from the "trend-cycle" polynomial by the differencing operation and the new residual component, v, replaces u. The π and θ coefficients have different interpretations than the original α and β coefficients, of course.

We now write the seasonal terms in equation (2) in the form

$$(3) \qquad \sum_{m=1}^{11} \left(\sum_{j=0}^{2} \theta_{jm} t^j \right) D_m = \sum_{m=1}^{11} \theta_{0m} D_m + \sum_{m=1}^{11} \theta_{1m} t D_m + \sum_{m=1}^{11} \theta_{2m} t^2 D_m.$$

Our interest is in testing for significance the set of coefficients $\theta_{1m}(m=1,2,\ldots,11)$, the set $\theta_{2m}(m=1,2,\ldots,11)$, and the two sets combined. This we do by employing the standard F-test for subsets of independent variables, based on the differences between the sums of squares of residuals when the subsets are included in or excluded from the regression equation.*

The results of the F-tests are displayed in Tables V-6 - V-10. The first set of columns in each table records whether linear trend in the seasonal coefficients is significant at three selected significance levels. The second set of columns records whether quadratic trend is significant, in comparison with linear trend alone. The third set indicates whether linear and quadratic trends combined are significant. The first set of columns is based on the testing of an equation containing both D_m and $D_m t$ against one containing D_m alone, the second set on the testing of an equation containing D_m, $D_m t$ and $D_m t^2$ against one containing only D_m and $D_m t$, and the third set on the testing of an equation containing D_m, $D_m t$, and $D_m t^2$ against one containing only D_m.

The F-tests indicate widespread changes in seasonal patterns.** There is strong evidence of change in the patterns for total employment,

---

* A good discussion relevant to the use of dummy variables in regression analysis and related statistical testing is contained in Melichar [21].

** It is the significance of linear trend that is most important with regard to a period as short as the 1961-73 period and, a fortiori, the 1966-73 period examined in the case of the industrial employment series. Most of the discussion that follows is based on the evidence regarding linear trend in Tables V-6 - V-10.

employment among paid workers, employment in all but the oldest male category, and employment of women under 25. There is also evidence of change in each of the five regions, the evidence being strongest for the Atlantic Provinces and Ontario, weakest for British Columbia. For industries, the evidence, based on the period 1966-73, indicates a change in forestry and, with less force, in construction and public administration. Goods-producing industries as a group also show evidence of change, reflecting in large part, no doubt, the changes in forestry and construction, both of which are included in the goods-producing total. Elsewhere, there is no statistical evidence to indicate other than stable seasonal patterns since 1966.

The tests reported in Table V-9 indicate clearly that seasonal patterns of unemployment have changed since the early 1960's, thus confirming the earlier results based on the X-11 seasonal factors. There is strong evidence of change in the pattern for total unemployment and for male unemployment in every age group except 65 and over. For women, there is strong evidence of change for the 45-64 group, but no evidence of change for other groups. There is strong evidence of change for all of the regions.

The tests pertaining to the labour force, as reported in Table V-10, indicate strongly that there were changes in the overall labour force pattern and the patterns for men and women under 25. They also indicate changes in each of the regions.

By and large, the results of the F-tests accord with the results based on changes in the X-11 seasonal factors, as discussed previously. It should be noted, though, that the F-tests relate to any changes in seasonal patterns, not just to changes in overall amplitude. Thus, the F-tests should detect significant shifts between different months which might alter a seasonal pattern without affecting average seasonal variation for the year as a whole, or even the levels and timing of seasonal peaks and troughs.

Seasonal Variation and the State of the Labour Market

We consider now the extent to which changes in the seasonal variation of employment, unemployment, and the labour force may represent a response to changes in the degree of tightness or slack in the labour market, and to what extent they represent trends which are independent of the state of the market. For this purpose, we choose the overall Canadian unemployment rate to represent the state of the market and carry out a regression analysis in which the MSFV measures are the dependent variables and the independent variables are the overall annual average unemployment rate and time-trend variables. Thus, for any particular series i (e.g., employment among men 14-19 years of age), the regression equation is

$$(4) \qquad MSFV_i = \beta_0 + \beta_1 u + \beta_2 t + \beta_3 t^2 + e$$

where u is the overall annual percentage unemployment rate, t represents time, and e is an error term. The analysis is based on 13 annual observations for the period 1961-73.

Results of the analysis are reported in Tables V-11 - V-14. Regression coefficients are reported for each equation, along with t-ratios, the coefficient of determination (corrected for degrees of freedom), and the Durbin-Watson statistic, to indicate the degree of first-order serial correlation in the residuals. Also reported is the F-ratio associated with t and t^2. This ratio, which is based on the difference between the sums of squared residuals in equations which include and exclude t and t^2, provides a basis for testing the significance of both trend terms combined. The trend value t has value 0 in 1967, the mid-year of the period, and changes by unit increments between consecutive years (t = - 6 in 1961, t = - 5 in 1962, etc.). This implies orthogonality between t and t^2, thus facilitating significance tests of the individual contributions of linear and quadratic trend, in addition to the joint test of significance based on the F-ratio.

The MSFV measures represent the average departures of the percentage seasonal factors from 100, over the course of a year. Thus we are concerned here with the influences of trend and labour market conditions on the magnitude of the percentage variations implicit in a seasonal pattern. Other measures of seasonal variation could be used but this seems to us to be the most interesting and meaningful one on which to focus attention.

The rationale for using the overall Canadian unemployment rate as an independent variable in all of the equations is as follows. We think of this variable as a convenient summary measure of the tightness or slack in the labour market as a whole, and hence as a variable representing

the effect of general market conditions, both on aggregate seasonal patterns and on seasonal patterns in particular component labour force groups (age-sex groups, regions, etc.). An alternative would be to use in the equations for each group the unemployment rate for that group, rather than the overall rate. However, the group rates are generally highly correlated and we find it convenient to use the same overall rate in all of the equations. This allows us to think of the overall labour market as a single entity, represented by a single "state" variable. It also avoids problems associated with the fact that the Labour Force Survey unemployment rates for smaller groups tend to be subject to substantial degrees of sampling error.

The regression results and associated significance tests should be interpreted with some caution. Because of the averaging processes involved in computing the X-11 seasonal vectors, the MSFV values for consecutive years are by no means independent. It is well known that passing moving averages through a time series can introduce smooth cycles or trend-like patterns, even if the underlying series is free of trend -- the so-called Slutsky-Yule effect.* For this reason, one would want to be careful in evaluating the significance tests for the presence of trend. Moreover, the averaging processes raise questions about the real degrees of freedom in the analysis. To illustrate, suppose that seasonal factors were computed for 1961-73 on the basis of averages over the whole of the period, so that there was no allowance in the seasonal adjustment

---

* See Kendall and Stuart [15], pp. 378ff.

procedures for moving seasonal patterns. The seasonal factors, and hence the MSFV measures derived from them, would then be the same in every one of the 13 years. In effect, there would be only one observation on the MSFV, rather than 13. In practice, seasonal patterns are allowed to change by virtue of the use of moving averages in the seasonal adjustment procedures, and the moving-average processes act merely as constraints on the rate of change. However, the example serves to illustrate the fact that the MSFV values for a particular series are not independently determined. Unfortunately, to disentangle the effects on the regression analysis of the complicated averaging and other procedures incorporated into the X-11 method is virtually impossible. For this reason, we choose the course of ignoring the effects in carrying out the analysis but proceeding cautiously in the interpretation of the results.

Having said all of this, the results in Tables V-11 - V-14 point toward a number of interesting conclusions. For one thing, they suggest that the extent of seasonal variation in total unemployment is responsive to changes in the overall annual unemployment rate; more specifically, that a decrease in the unemployment rate is associated with an increase in the extent of percentage seasonal variation. For another, they suggest that there have been significant trends in seasonal variation quite aside from changes induced by changes in the unemployment rate over the 1961-73 period. The latter applies to employment, unemployment, and the labour force, both in the aggregate and in most of the component groups. Thus it appears that the prevalence of changes in the seasonal patterns during the 1960's and early 1970's, as noted in the earlier analyses of this chapter, was not merely a consequence of changes in the

level of unemployment but of other influences as well.

The nature of the response of seasonal variation to changes in the unemployment rate varies from group to group. In some cases, the MSFV increases as the unemployment rate declines, in others it decreases. In most cases, the MSFV for unemployment responds inversely: there is more seasonal variation at low levels of annual unemployment than at high levels, if one takes the results in Table V-13 at face value. (A notable exception is women 20-24 years of age, for which an opposite relationship is indicated.)

Seasonal Variations and Changes in Composition

The final piece of analysis that we present in this chapter is concerned with the effects of changes in composition on the aggregate seasonal variation of employment, unemployment, and the labour force. For example, the ratio of male to female labour force has fallen substantially. Given that the seasonal patterns of labour force participation are quite different for men and women, what effect has this shift had on the seasonal pattern of the total labour force?

The approach that we take is as follows. Using the same three-year periods as before, we compute what the MSFV would be for each period if the seasonal factors for groups within a total had remained the same, while the relative sizes of the groups had changed. In effect, we weight the group seasonal factors for each period, using the weights of that period and of each of the other periods, and compare the results. In the case of total employment, we do this separately by sex, by sex and age, by region, and by industry. In the case of nonagricultural employment,

we do it only by sex and by region. In the case of unemployment and the labour force, we do it by sex, by sex and age, and by region. In all cases except industry, we carry out the cross-weighting for each of the periods 1961-63, 1966-68, and 1971-73, thus obtaining a 3 x 3 "cross-standardization" matrix, the elements of which represent the MSFV values obtained from the various combinations of seasonal factors for different periods with weights for different periods. As before, though, the industry calculations are carried out only for the two later periods, 1966-68 and 1971-73. In all cases, the numbers of groups treated separately in the analysis correspond to the groups shown in the earlier tables of Chapters IV and V (5 regions; 12 industries; 10 age-sex groups in the case of employment and the labour force, 8 in the case of unemployment).

Adapting the notation of Chapter II, let x_{im} and x_{im}^a stand for the seasonally unadjusted and seasonally adjusted values of a series for the i^{th} group (e.g., unemployed males 14-19 years of age) in month m. Let x_m and x_m^a be the corresponding aggregates (e.g., total unemployment). The seasonal factors, in percentage form, are given by $s_{im} = 100(x_{im}/x_{im}^a)$ and $s_m = 100(x_m/x_m^a)$. Assuming consistency between the groups and the totals, so that $x_m = \sum_i x_{im}$ and $x_m^a = \sum_i x_{im}^a$, these expressions can be manipulated to yield

$$(5) \qquad s_m = \sum_i (x_{im}^a/x_m^a)s_{im} = \sum_i w_{im}s_{im}$$

where $w_{im} = x_{im}^a/x_m^a$ may be regarded as the weight to be applied to the seasonal factor for the i^{th} group in calculating the seasonal factor for the aggregate. Our approach is to set the weights equal to the average

annual values in the various three-year periods, to compute the average group seasonal factors in those periods (the average January factor, the average February factor, etc.), and then to combine the weights with the seasonal factors for different periods to determine hypothetical aggregate seasonal factors which reflect the changes in weights from period to period. MSFV values are then calculated for each set of hypothetical aggregate seasonal factors.

The results are reported in Tables V-15 - V-18. In Table V-15, for example, the first 3 x 3 cross-standardization matrix refers to sex. That is to say, MSFV values are shown, based on the male-female weights or proportions of total employment in the three periods. Each column of this matrix represents the effects of changes in weights with the male and female seasonal factors held constant; conversely, each row represents the effects of changes in male and female seasonal factors with the weights held constant. The elements on the principal diagonal represent the "actual" MSFV values, obtained by combining seasonal factors and weights for the same periods.*

Table V-15 indicates some tendency for the changes that have taken place in industrial composition to reduce seasonal employment variation: between 1966-68 and 1971-73, the changes in industry weights brought the MSFV down from 2.8 to 2.5. In the case of sex, age, and region, however, compositional effects are scarcely noticeable. The

---

* Because of the nature of the calculations, the "actual" MSFV values in these tables may differ from those shown in previous tables. However, the differences are small and are of no consequence for the analysis.

absence of sex or regional weighting effects is evident also in the case of nonagricultural employment, as indicated by Table V-16. In the case of unemployment, changes in sex composition have tended to reduce total seasonal variation somewhat but this accounts for only a small part of the overall change. Changes in age composition and regional composition appear to have had only slight effects. Finally, as indicated by Table V-18, compositional shifts relating to sex, age, and region appear to have left the overall extent of seasonal variation in the labour force virtually unaffected.

Table V-1: Analysis of Changes in Seasonal Patterns in Employment, Unemployment, and the Labour Force from 1961 to 1973

	Seasonal peak	Seasonal trough	Average seasonal factor		MSFV	SFR	SFD
			Jan.-March	Aug.-Oct.			
Total employment							
1961	July(105.5)	Feb.(94.9)	95.1	103.2	3.2	10.6	8.2
1962	July(105.5)	Feb.(95.0)	95.2	103.1	3.1	10.5	7.9
1963	July(105.6)	Feb.(95.1)	95.3	103.0	3.0	10.4	7.7
1964	July(105.6)	Feb.(95.2)	95.4	102.8	3.0	10.4	7.4
1965	July(105.6)	Feb.(95.4)	95.6	102.7	2.9	10.2	7.2
1966	July(105.6)	Feb.(95.5)	95.7	102.6	2.8	10.1	6.9
1967	July(105.5)	Feb.(95.6)	95.8	102.5	2.8	9.9	6.8
1968	July(105.5)	Feb.(95.7)	95.8	102.4	2.8	9.8	6.6
1969	July(105.5)	Feb.(95.8)	95.9	102.3	2.7	9.7	6.4
1970	July(105.5)	Feb.(95.9)	96.0	102.1	2.7	9.6	6.1
1971	July(105.5)	Jan.(96.0)	96.1	102.1	2.6	9.5	6.0
1972	July(105.6)	Jan.(96.0)	96.1	102.0	2.6	9.6	5.9
1973	July(105.6)	Jan.(96.0)	96.2	102.0	2.6	9.6	5.8
Nonagricultural employment							
1961	July(104.0)	Mar.(95.9)	96.1	102.2	2.5	8.1	6.1
1962	July(104.2)	Feb.(96.0)	96.2	102.1	2.4	8.1	5.9
1963	July(104.3)	Feb.(96.2)	96.3	102.0	2.4	8.1	5.7
1964	July(104.3)	Feb.(96.3)	96.5	101.9	2.3	8.0	5.4
1965	July(104.4)	Feb.(96.5)	96.6	101.8	2.2	7.9	5.2
1966	July(104.4)	Feb.(96.6)	96.7	101.8	2.1	7.7	5.0
1967	July(104.4)	Feb.(96.8)	96.8	101.7	2.1	7.6	4.9
1968	July(104.4)	Mar.(96.8)	96.8	101.6	2.0	7.5	4.8
1969	July(104.4)	Mar.(96.8)	96.9	101.6	2.0	7.5	4.7
1970	July(104.4)	Feb.-Mar.(96.9)	96.9	101.5	2.0	7.5	4.6
1971	July(104.4)	Jan.(96.9)	97.0	101.5	2.0	7.4	4.5
1972	July(104.4)	Jan.(96.8)	96.9	101.4	2.0	7.6	4.5
1973	July(104.4)	Jan.(96.8)	97.0	101.4	2.1	7.6	4.4

Table V-1 (Continued)

	Seasonal peak	Seasonal trough	Average seasonal factor Jan.-March	Average seasonal factor Aug.-Oct.	MSFV	SFR	SFD
Unemployment							
1961	Feb.(144.8)	Sept.(68.0)	142.8	71.7	26.3	76.9	-71.1
1962	Feb.(142.8)	Sept.(68.7)	140.9	72.5	24.8	74.2	-68.4
1963	Feb.(140.8)	Sept.(68.9)	139.3	73.2	23.4	71.9	-66.1
1964	Feb.(138.7)	Sept.(69.0)	137.6	73.8	22.0	69.7	-63.7
1965	Feb.(136.6)	Sept.(68.9)	135.7	74.5	20.8	67.7	-61.2
1966	Feb.(134.4)	Sept.(69.1)	133.4	75.2	19.5	65.3	-58.3
1967	Feb.(132.1)	Sept.(69.7)	130.9	76.0	18.0	62.4	-55.0
1968	Feb.(129.5)	Sept.(70.7)	128.1	76.9	16.4	58.8	-51.2
1969	Feb.(126.7)	Sept.(72.2)	125.4	78.0	14.9	54.5	-47.4
1970	Feb.(124.1)	Sept.(73.7)	123.1	79.2	13.7	50.4	-43.8
1971	Jan.(123.2)	Sept.(75.1)	121.4	80.3	12.8	48.0	-41.0
1972	Jan.(122.7)	Sept.(76.0)	120.3	81.1	12.3	46.7	-39.2
1973	Jan.(122.5)	Sept.(76.4)	119.8	81.4	12.0	46.1	-38.4
Labour force							
1961	July(103.7)	Feb.(97.9)	98.0	101.4	1.5	5.8	3.4
1962	July(104.0)	Feb.(97.7)	97.8	101.4	1.6	6.2	3.5
1963	July(104.2)	Feb.(97.6)	97.7	101.4	1.7	6.6	3.7
1964	July(104.5)	Feb.(97.4)	97.6	101.4	1.8	7.0	3.8
1965	July(104.7)	Feb.(97.3)	97.5	101.4	1.8	7.4	4.0
1966	July(104.9)	Feb.(97.2)	97.4	101.4	1.9	7.6	4.0
1967	July(105.0)	Feb.(97.2)	97.3	101.3	2.0	7.7	4.0
1968	July(105.0)	Feb.(97.2)	97.3	101.2	2.1	7.8	3.9
1969	July(105.0)	Jan.(97.3)	97.3	101.1	2.1	7.8	3.7
1970	July(105.0)	Feb.(97.3)	97.4	100.9	2.1	7.7	3.6
1971	July(105.1)	Feb.(97.4)	97.5	100.9	2.1	7.6	3.4
1972	July(105.1)	Feb.(97.4)	97.5	100.8	2.1	7.7	3.4
1973	July(105.1)	Feb.(97.4)	97.5	100.8	2.2	7.7	3.3

Source: See source note to Table III-1.

Table V-2: Analysis of Changes in Seasonal Patterns in Employment by Sex, Age, Region, Industry, and Class of Worker: 1961-63, 1966-68, and 1971-73 Averages Compared

	Seasonal peak/trough			MSFV			SFR			SD as percent of total		
	1961-63	1966-68	1971-73	1961-63	1966-68	1971-73	1961-63	1966-68	1971-73	1961-63	1966-68	1971-73
Total employment	July/Feb.	July/Feb.	July/Jan.	3.1	2.8	2.6	10.5	9.9	9.5	100.0	100.0	100.0
Men	July/Mar.	Aug./Feb.	July/Feb.	3.8	3.4	3.3	12.6	11.8	11.4	84.8	79.7	81.8
Women	July/Feb.	July/Jan.	July/Jan.	1.7	1.6	1.5	5.2	6.2	6.3	15.2	20.3	18.2
Men 14-19	July/Feb.	July/Feb.	July/Feb.	16.4	17.9	17.3	66.4	69.0	64.6	20.5	24.7	27.0
Men 20-24	July/Mar.	July/Feb.	July/Feb.	6.4	6.0	6.7	21.1	19.6	21.2	13.2	14.3	17.1
Men 25-44	July/Mar.	Sept./Feb.	Aug./Jan.	2.5	1.7	1.6	7.0	4.8	4.5	27.9	20.9	21.3
Men 45-64	Sept./Feb.	Sept./Feb.	June/Mar.	2.6	1.9	1.6	7.2	5.5	4.5	19.0	16.5	14.0
Men 65 and over	Sept./Jan.	Sept./Jan.	Sept./Feb.	4.2	4.3	4.2	12.4	12.6	14.3	4.1	3.8	3.2
Women 14-19	July/Apr.	July/Mar.	July/Mar.	8.2	10.1	11.6	33.7	42.8	46.8	9.2	13.0	13.7
Women 20-24	June/Jan.	June/Jan.	June/Jan.	1.1	1.0	1.9	4.5	5.3	7.7	0.4	1.0	3.0
Women 25-44	Nov./Feb.	Oct./Aug.	Dec./Aug.	1.6	1.4	1.4	4.5	5.0	5.8	3.6	2.6	-0.5
Women 45-64	Sept./Jan.	Sept./Jan.	Sept./Aug.	1.3	1.4	1.2	4.0	5.0	4.7	2.2	3.5	1.3
Women 65 and over	May/July	Nov./Aug.	Dec./Aug.	1.3	2.6	3.0	7.1	12.6	10.3	-0.1	-0.3	0.0
Atlantic Provinces	July/Mar.	July/Feb.	July/Feb.	6.4	5.6	5.3	20.9	18.3	17.6	16.4	16.7	16.5
Quebec	July/Mar.	July/Feb.	Aug./Feb.	3.3	2.8	2.8	11.1	10.5	10.1	28.5	29.5	30.2
Ontario	Aug./Feb.	Aug./Feb.	July/Feb.	2.1	2.0	2.0	7.8	8.1	7.6	24.5	25.5	23.8
Prairie Provinces	Aug./Feb.	July/Jan.	July/Jan.	4.1	3.4	3.5	13.3	10.8	10.8	22.8	20.3	21.6
British Columbia	July/Jan.	July/Jan.	July/Jan.	2.8	2.5	2.1	10.8	10.4	9.4	7.7	8.1	7.8

Table V-2 (Continued)

	Seasonal peak/trough			MSFV			SFR			SD as percent of total		
	1961-63	1966-68	1971-73	1961-63	1966-68	1971-73	1961-63	1966-68	1971-73	1961-63	1966-68	1971-73
Agriculture	-	Aug./Jan.	Aug./Feb.	-	12.2	12.1	-	38.2	38.5	-	32.0	28.8
Forestry	-	July/Apr.	Aug./Apr.	-	14.0	11.2	-	60.1	50.0	-	3.6	3.5
Fishing and trapping	-	June/Jan.	June/Feb.	-	26.6	26.9	-	85.6	89.7	-	2.8	2.7
Mines, quarries, and oil wells	-	July/Apr.	June/Nov.	-	2.5	3.0	-	9.1	10.0	-	0.4	0.5
Manufacturing	-	Aug./Jan.	Aug./Jan.	-	1.8	2.0	-	8.1	7.9	-	16.0	16.7
Construction	-	Aug./Feb.	Aug./Feb.	-	9.5	10.3	-	30.9	33.2	-	25.2	29.1
Transportation and communication	-	July/Feb.	Aug./Feb.	-	2.5	2.1	-	8.9	7.4	-	6.0	5.6
Electric power, gas, and water utilities	-	July/Nov.	June/Oct.	-	3.4	2.4	-	11.0	9.4	-	0.3	-0.5
Trade	-	July/Feb.	Dec./Feb.	-	2.0	2.1	-	6.8	6.6	-	5.7	8.9
Finance, insurance, and real estate	-	Aug./Apr.	Aug./Dec.	-	1.0	1.4	-	4.6	5.4	-	0.3	0.0
Community, business, and personal service	-	June/Jan.	June/Sept.	-	0.9	1.0	-	3.3	4.1	-	4.7	2.9
Public administration	-	July/Dec.	July/Sept.	-	3.2	3.4	-	11.5	13.6	-	2.9	1.9
Goods-producing industries	-	Aug./Jan.	Aug./Jan.	-	5.3	5.4	-	17.5	17.4	-	79.6	81.0
Service-producing industries	-	July/Feb.	July/Mar.	-	1.4	1.4	-	5.6	5.4	-	20.4	19.0
Paid Workers	July/Mar.	July/Feb.	July/Jan.	2.9	2.5	2.3	9.6	9.0	8.5	75.4	75.8	77.2

Source: See source note to Table III-1.

Table V-3: Analysis of Changes in Seasonal Patterns in Nonagricultural Employment by Sex, Region, and Class of Worker: 1961-63, 1966-68, and 1971-73 Averages Compared

	Seasonal peak/trough			MSFV			SFR			SD as a percent of total		
	1961-63	1966-68	1971-73	1961-63	1966-68	1971-73	1961-63	1966-68	1971-73	1961-63	1966-68	1971-73
Total nonagricultural employment	July/Mar.	July/Feb.	July/Jan.	2.4	2.1	2.0	8.1	7.6	7.5	100.0	100.0	100.0
Men	July/Mar.	July/Feb.	July/Feb.	3.2	2.6	2.7	10.8	9.5	9.5	91.3	84.9	88.8
Women	Dec./Jan.	July/Jan.	July/Jan.	1.0	1.1	1.2	3.1	3.9	4.4	8.7	15.1	11.2
Atlantic Provinces	July/Mar.	July/Feb.	July/Feb.	6.1	5.1	4.9	19.6	16.6	16.2	20.6	21.1	20.7
Quebec	July/Mar.	July/Mar.	Aug./Mar.	2.8	2.4	2.4	9.4	8.3	8.7	32.8	32.3	34.1
Ontario	July/Feb.	July/Feb.	July/Feb.	1.6	1.7	1.7	5.6	6.6	6.4	23.6	26.5	23.5
Prairie Provinces	July/Feb.	July/Feb.	July/Jan.	2.2	1.6	2.0	7.9	6.5	7.1	13.6	10.0	12.3
British Columbia	Aug./Jan.	Aug./Jan.	July/Jan.	2.3	2.0	1.8	8.5	8.2	7.3	9.4	10.1	9.5
Paid workers	July/Feb.	July/Feb.	July/Jan.	2.5	2.1	2.0	8.3	7.8	7.4	93.3	93.4	91.2

Source: See source note to Table III-1.

Table V-4: Analysis of Changes in Seasonal Patterns in Unemployment by Sex, Age, and Region: 1961-63, 1966-68, and 1971-73 Averages Compared

	Seasonal peak/trough			MSFV			SFR			SD as percent of total		
	1961-63	1966-68	1971-73	1961-63	1966-68	1971-73	1961-63	1966-68	1971-73	1961-63	1966-68	1971-73
Total unemployment	Feb./Sept.	Feb./Sept.	Jan./Sept.	24.8	18.0	12.4	74.3	62.2	47.0	100.0	100.0	100.0
Men	Feb./Sept.	Feb./Sept.	Jan./Sept.	28.4	22.2	16.4	84.3	73.7	55.2	95.4	96.2	95.5
Women	Jan./May	June/Dec.	June/Dec.	7.0	5.8	5.1	31.4	27.9	23.5	4.6	3.8	4.5
Men 14-19	Feb./Sept.	June/Sept.	June/Sept.	16.2	18.8	16.9	50.4	76.4	75.7	7.8	9.6	11.2
Men 20-24	Feb./Sept.	Feb./Oct.	Jan./Sept.	28.5	20.9	16.3	86.2	63.3	50.1	14.5	14.2	19.8
Men 25-44	Mar./Sept.	Feb./Sept.	Jan./Sept.	35.0	29.9	22.3	99.2	88.9	63.9	44.0	40.4	37.8
Men 45 and over	Mar./Sept.	Feb./Sept.	Jan./Sept.	30.6	28.7	22.6	87.6	82.5	61.1	29.1	32.8	26.3
Women 14-19	July/Dec.	June/Dec.	June/Dec.	12.9	20.9	18.5	54.3	91.0	79.8	0.0	-2.3	-3.2
Women 20-24	Jan./June	Feb./Dec.	May/Dec.	8.4	6.4	6.6	34.3	20.6	30.7	0.7	0.6	0.3
Women 25-44	Jan./July	Jan./June	Jan./July	14.7	9.5	9.8	53.8	36.2	38.3	2.3	2.4	4.6
Women 45 and over	Jan./Aug.	Mar./July	Feb./July	15.7	14.7	14.5	51.3	54.2	56.0	1.6	2.4	3.2
Atlantic Provinces	Mar./Sept.	Feb./Sept.	Feb./Sept.	32.5	30.4	21.7	93.4	87.5	65.1	18.0	19.9	17.3
Quebec	Mar./Sept.	Mar./Sept.	Jan./Sept.	25.0	17.6	11.7	76.1	59.4	43.5	36.1	35.5	35.5
Ontario	Feb./Sept.	Jan./Sept.	Feb./Sept.	19.0	16.7	13.0	64.9	52.8	38.8	21.8	22.7	25.5
Prairie Provinces	Jan./Sept.	Jan./Sept.	Jan./Sept.	35.2	26.2	17.9	104.5	80.0	59.4	16.0	13.4	14.8
British Columbia	Jan./Sept.	Jan./Sept.	Jan./Sept.	18.4	11.7	8.7	71.2	52.9	41.1	8.1	8.5	8.9

Source: See source note to Table III-1.

Table V-5: Analysis of Changes in Seasonal Patterns in the Labour Force by Sex, Age, and Region: 1961-63, 1966-68, and 1971-73 Averages Compared

	Seasonal peak/trough			MSFV			SFR			SD as a percent of total		
	1961-63	1966-68	1971-73	1961-63	1966-68	1971-73	1961-63	1966-68	1971-73	1961-63	1966-68	1971-73
Total labour force	July/Feb.	July/Feb.	July/Feb.	1.6	2.0	2.1	6.2	7.7	7.7	100.0	100.0	100.0
Men	July/Feb.	July/Feb.	July/Feb.	1.8	2.4	2.5	6.8	8.5	8.4	73.1	69.0	71.6
Women	July/Feb.	July/Jan.	July/Jan.	1.5	1.6	1.4	5.0	6.0	5.8	26.9	31.0	28.4
Men 14-19	July/Feb.	July/Feb.	July/Feb.	14.4	17.2	16.7	55.7	64.9	61.4	34.8	34.3	38.1
Men 20-24	July/Mar.	July/Mar.	July/Feb.	3.4	4.8	5.5	10.7	14.4	15.5	11.4	13.4	16.3
Men 25-44	June/Feb.	Aug./Feb.	June/Jan.	0.4	0.4	0.5	1.3	1.4	1.4	10.2	8.4	9.3
Men 45-64	June/Jan.	June/Jan.	May/Feb.	0.6	0.6	0.4	1.8	1.8	1.3	10.5	8.5	5.8
Men 65 and over	Sept./Jan.	Sept./Jan.	June/Feb.	2.7	3.1	3.2	8.4	9.5	9.7	5.9	4.7	3.9
Women 14-19	July./Apr.	July/Feb.	July/Mar.	8.2	11.0	12.3	34.5	45.1	48.7	19.8	23.1	24.8
Women 20-24	June/Aug.	June/Jan.	June/Apr.	0.9	0.9	1.8	4.2	4.5	7.4	-0.4	1.0	4.9
Women 25-44	Nov./July	Oct./Aug.	Nov./Aug.	1.3	1.3	1.4	4.2	5.0	6.2	5.7	2.9	-3.6
Women 45-64	Sept./July	Sept./July	Oct./Aug.	1.1	1.3	1.0	3.6	4.8	4.1	2.4	4.2	0.5
Women 65 and over	May/Aug.	Nov./Aug.	Oct./Aug.	1.8	2.8	3.2	8.6	12.8	11.7	-0.4	-0.6	0.0
Atlantic Provinces	July/Mar.	July/Feb.	July/Feb.	2.7	3.1	3.3	9.8	11.4	12.8	16.1	15.1	16.3
Quebec	July/Mar.	July/Feb.	July/Feb.	1.3	1.7	2.0	5.0	7.1	7.7	19.5	25.8	27.6
Ontario	July/Feb.	July/Feb.	July/Feb.	1.4	2.0	1.9	5.2	7.0	6.4	25.9	27.5	24.0
Prairie Provinces	July/Feb.	July/Feb.	July/Feb.	2.6	2.6	2.7	9.4	8.9	8.8	30.5	23.7	25.5
British Columbia	July/Jan.	July/Jan.	July/Jan.	1.6	1.9	1.8	6.1	7.7	6.9	7.9	7.9	6.6

Source: See source note to Table III-1.

Table V-6: F-tests for Trends in Seasonal Patterns in Employment by Sex, Age, Region, and Class of Worker, for the Period 1961-73

	Linear trend compared with no trend			Quadratic trend compared with linear trend alone			Linear and quadratic trend combined compared with no trend		
	Significant at the -			Significant at the -			Significant at the -		
	1% level?	5% level?	10% level?	1% level?	5% level?	10% level?	1% level?	5% level?	10% level?
Total employment	YES	YES	YES	NO	NO	NO	YES	YES	YES
Men	YES	YES	YES	NO	YES	YES	YES	YES	YES
Women	NO	NO	NO	NO	NO	NO	NO	NO	NO
Men 14-19	YES	YES	YES	NO	NO	NO	YES	YES	YES
Men 20-24	YES	YES	YES	NO	NO	NO	YES	YES	YES
Men 25-44	YES	YES	YES	NO	YES	YES	YES	YES	YES
Men 45-64	YES	YES	YES	NO	NO	NO	YES	YES	YES
Men 65 and over	NO	NO	NO	NO	NO	NO	NO	NO	NO
Women 14-19	YES	YES	YES	NO	NO	NO	YES	YES	YES
Women 20-24	YES	YES	YES	NO	YES	YES	YES	YES	YES
Women 25-44	NO	NO	NO	NO	NO	NO	NO	NO	NO
Women 45-64	NO	NO	NO	NO	NO	NO	NO	NO	NO
Women 65 and over	NO	NO	NO	NO	NO	NO	NO	NO	NO
Atlantic Provinces	YES	YES	YES	NO	NO	NO	YES	YES	YES
Quebec	NO	YES	YES	NO	NO	NO	NO	YES	YES
Ontario	YES	YES	YES	NO	NO	NO	NO	YES	YES
Prairie Provinces	NO	YES	YES	NO	NO	NO	NO	NO	YES
British Columbia	NO	NO	YES	NO	NO	NO	NO	NO	NO
Paid workers	YES	YES	YES	NO	YES	YES	YES	YES	YES

Table V-7: F-tests for Trends in Seasonal Patterns in Employment by Industry, for the Period 1966-73

	Linear trend compared with no trend			Quadratic trend compared with linear trend alone			Linear and quadratic trend combined compared with no trend		
	Significant at the -			Significant at the -			Significant at the -		
	1% level?	5% level?	10% level?	1% level?	5% level?	10% level?	1% level?	5% level?	10% level?
Agriculture	NO	NO	NO	NO	NO	NO	NO	NO	NO
Forestry	YES	YES	YES	NO	NO	NO	YES	YES	YES
Fishing and trapping	NO	NO	NO	NO	NO	NO	NO	NO	NO
Mines, quarries, and oil wells	NO	NO	NO	NO	NO	NO	NO	NO	NO
Manufacturing	NO	NO	NO	NO	NO	NO	NO	NO	NO
Construction	NO	NO	YES	NO	NO	NO	NO	NO	YES
Transportation and communication	NO	NO	NO	NO	NO	NO	NO	NO	NO
Electric power, gas, and water utilities	NO	NO	NO	NO	NO	NO	NO	NO	NO
Trade	NO	NO	NO	NO	NO	NO	NO	NO	NO
Finance, insurance, and real estate	NO	NO	NO	NO	NO	NO	NO	NO	NO
Community, business, and personal service	NO	NO	NO	NO	NO	NO	NO	NO	NO
Public administration	NO	NO	YES	NO	NO	NO	NO	NO	NO
Goods-producing industries	NO	YES	YES	NO	NO	YES	NO	YES	YES
Service-producing industries	NO	NO	NO	NO	NO	NO	NO	NO	NO

Table V-8: F-tests for Trends in Seasonal Patterns in Nonagricultural Employment by Sex, Region, and Class of Worker, for the Period 1961-73

	Linear trend compared with no trend			Quadratic trend compared with linear trend alone			Linear and quadratic trend combined compared with no trend		
	Significant at the -			Significant at the -			Significant at the -		
	1% level?	5% level?	10% level?	1% level?	5% level?	10% level?	1% level?	5% level?	10% level?
Total nonagricultural employment	YES	YES	YES	NO	NO	YES	YES	YES	YES
Men	YES	YES	YES	YES	YES	YES	YES	YES	YES
Women	NO	NO	NO	NO	NO	NO	NO	NO	NO
Atlantic Provinces	YES	YES	YES	NO	NO	NO	YES	YES	YES
Quebec	NO	YES	YES	NO	NO	NO	NO	YES	YES
Ontario	YES	YES	YES	NO	NO	NO	NO	YES	YES
Prairie Provinces	NO	NO	NO	NO	NO	YES	NO	YES	YES
British Columbia	NO	NO	NO	NO	NO	NO	NO	NO	NO
Paid workers	YES	YES	YES	NO	YES	YES	YES	YES	YES

Table V-9: F-tests for Trends in Seasonal Patterns in Unemployment by Sex, Age, and Region, for the Period 1961-73

	Linear trend compared with no trend			Quadratic trend compared with linear trend alone			Linear and quadratic trend combined compared with no trend		
	Significant at the -			Significant at the -			Significant at the -		
	1% level?	5% level?	10% level?	1% level?	5% level?	10% level?	1% level?	5% level?	10% level?
Total unemployment	YES	YES	YES	NO	YES	YES	YES	YES	YES
Men	YES	YES	YES	YES	YES	YES	YES	YES	YES
Women	NO	NO	YES	NO	NO	NO	NO	NO	YES
Men 14-19	YES	YES	YES	YES	YES	YES	YES	YES	YES
Men 20-24	YES	YES	YES	NO	NO	NO	YES	YES	YES
Men 25-44	YES	YES	YES	YES	YES	YES	YES	YES	YES
Men 45-64	NO	YES	YES	NO	NO	NO	NO	NO	YES
Men 65 and over	NO	NO	NO	NO	NO	NO	NO	NO	YES
Women 14-19	NO	NO	NO	NO	YES	YES	NO	NO	NO
Women 20-24	NO	NO	NO	NO	NO	NO	NO	NO	NO
Women 25-44	NO	NO	NO	NO	NO	NO	NO	NO	NO
Women 45-64	YES	YES	YES	NO	NO	YES	YES	YES	YES
Women 65 and over	---	---	---	---	---	---	---	---	---
Atlantic Provinces	YES	YES	YES	NO	NO	YES	YES	YES	YES
Quebec	YES	YES	YES	NO	NO	NO	YES	YES	YES
Ontario	YES	YES	YES	NO	YES	YES	YES	YES	YES
Prairie Provinces	YES	YES	YES	NO	NO	NO	YES	YES	YES
British Columbia	NO	YES	YES	NO	NO	NO	NO	NO	NO

Table V-10: F-tests for Trends in Seasonal Patterns in the Labour Force by Sex, Age, and Region, for the Period 1961-73

	Linear trend compared with no trend			Quadratic trend compared with linear trend alone			Linear and quadratic trend combined compared with no trend		
	Significant at the -			Significant at the -			Significant at the -		
	1% level?	5% level?	10% level?	1% level?	5% level?	10% level?	1% level?	5% level?	10% level?
Total labour force	YES	YES	YES	NO	NO	NO	YES	YES	YES
Men	YES	YES	YES	YES	YES	YES	YES	YES	YES
Women	NO	NO	NO	NO	NO	NO	NO	NO	NO
Men 14-19	YES	YES	YES	NO	YES	YES	YES	YES	YES
Men 20-24	YES	YES	YES	NO	NO	NO	YES	YES	YES
Men 25-44	NO	NO	NO	NO	NO	NO	NO	NO	NO
Men 45-64	NO	NO	NO	NO	NO	NO	NO	NO	NO
Men 65 and over	NO	NO	NO	NO	NO	NO	NO	NO	NO
Women 14-19	YES	YES	YES	NO	NO	NO	YES	YES	YES
Women 20-24	YES	YES	YES	NO	NO	YES	YES	YES	YES
Women 25-44	NO	NO	NO	NO	NO	NO	NO	NO	NO
Women 45-64	NO	NO	NO	NO	NO	NO	NO	NO	NO
Women 65 and over	NO	NO	NO	NO	NO	NO	NO	NO	NO
Atlantic Provinces	YES	YES	YES	NO	NO	NO	NO	YES	YES
Quebec	YES	YES	YES	NO	NO	NO	YES	YES	YES
Ontario	NO	YES	YES	NO	NO	NO	NO	YES	YES
Prairie Provinces	NO	YES	YES	NO	NO	NO	NO	NO	YES
British Columbia	NO	YES	YES	NO	NO	NO	NO	NO	NO

Table V-11: Regression Equations to Test for Effects of the Annual Unemployment Level and Trend on Seasonal Variations in Employment, 1961-73, by Sex, Age, Region, and Class of Worker

$$MSFV_i = \beta_0 + \beta_1 u + \beta_2 t + \beta_3 t^2$$

Dependent variable: MSFV for -	Coefficients				t-ratios				$\bar{R}^2$	DW	F
	β_0	β_1	β_2	β_3	β_0	β_1	β_2	β_3			
Total employment	2.75	.0079	-.0480	.0033	112.8	1.4	53.2	7.3	.9961	1.48	72.95***
Men	3.26	.0247	-.0424	.0049	115.1	3.9	40.5	9.4	.9943	1.76	44.38***
Women	1.88	-.0553	-.0186	.0020	31.6	4.1	8.5	1.8	.8926	1.38	1.91
Men 14-19	19.34	-.3354	.0846	-.0171	74.7	5.8	8.8	3.5	.9599	1.76	2.36
Men 20-24	5.21	.1881	.0370	.0064	36.3	5.8	7.0	2.4	.9500	1.90	1.29
Men 25-44	1.54	.0359	-.0856	.0104	23.9	2.5	35.8	8.6	.9926	1.47	34.89***
Men 45-64	2.03	-.0234	-.1021	.0069	49.3	2.5	67.1	9.0	.9975	1.24	116.30***
Men 65 and over	3.58	.1454	.0110	-.0083	12.6	2.3	1.0	1.6	.2444	.91	.09
Women 14-19	9.49	.1391	.3462	-.0170	60.3	3.9	59.4	5.8	.9967	1.21	89.64***
Women 20-24	.57	.1285	.0808	.0044	4.5	4.5	17.2	1.8	.9717	1.46	7.29**
Women 25-44	1.30	.0340	-.0145	.0006	27.4	3.2	8.2	0.7	.8935	1.69	1.72
Women 45-64	1.49	-.0225	-.0159	-.0033	30.0	2.0	8.6	3.6	.9284	1.47	2.05
Women 65 and over	2.88	-.0352	.1658	-.0172	17.8	1.0	27.7	5.7	.9867	1.93	20.50***
Atlantic Provinces	5.71	-.0159	-.1154	.0107	30.4	0.6	22.3	3.7	.9899	1.03	19.25***
Quebec	2.50	.0546	-.0482	.0038	23.0	3.0	12.3	2.1	.9430	.97	4.03*
Ontario	2.05	.0045	-.0069	.0002	90.1	0.6	6.0	0.4	.7481	1.45	.94
Prairie Provinces	3.41	.0274	-.0646	.0097	30.9	0.7	11.5	3.7	.9381	.77	4.22*
British Columbia	2.66	-.0356	-.0733	.0025	50.5	3.6	32.2	2.6	.9891	2.36	26.34***
Paid workers	2.52	-.0089	-.0579	.0059	47.5	0.7	29.5	6.0	.9876	1.10	23.10***

Note: MSFV is "mean seasonal factor variation"; u is overall annual average unemployment rate, in percentage form; t is time, with value -6 in 1961, -5 in 1962, ..., +5 in 1972, +6 in 1973; $\bar{R}^2$ is coefficient of determination, corrected for degrees of freedom; DW is Durbin-Watson statistic; F is F-ratio for test of combined significance of t and t^2; significance levels are indicated by * for 10 percent level, ** for 5 percent, and *** for 1 percent.

Table V-12: Regression Equations to Test for Effects of the Annual Unemployment Level and Trend on Seasonal Variations in Nonagricultural Employment, 1961-73, by Sex, Region, and Class of Worker

$$MSFV_i = \beta_0 + \beta_1 u + \beta_2 t + \beta_3 t^2$$

Dependent variable: MSFV for -	Coefficients				t-ratios				$\bar{R}^2$	DW	F
	$\hat{\beta}_0$	$\hat{\beta}_1$	$\hat{\beta}_2$	$\hat{\beta}_3$	β_0	β_1	β_2	β_3			
Total nonagricultural employment	2.10	-.0040	-.0389	.0062	76.0	0.6	38.2	12.1	.9936	1.37	41.52***
Men	2.50	.0414	-.0492	.0080	39.8	2.9	21.1	6.9	.9827	1.53	12.78***
Women	1.29	-.0407	.0212	.0008	22.7	3.2	10.0	0.8	.9029	1.17	2.48
Atlantic Provinces	4.82	.0486	-.1136	.0085	17.7	1.2	15.2	2.0	.9826	1.05	9.34***
Quebec	1.96	.0688	-.0402	.0049	24.6	5.2	14.1	3.6	.9669	1.52	5.55**
Ontario	1.63	.0116	.0169	-.0022	50.0	1.1	10.3	3.0	.9106	1.12	3.09*
Prairie Provinces	1.49	.0701	-.0235	.0137	14.7	2.0	4.5	5.6	.9264	1.12	1.62
British Columbia	2.12	-.0217	-.0572	.0036	42.7	2.3	26.8	3.9	.9844	1.47	15.66***
Paid workers	2.18	-.0135	-.0461	.0065	50.4	1.4	28.9	8.0	.9879	1.05	23.11***

Note: See note to Table V-11.

Table V-13: Regression Equations to Test for Effects of the Annual Unemployment Level and Trend on Seasonal Variations in Unemployment, 1961-73, by Sex, Age, and Region

$$MSFV_i = \beta_0 + \beta_1 u + \beta_2 t + \beta_3 t^2$$

Dependent variable: MSFV for -	Coefficients				t-ratios				$\bar{R}^2$	DW	F
	β_0	β_1	β_2	β_3	β_0	β_1	β_2	β_3			
Total unemployment	20.03	-.5231	-1.2590	.0689	56.2	6.5	95.4	10.4	.9987	1.99	233.57***
Men	24.99	-.6895	-1.2204	.0615	50.6	6.2	66.7	6.7	.9974	1.77	113.10***
Women	5.74	.0309	-.2222	.0120	15.2	0.4	15.9	1.7	.9561	1.92	6.42**
Men 14-19	18.65	-.0467	.0819	-.0681	22.8	0.3	2.7	4.5	.8455	.82	.72
Men 20-24	20.98	-.0094	-1.2028	.0583	37.5	0.1	58.0	5.6	.9966	1.29	85.47***
Men 25-44	35.01	-1.2298	-1.2975	.0441	37.9	5.9	37.9	2.6	.9922	1.65	36.21***
Men 45 and over	32.09	-.8822	-.8122	-.0013	46.7	5.7	32.0	0.1	.9897	1.91	25.35***
Women 14-19	23.03	-.5451	.5361	-.1489	26.5	2.8	16.7	9.2	.9817	1.27	9.54***
Women 20-24	4.93	.3818	-.1907	.0138	18.4	6.3	19.2	2.8	.9791	2.27	9.55***
Women 25-44	12.60	-.6246	-.5369	.1292	6.3	1.4	7.3	3.5	.8541	.84	1.72
Women 45 and over	17.87	-.6691	-.1624	.0497	13.7	2.3	3.4	2.0	.5583	.90	.41
Atlantic Provinces	41.60	-1.6858	-1.3851	.0661	14.1	4.0	17.0	1.4	.9769	1.53	12.56***
Quebec	18.65	-.2041	-1.3275	.0547	43.2	2.9	85.5	7.5	.9984	1.23	187.84***
Ontario	16.49	-.0596	-.5939	-.0044	26.9	0.3	19.3	0.3	.9694	.79	9.25***
Prairie Provinces	28.61	-.9867	-1.7391	.0798	41.8	4.1	49.8	4.9	.9958	1.23	67.29***
British Columbia	12.86	-.2153	-.9899	.0862	29.5	2.6	52.6	10.5	.9960	1.71	74.17***

Note: See note to Table V-11.

Table V-14: Regression Equations to Test for Effects of the Annual Unemployment Level and Trend on Seasonal Variations in the Labour Force, 1961-73, by Sex, Age, and Region

$$MSFV_i = \beta_0 + \beta_1 u + \beta_2 t + \beta_3 t^2$$

Dependent variable: MSFV for -	Coefficients				t-ratios				$\bar{R}^2$	DW	F
	β_0	β_1	β_2	β_3	β_0	β_1	β_2	β_3			
Total labour force	1.96	.0087	.0544	-.0053	64.2	1.3	48.2	9.3	.9953	1.26	61.62***
Men	2.31	.0069	.0793	-.0077	37.6	0.5	35.0	6.7	.9912	.96	32.32***
Women	1.82	-.0522	-.0021	-.0018	43.0	5.5	1.3	2.3	.9287	2.08	.16
Men 14-19	18.71	-.3562	.2211	-.0368	75.0	6.3	24.0	7.9	.9888	2.20	16.49***
Men 20-24	4.23	.1294	.2230	-.0218	19.7	2.7	28.0	5.4	.9859	.96	20.74***
Men 25-44	.44	-.0004	.0057	.0007	41.0	0.2	14.6	3.5	.9527	2.13	5.38**
Men 45-64	.72	-.0304	-.0243	-.0003	41.2	7.7	37.4	1.0	.9929	2.73	34.70***
Men 65 and over	2.41	.1445	.0495	-.0125	8.8	2.4	4.9	2.5	.7135	.92	.79
Women 14-19	10.92	.0304	.4087	-.0325	90.7	1.1	91.8	14.5	.9987	1.22	218.13***
Women 20-24	.38	.1457	.0965	.0034	3.2	5.3	21.4	1.5	.9804	1.76	11.30***
Women 25-44	1.16	.0350	.0070	-.0008	20.4	2.7	3.3	0.8	.6589	1.20	.30
Women 45-64	1.39	-.0368	-.0158	-.0040	20.8	2.4	6.4	3.2	.9103	1.26	1.19
Women 65 and over	3.47	-.1383	.1325	-.0049	18.5	3.3	19.1	1.4	.9717	1.10	9.24***
Atlantic Provinces	3.07	.0084	.0633	-.0051	78.0	1.5	58.4	8.4	.9985	2.06	136.38***
Quebec	1.59	.0263	.0738	-.0057	25.7	2.6	33.3	5.4	.9900	.96	29.44***
Ontario	2.08	-.0405	.0579	-.0098	57.4	3.6	31.8	11.8	.9921	1.63	31.08***
Prairie Provinces	2.62	-.0043	.0008	.0021	34.3	0.2	0.2	1.2	(a)	.67	.03
British Columbia	2.03	-.0280	.0171	-.0053	40.9	3.0	8.0	5.6	.9419	1.92	2.58

Note: See note to Table V-11; the symbol (a) indicates a computed value of $\bar{R}^2$ less than 0.

Table V-15: Effects of Changes in Composition on Seasonal Variations in Employment: MSFV Cross-standardized by Sex, Age, Region, and Industry for 1961-63, 1966-68, and 1971-73

Type of cross-standardization	MSFV based on -			
	Weights for -	Seasonal factors for -		
		1961-63	1966-68	1971-73
By sex	1961-63	3.1	2.9	2.8
	1966-68	3.1	2.8	2.7
	1971-73	3.0	2.8	2.6
By sex and age	1961-63	3.1	2.7	2.6
	1966-68	3.2	2.8	2.7
	1971-73	3.1	2.8	2.7
By region	1961-63	3.2	2.8	2.7
	1966-68	3.1	2.8	2.7
	1971-73	3.1	2.8	2.6
By industry	1961-63	-	-	-
	1966-68	-	2.8	2.8
	1971-73	-	2.5	2.5

Table V-16: Effects of Changes in Composition on Seasonal Variations in Nonagricultural Employment: MSFV Cross-standardized by Sex, and Region, for 1961-63, 1966-68, and 1971-73

Type of cross-standardization	MSFV based on -			
	Weights for -	Seasonal factors for -		
		1961-63	1966-68	1971-73
By sex	1961-63	2.4	2.1	2.1
	1966-68	2.4	2.1	2.1
	1971-73	2.3	2.0	2.0
By region	1961-63	2.4	2.1	2.1
	1966-68	2.4	2.1	2.1
	1971-73	2.4	2.0	2.1

Table V-17: Effects of Changes in Composition on Seasonal Variations in Unemployment: MSFV Cross-standardized by Sex, Age, and Region for 1961-63, 1966-68, and 1971-73

Type of cross-standardization	MSFV based on -			
	Weights for -	Seasonal factors for -		
		1961-63	1966-68	1971-73
By sex	1961-63	24.9	19.2	13.8
	1966-68	23.3	17.8	12.7
	1971-73	21.9	16.5	12.0
By sex and age	1961-63	25.2	20.1	15.0
	1966-68	22.7	17.6	12.8
	1971-73	21.3	16.1	11.6
By region	1961-63	24.9	18.5	12.8
	1966-68	24.4	18.1	12.5
	1971-73	24.4	17.8	12.4

Table V-18: Effects of Changes in Composition on Seasonal Variations in the Labour Force: MSFV Cross-standardized by Sex, Age, and Region for 1961-63, 1966-68, and 1971-73

Type of cross-standardization	MSFV based on -			
	Weights for -	Seasonal factors for -		
		1961-63	1966-68	1971-73
By sex	1961-63	1.6	2.1	2.2
	1966-68	1.6	2.0	2.2
	1971-73	1.6	2.0	2.1
By sex and age	1961-63	1.6	1.9	2.0
	1966-68	1.7	2.0	2.1
	1971-73	1.7	2.1	2.2
By region	1961-63	1.6	2.0	2.2
	1966-68	1.6	2.0	2.2
	1971-73	1.6	2.0	2.1

CHAPTER VI

STUDENTS IN THE LABOUR MARKET

As noted previously, the movements of students into and out of the labour market during the summer months account for a substantial proportion of the total seasonal variation in the Canadian labour force and Canadian employment. It is of interest, therefore, to consider these movements in more detail.

Information on students in the summer labour force has been collected since 1970 by Statistics Canada by adding special questions to the regular monthly Labour Force Survey.* Some estimates obtained in this way are reported here in Tables VI-1 - VI-4 for the period May-September, 1972.

Table VI-1 provides estimates of the student labour force and of the numbers employed and unemployed, for persons 14-19 years of age, 20-24 years of age, and both groups combined. These estimates refer to persons planning to return to school in the fall. Also shown are the total population and the rates of unemployment and of labour force participation. (For purposes of this table and the subsequent ones, the term "students" refers to persons who had been full-time students in March, 1972.)

It will be seen, in Table VI-1, that the number of students in the labour force** reached a peak of some 955 thousand in July 1972, fell

---

* See Statistics Canada [32,33,34].

** For purposes of this chapter we exclude the small number of students in the labour force aged 25 and over.

somewhat in August, and then fell very sharply in September as schools, colleges, and universities commenced their fall terms. At the peak, in July, about 82 percent of the student labour force were under the age of 20, and 18 percent were in the 20-24 age group. Again in July, about 42 percent of the total student population 14-19 years of age were in the labour force. Among students 20-24, the proportion was about 77 percent.

The unemployment rates in Table VI-1 indicate heavy unemployment in the late spring or early summer, with substantial reductions thereafter. Among students 20-24 years of age, the estimated unemployment rate in May of 1972 was in excess of 18 percent. It then declined to 11 percent in June and to 7 percent in July. Among students 14-19, the rate was at its highest point in June, at about 15 percent, with a decline to 10 percent following in July and to 5 or 6 percent in August. These patterns, which are evident also in the data for other recent years, indicate high rates of unemployment during the initial period of summer job seeking and lower ones subsequently, when either jobs have been found or, as no doubt happens in many cases if general labour market conditions are unfavourable, students have become discouraged and have given up looking.

The summer labour force participation rates of students planning to return to school are compared, in Table VI-2, with those for students not planning to return and for other members of the population under 25. It is evident that the substantial variation in the overall participation rates for younger population groups is a consequence mainly of the summer influx of students, both those planning to return and those not planning

to return; for others (i.e., "non-students"), the changes in participation rates are comparatively small.

The pattern of participation rates for persons who had been students in the previous school year but were not planning to return is of some interest. For these people, the participation rates start off at relatively low levels at the beginning of the summer and climb to relatively high ones by the end. Thus, for 14-19-year-olds, the rate for non-returning students was about 46 percent in May, 80 percent in July, and 88 percent in September. For 20-24-year-old "non-returners", the rate was 62 percent in May, 82 percent in July, and 90 percent in September. These patterns suggest that students emerging from school to take continuing employment tend not to be in a hurry. Either because they preferred a period of holiday or because they were discouraged by employment prospects, large numbers delayed their entry into the labour force.

Unemployment rates for the various student and non-student categories are displayed in Table VI-3. The pattern of rates for students planning to return to school has already been remarked on. The rates for "non-returners" are higher than those for "returners" in every month from May to September -- indeed, much higher. They are also higher than the rates for other persons of the same age, suggesting either that young people entering the labour market are initially more particular about the jobs they will accept or that they encounter a substantial degree of difficulty in acquiring a "permanent" job by virtue of their inexperience.

Table VI-4 provides an indication of the types of jobs that students take during their periods of temporary summer employment. (The table refers only to students planning to return to school in the fall.) As one would expect, there are substantial differences between the occupational distributions for males and females. Whereas the highest concentrations of male students are in unskilled labour and farm help, female students are concentrated in service occupations and, to a lesser degree, in clerical and sales occupations.

Table VI-1: Labour Force Status During the Period May-September, 1972, of Persons Who Had Been Full-Time Students in March and Were Planning to Return to School in the Fall, by Age Group

	May	June	July	August	September
14-24 years of age					
Population ('000)	2,071	2,051	2,092	2,131	2,166
Labour force ('000)	525	686	955	881	367
Employed ('000)	469	588	865	832	355
Unemployed ('000)	56	98	90	49	12
Unemployment rate (%)	10.7	14.3	9.4	5.6	3.3
Participation rate (%)	25.4	33.4	45.7	41.3	16.9
14-19 years of age					
Population ('000)	1,847	1,835	1,863	1,888	1,919
Labour force ('000)	406	531	779	714	319
Employed ('000)	371	450	701	675	309
Unemployed ('000)	35	81	78	39	10
Unemployment rate (%)	8.6	15.3	10.0	5.5	3.1
Participation rate (%)	22.0	28.9	41.8	37.8	16.6
20-24 years of age					
Population ('000)	224	216	229	243	247
Labour force ('000)	119	155	176	167	48
Employed ('000)	98	139	164	157	46
Unemployed ('000)	22	17	12	10	n.a.
Unemployment rate (%)	18.5	11.0	6.8	6.0	n.a.
Participation rate (%)	53.1	71.8	76.9	68.7	19.4

n.a. - not available

Source: Statistics Canada, The Labour Force, October, 1972 (Catalogue 71-001).

Table VI-2: Labour Force Participation Rates During the Period May-September, 1972, of Persons Under 25, by Age Group and Student Status

	May (%)	June (%)	July (%)	August (%)	September (%)
14-24 years of age					
All persons	52.3	57.0	63.2	60.9	49.0
Full-time students in March	28.3	37.0	50.2	47.1	26.8
Planning to return	25.4	33.4	45.7	41.3	16.9
Not planning to return	53.0	62.3	80.7	85.1	88.5
Undecided	39.0	49.2	70.1	69.4	n.a.
Others ("non-students")	78.8	79.3	78.2	77.5	76.2
14-19 years of age					
All persons	35.7	41.5	52.2	49.1	33.3
Full-time students in March	23.8	31.6	45.6	42.6	24.1
Planning to return	22.0	28.9	41.8	37.8	16.6
Not planning to return	45.8	59.3	79.9	85.8	87.6
Undecided	32.9	44.1	69.1	68.4	n.a.
Others ("non-students")	79.9	79.4	78.8	77.3	75.2
20-24 years of age					
All persons	74.6	77.7	77.9	76.8	70.1
Full-time students in March	56.2	70.5	77.9	73.2	43.0
Planning to return	53.1	71.8	76.9	68.7	19.4
Not planning to return	62.2	67.0	81.9	84.7	90.2
Undecided	63.6	68.0	76.0	71.4	n.a.
Others ("non-students")	78.3	79.3	77.9	77.7	76.5

n.a. - not available

Source: See source note to Table VI-1.

Table VI-3: Unemployment Rates During the Period May-September, 1972, of Persons Under 25, by Age Group and Student Status

	May (%)	June (%)	July (%)	August (%)	September (%)
14-24 years of age					
All persons	11.3	12.4	10.6	9.4	9.7
Full-time students in March	12.6	15.5	11.4	8.2	9.2
Planning to return	10.7	14.3	9.4	5.6	3.3
Not planning to return	17.9	20.9	18.9	16.7	16.5
Undecided	n.a.	n.a.	17.3	n.a.	n.a.
Others ("non-students")	10.8	10.7	10.0	10.3	9.9
14-19 years of age					
All persons	13.0	17.0	12.9	10.6	11.6
Full-time students in March	9.7	16.3	11.6	8.0	8.3
Planning to return	8.6	15.3	10.0	5.5	3.1
Not planning to return	n.a.	23.8	20.2	17.9	17.2
Undecided	n.a.	n.a.	17.8	n.a.	n.a.
Others ("non-students")	17.0	18.5	16.0	16.9	16.1
20-24 years of age					
All persons	10.2	8.9	8.4	8.4	8.5
Full-time students in March	20.5	13.4	10.3	8.9	11.9
Planning to return	18.5	11.0	6.8	6.0	n.a.
Not planning to return	21.2	18.6	16.9	14.5	15.3
Undecided	n.a.	n.a.	n.a.	n.a.	n.a.
Others ("non-students")	8.7	8.1	8.0	8.3	8.1

n.a. - not available

Source: See source note to Table VI-1.

Table VI-4: Occupational Distribution of Employment in July, 1972, of Persons Who Had Been Full-Time Students in March and Were Planning to Return to School in the Fall, by Sex

	Both sexes (%)	Men (%)	Women (%)
Total	100.0	100.0	100.0
Managerial and professional	7.1	7.1	7.3
Clerical	11.8	8.6	17.5
Sales	11.7	10.5	13.9
Service	26.8	15.6	46.2
Farming	14.5	19.3	6.3
Crafts	9.1	11.3	5.3
Labourer	15.1	22.7	3.5
Other*	3.7	5.0	

* Includes transportation, communications, logging, fishing, and mining.

Source: G. Klassen, "Student Employment and Unemployment, Summer 1972", Canada Manpower Review, First Quarter, 1973.

CHAPTER VII

SEASONAL RELATIONSHIPS BETWEEN EMPLOYMENT AND PRODUCTION

Seasonal fluctuations in employment are associated with seasonal fluctuations in production and it is of interest to compare them. This we do now by comparing the quarterly seasonal factors for employment, based on Labour Force Survey data, with those for output, based on the Statistics Canada estimates of real domestic product. In addition, we derive the seasonal patterns for output per worker implicit in the employment and production seasonal patterns. Results are displayed in Table VII-1 for the nonagricultural sector as a whole and for 11 component industrial divisions, for the period 1971-73. As convenient summary measures, the table displays also the MSFV and SFR measures for each series.*

Considerable caution is warranted in comparing employment and output data from different sources. Such comparisons are fraught with difficulties arising from differences -- and sometimes quite subtle ones -- in the concepts and definitions underlying the data. Even rather small discrepancies in rates of change can lead to substantial errors in calculated productivity series (i.e., average labour productivity). For example, if output increases by 8 percent over a year, while employment increases by 7 percent, the implied increase in output per worker is

---

* The MSFV and SFR measures in Table VII-1 are calculated from quarterly seasonal factors. In consequence, the measures for nonagricultural employment differ from those shown in the tables of Chapters IV and V, which are based on monthly factors. The range and mean variation can not be less for the monthly factors than for the quarterly ones, and in general they are greater.

about 1 percent. Suppose, though, that it is estimated, incorrectly, that output has risen by 9 percent rather than 8. Given the statistical difficulties involved in measuring output, this might not be regarded as a very large error. For the productivity calculation, though, its implications are serious: it implies an increase of about 2 percent in output per worker, rather than 1 percent. In other words, the estimated rate of productivity increase is twice the actual increase. Moreover, if estimated employment should happen to err in the opposite direction, indicating an increase of 6 percent rather than 7, the estimated productivity increase would be about 3 percent, or triple the actual increase. Duly cognizant of the pitfalls in calculations of this kind, let us nevertheless see what general conclusions the results in Table VII-1 might support.

The most interesting conclusion is that productivity in the nonagricultural sector as a whole experiences rather little seasonal variation. The quarterly seasonal factors for output per worker range between a high of 102.3 in the 4th quarter and a low of 96.8 in the 3rd. But the employment total no doubt includes a larger fraction of people on holiday in the 3rd quarter, so that the actual number of man-days worked would be understated somewhat, relative to other quarters. Added to this is the fact that the third-quarter increase in employment reflects, in large measure, the summer influx of less experienced and hence less productive student manpower. Moreover, the average numbers of hours worked per day or per week are subject to seasonal variation, and it seems reasonable to suppose that this would act in the direction of smoothing

out even further the apparent variations in output per worker. All in all, we interpret the total nonagricultural results in Table VII-1 as implying comparatively little variation in basic labour productivity over the course of the year.

While this is true of the nonagricultural sector as a whole, it is not true of some of the individual divisions within the sector. Agriculture is excluded from the table because of the difficulties and necessary statistical conventions associated with measuring quarterly output in an industry in which the harvest is largely concentrated in a particular period of the year. A somewhat similar situation arises in the case of the fishing and trapping division, which is considered in the table, and which does experience wide seasonal swings in output per worker, associated mainly with the concentration of the fishing catch in the 3rd quarter. The utilities group also displays a high degree of seasonal variability, associated with the marked seasonal increase in energy provision in the winter months and the fact that this increase can be achieved with little alteration in the overall size of the work force, owing to the nature of the capital facilities involved. The seasonal increases in output per worker in trade are also worth noting, these increases being related to the concentration of retail and wholesale activity in the 4th quarter and, in lesser degree, in the 2nd. While there is some variation in the work force in trade from quarter to quarter, this variation is considerably less than the variation of measured output. The implication is that the industry must allow for substantial underutilization of capacity in some periods of the year in

order to cope with high activity levels in others, and that this under-utilization refers both to the work force and to the physical plant involved.

There are, then, some noteworthy patterns of seasonal variation in labour productivity in particular industries or groups of industries. To repeat, though, we judge the most interesting finding to be that labour productivity in the nonagricultural sector as a whole apparently does not experience wide seasonal swings, especially when allowance is made for the imperfections of the employment series as a measure of total labour input into production processes.

Table VII-1: Seasonal Patterns in Real Domestic Product (RDP), Employment (E), and Output per Worker (RDP/E) in Nonagricultural Industries: 1971-73 Averages

	Average percentage seasonal factor				MSFV	SFR
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter		
Total nonagriculture						
RDP	97.4	101.1	99.4	102.3	1.6	4.9
E	97.0	100.4	102.7	100.0	1.5	5.7
RDP/E	100.4	100.7	96.8	102.3	1.7	5.5
Forestry						
RDP	94.1	84.8	109.3	111.1	10.4	26.2
E	90.2	89.0	115.4	105.3	10.4	26.4
RDP/E	104.3	95.3	94.7	105.5	5.0	10.8
Fishing and trapping						
RDP	51.4	102.8	178.9	74.6	38.9	127.5
E	61.7	123.8	127.8	86.9	25.8	66.1
RDP/E	83.3	83.0	140.0	85.9	22.0	57.0
Mines, quarries, and oil wells						
RDP	100.0	100.1	98.4	101.4	0.8	3.0
E	98.2	102.6	102.0	97.3	2.3	5.3
RDP/E	101.8	97.5	96.6	104.2	3.0	7.6
Manufacturing						
RDP	98.2	102.9	97.5	101.3	2.1	5.4
E	97.6	100.2	102.8	99.4	1.5	5.2
RDP/E	100.6	102.6	94.8	102.0	2.6	7.8
Construction						
RDP	85.8	98.3	115.6	105.3	9.2	29.7
E	84.4	100.6	113.8	101.2	7.8	29.5
RDP/E	101.7	97.7	101.5	104.0	2.4	6.4
Transportation and communication						
RDP	95.7	101.2	102.5	100.7	2.2	6.8
E	97.4	99.9	103.3	99.4	1.6	5.8
RDP/E	98.2	101.3	99.3	101.3	1.3	3.1

Table VII-1 (Continued)

	Average percentage seasonal factor				MSFV	SFR
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter		
Electric power, gas, and water utilities						
RDP	117.1	94.8	83.8	103.2	10.4	33.3
E	99.9	102.2	100.4	97.5	1.3	4.7
RDP/E	117.2	92.8	83.4	105.8	11.7	33.8
Trade						
RDP	90.3	102.7	97.5	109.6	6.1	19.4
E	97.4	99.0	101.3	102.3	1.8	4.9
RDP/E	92.7	103.8	96.3	107.2	5.5	14.5
Finance, insurance, and real estate						
RDP	99.1	99.8	101.1	100.0	0.6	2.0
E	100.2	99.9	101.6	98.2	0.9	3.4
RDP/E	98.9	99.9	99.5	101.8	0.9	2.9
Community, business, and personal service						
RDP	100.6	101.7	96.9	100.9	1.6	4.8
E	99.0	100.9	100.0	100.1	0.5	2.0
RDP/E	101.7	100.8	96.9	100.8	1.6	4.8
Public administration						
RDP	98.5	100.4	102.5	98.6	1.4	3.9
E	98.2	100.9	103.6	97.2	2.3	6.4
RDP/E	100.4	99.5	98.9	101.4	0.8	2.5

Source: Employment - see source note to Table III-1.
Real domestic product - Statistics Canada, Indexes of Real Domestic Product by Industry, December 1973 and 1973 Supplement (Catalogue 61-005).

CHAPTER VIII

THE COST OF SEASONALITY TO THE CANADIAN ECONOMY

To the extent that the labour force is underutilized because of seasonal influences during some parts of the year, there is an implied cost to the Canadian economy in the sense that the total output of goods and services is below the attainable level. The purpose of this chapter is to provide some estimates of this cost, albeit very rough ones.

We confine our attention, in the first instance, to the non-agricultural sector. There are seasonal variations in agricultural employment and output, of course, but these are so closely linked to climatic influences that it makes little sense to think of the increase in output that could be obtained by increasing agricultural employment in the winter months. Moreover, the measurement of monthly or quarterly output in agriculture is necessarily based on rather arbitrary conventions and procedures and the output figures are therefore somewhat difficult to interpret, for our purposes. Accordingly, we take agricultural output as given and concern ourselves with the question of how much nonagricultural output might be increased by the elimination of seasonal slack in the labour market. At the end of the exercise, though, we adapt the results obtained for the nonagricultural sector to arrive at estimates relating to the economy as a whole.

Our approach is as follows. Let Q and E be total nonagricultural output and employment, respectively. Let D_1, D_2, D_3, and D_4 be dummy variables for the four quarters of the year. (D_1 = 1 in the first quarter, 0 in other quarters; D_2 = 1 in the second quarter, 0 in other quarters;

etc.). Let t stand for time (t=1,2,...). A representation of the relationship between output and employment which meets our needs, and which leads to what we think are reasonable empirical results, is embodied in the equation

$$(1) \qquad Q = \alpha E^{\beta}(e^{\gamma t+\delta})u$$

where u is a stochastic variable representing random shifts, e is the base of the system of natural logarithms, $\beta = \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4$, and $\delta = \delta_1 D_1 + \delta_2 D_2 + \delta_3 D_3 + \delta_4 D_4$. The parameter β represents the response of output to changes in employment, the response being allowed to vary from quarter to quarter in accordance with the changing values of the β_i coefficients. (More specifically, it represents the elasticity of Q with respect to E.) The δ parameter represents seasonal shifts in the production relationship which are independent of the level of employment. The parameter γ represents trend in the production relationship resulting from growth of the capital stock, changes in technology, and other factors; α is simply a scale parameter.

E stands for the actual number of persons employed in a given quarter. Let E_* stand for the "seasonal full-employment" level of employment, i.e., the level that would obtain in a given month if seasonal underutilization of manpower were eliminated. The corresponding "seasonal full-employment" level of Q is Q_*, given by

$$(2) \qquad Q_* = \alpha E_*^{\beta}(e^{\gamma t+\delta})u.$$

The ratio of "seasonal full-employment" output to actual output is then

$$(3) \qquad \frac{Q_*}{Q} = \left(\frac{E_*}{E}\right)^{\beta}$$

and Q_* itself may be calculated from

$$(4) \qquad Q_* = Q\left(\frac{E_*}{E}\right)^{\beta}.$$

Given the actual values of Q and E we require, for this calculation, values of E_* and the β_i coefficients.

Estimates of the coefficients were calculated from time series of nonagricultural employment and real domestic product indexes. The original equation was transformed into linear form by taking logarithms on both sides. In addition, the first-quarter dummy variable, D_1, was dropped in order to avoid the problem of matrix singularity in the estimation of the equation arising from the relationship $D_1 + D_2 + D_3 + D_4 = 1$. The resulting equation can be written in the form

$$(5) \qquad \ln Q = \pi + \sum_{1}^{4}\beta_i(D_i \ln E) + \gamma t + \sum_{2}^{4}\theta_i D_i + \ln u$$

where $\pi = \ln \alpha + \delta_1$ and $\theta_i = \delta_i - \delta_1$.

This equation was fitted, by least squares, to data for the 84 quarters of 1953-73. The estimated equation is

$$(6) \qquad \ln Q = \underset{(10.3)}{-8.0126} + \underset{(15.6)}{1.4637}(D_1 \ln E) + \underset{(14.6)}{1.3651}(D_2 \ln E)$$

$$+ \underset{(13.7)}{1.2796}(D_3 \ln E) + \underset{(14.7)}{1.4176}(D_4 \ln E)$$

(equation continued on next page)

$$+ \underset{(2.3)}{.0017t} + \underset{(4.2)}{.8639D_2}$$

$$+ \underset{(7.6)}{1.5704D_3} + \underset{(1.9)}{.4061D_4} \cdot$$

The coefficient of determination, corrected for degrees of freedom ($\bar{R}^2$), is .9977. The t-ratios, given in brackets, indicate a high degree of significance for most of the coefficients, including, in particular, the β_i coefficients, which are the ones of principal interest.*

In addition to considerations of statistical significance, the values of the parameters obtained seem more or less reasonable to us. The β_i coefficients are all greater than unity. If E represented total labour input this would be contrary to expectations, under the usual assumption of declining marginal productivity. But E represents only numbers of people and the total labour input is determined also by average hours worked. Thus one interpretation of the fact that the β_i coefficients are greater than 1 is that hours of work tend to increase as E moves in the direction of full employment. A second possibility is that capital is used more intensively when employment rises. A third is that labour is used more efficiently as the economy moves toward full employment. In all of the alternative forms of the equation with which we have experimented the β_i coefficients always exceed unity.

---

* The t-ratios should be treated with some caution, though, inasmuch as there is considerable serial correlation in the residuals from the fitted equation, and hence the likelihood that the t-ratios are biased upward. (A value of .8 was obtained for the Durbin-Watson ratio.) An attempt to reduce the serial correlation by a simple autoregressive transformation left the equation virtually unchanged.

The coefficients of D_2, D_3, and D_4 also seem reasonable. They imply a downward shift of the output-employment relationship in the colder months of the year and an upward shift in the warmer months. This pattern is consistent with expectations regarding the effect of weather on the efficiency of production.

The values of E^* to be used in generating Q^* were obtained in the following way. It was assumed that "seasonal full-employment" would obtain throughout the year if the number of persons employed in the nonagricultural sector did not fall below the number employed in October or November, whichever was higher. The summer months were excluded from the calculation of peak employment inasmuch as the higher levels of employment in the summer are associated with the temporary influx of student workers and it would not be reasonable to define "seasonal full-employment" at other times of the year so as to include students.

The calculation of E^* values was based on monthly data. In order to allow for changes in employment conditions during the year, values were obtained for individual months by linear interpolation between the October or November values for consecutive years. Letting $\overline{E}$ be the interpolated value for some month (e.g., March), E^* is then defined as equal to $\overline{E}$ or to actual employment, whichever is higher: symbolically, $E^* = \max(\overline{E},E)$.

Monthly E^* values having been obtained in the foregoing way, these were then converted into quarterly averages, and thence into quarterly estimates of Q^*, using equation (4) and the estimated coefficients from equation (6). The quarterly estimates were then used to obtain

annual estimates and the percentage differences between annual Q and annual Q_* were calculated. These represent estimates of the percentages by which annual real output in the nonagricultural sector could be increased if "seasonal full-employment" (as we have defined it) were maintained throughout the year. Estimates of the corresponding percentages for the economy as a whole were then derived, based on the proportions of real output in the agricultural and nonagricultural sectors, as calculated using the real domestic product (RDP) base-period (1961) weights, projected to other years on the basis of the RDP indexes in the two sectors. It was assumed that employment and output in agriculture would be unaffected by the transition to "seasonal full-employment", so that the calculation for the economy as a whole involved, in effect, an appropriate weighting of a positive percentage increase for the nonagricultural sector with a zero increase for the agricultural sector. Percentage increases for the economy as a whole were then applied to annual gross national product totals, from the national accounts, to arrive at estimates of what GNP would have been if seasonal shortfalls in employment had been eliminated.

Results of calculations of this sort are presented in Table VIII-1 for the two years 1966 and 1972, these years being selected for illustrative purposes because the first was a year of very low annual unemployment (3.6 percent) and the second a more recent year with comparatively high annual unemployment (6.3 percent). The table compares the actual and hypothetical "seasonal full-employment" levels of employment and output (GNP) and displays both the simple differences and the

percentage differences between the actual and hypothetical levels. Results are shown for GNP in both constant-dollar and current-dollar terms, the same percentage differences between actual and hypothetical levels being assumed in both cases. Since the basic calculations relate to real output, the application of the derived percentages to current-dollar output involves the assumption that price levels in the agricultural and nonagricultural sectors had changed in the same proportions since 1961, so that the 1966 and 1972 weights of the two sectors in total GNP are the same in current-dollar terms as in constant-dollar terms. This assumption can be viewed only as an approximation to reality, of course, but its effect on the results is likely to be quite negligible, given the purpose of our calculations, which is simply to provide a rough indication of the order of magnitude of the economic cost of seasonal underutilization of manpower.

The estimates that we present are indeed rough. A different approach would probably produce somewhat different results. Nevertheless, we would like to think that they do serve to place the implications of seasonal employment variation in some sort of reasonable quantitative perspective.

A final point relating to methodology and assumptions should be noted. What we have done is to estimate the changes in annual output that would result from changes in employment alone. We have ignored the fact that increased output might result in increased investment, an enlarged capital stock, and hence additional increases in output through time. This is a feature which our calculations share with most other calculations of the "potential-output" variety.

The results in Table VIII-1 suggest that the elimination of seasonal underutilization of manpower would raise annual average employment by about 1.1 percent and total annual GNP by about 1.6 or 1.7 percent. In 1972, with prices at the levels obtaining in that year, the effect would have been to raise GNP by something of the order of 1.6 billion dollars.

Table VIII-1: Estimated Effects of Seasonality on Annual Levels of Employment and Gross National Product, 1966 and 1972

	1966	1972
Annual average employment, in thousands		
Actual (A)	7,152	8,329
Hypothetical (H)	7,235	8,419
Difference: H-A	83	90
Percent difference: 100(H-A)/A	1.16	1.08
GNP, in millions of current dollars		
Actual (A)	61,828	103,493
Hypothetical (H)	62,898	105,128
Difference: H-A	1,070	1,635
Percent difference: 100(H-A)/A	1.73	1.58
GNP, in millions of constant (1961) dollars		
Actual (A)	54,207	71,515
Hypothetical (H)	55,145	72,645
Difference: H-A	938	1,130
Percent difference: 100(H-A)/A	1.73	1.58

CHAPTER IX

SUMMARY AND CONCLUSIONS

The purpose of this study has been to examine and describe the patterns of seasonal variation that obtain in the Canadian labour force, the changes that have taken place in these patterns in recent years, and other related matters. We now summarize the study and note some of the principal findings.

We began, in Chapter II, by discussing briefly alternative approaches to the extraction of seasonal components from time series. We then defined some simple summary measures for use in describing seasonal patterns in subsequent chapters. These measures relate to the magnitude of seasonal variation and the contributions of particular regions or population groups to the seasonal variations of the total Canadian labour force and total employment and unemployment.

In Chapter III, we turned our attention to a description of aggregate seasonal patterns and to a comparison of Canadian seasonal patterns with those in other countries. We noted, among other things, that in 1971-73, the average increase in Canadian employment between January-March and August-October, for seasonal reasons alone, was about 495 thousand, while the average decrease in unemployment was about 216 thousand. In the comparison with the United States, we noted the greater degree of seasonal variation in Canada and also some important differences in timing between the Canadian and U.S. unemployment patterns. In comparing Canadian unemployment patterns with those in 17 other OECD countries, we observed that while the seasonal variations in Canada are

considerable, there are quite a few other countries in which the degree of variation appears to be just as great or greater. Substantial seasonal variation in the labour market was seen therefore to be a phenomenon which Canada shares with many other nations.

Chapter IV was concerned with seasonal patterns in particular regions, industries, and age-sex groups. These patterns were summarized in tabular form and displayed graphically for the period 1971-73. Men were seen to account for a disproportionately large fraction of the seasonal variability of employment and unemployment: in the case of unemployment, they accounted for more than 95 percent of the average 1971-73 seasonal change between January-March and August-October, while women accounted for less than 5 percent. A very high degree of concentration of seasonal variability among industries was also noted, with construction and the primary industries (other than mining and related activities) representing only about 13 percent of average employment in 1971-73 but being responsible for some 64 percent of the seasonal variation of employment. Among regions, the Atlantic Provinces, which are subject to the highest average rates of unemployment in the country, were seen to be subject also to the greatest seasonal fluctuations.

Changes in seasonal patterns between the early 1960's and the early 1970's were examined in Chapter V. Changes evidenced by the seasonal factors computed by the X-11 seasonal adjustment method were considered first, it being observed, in particular, that the degree of variability has decreased somewhat in the case of total employment and quite markedly in the case of total unemployment. The decline in the

seasonal variability of unemployment was found to be widespread, being evident in every major region of the country and in a number of age-sex groups within the total population. In general, the significance of changes indicated by the X-11 seasonal factors was confirmed by an alternative form of analysis based on regression methods. Relationships between the extent of seasonal variability and the state of the labour market, as indicated by the overall annual unemployment rate, were also explored in this chapter and it was found, in particular, that seasonal unemployment fluctuations (in proportionate terms) tended to be greater in years of low average unemployment rates than in years of high ones. Some of the changes observed since the early 1960's would appear therefore to be associated with the changes in general unemployment levels over this period. However, significant trends quite independent of unemployment levels were also observed. Finally, the influences of changes in the weights attaching to different regions, industries, and age-sex groups within the labour force, employment, and unemployment totals were considered in order to evaluate the extent to which changes in aggregate seasonal variability could be explained in terms of compositional shifts. While the effects of such shifts appeared not to be great, in most cases, there was some indication that changes in industrial composition may have been a factor in reducing the overall seasonal variability of employment in recent years and that the increasing proportion of women in the labour force may have had a similar effect on seasonal unemployment variability.

Separate attention was given, in Chapter VI, to the impact of students on the summer labour market, data for 1972 being examined for this purpose. The observed variation of labour force participation rates among young people was seen to be predominantly a result of the inflows and outflows of students, the rates for the population under the age of 25 being relatively stable when recent students are excluded. Among persons who had just left school and were not planning to return, a tendency for participation rates to climb during the summer was taken as an indication that many young people tend to make the transition from school to first "permanent" job rather slowly, either because they elect to take an intervening period of holiday or because of initial discouragement with respect to job prospects. Unemployment rates were seen to be high among students looking for temporary work in the summer and substantially higher among young people seeking "permanent" employment. The fact that new "permanent" job seekers experienced higher rates of unemployment than persons of comparable age who were already in the labour force might be taken to imply either that new seekers initially are more particular about the jobs they will accept or that they experience considerable difficulty in acquiring "permanent" jobs by virtue of their inexperience.

Relationships between seasonal variations in employment and output were considered in Chapter VII. The nonagricultural sector was examined from this point of view, both in total and by industry. Implicit seasonal patterns of output-per-worker ratios were derived. There was found to be some seasonal variation in these ratios, especially in

certain industries. However, the most interesting finding was considered to be that overall labour productivity seems not to vary greatly for seasonal reasons, especially when allowance is made for the effects of changes in average hours of work, of vacation time during the summer months, and of the summer influx of inexperienced student labour.

The final piece of analysis, as reported in Chapter VIII, took the form of an attempt to measure the cost of seasonal employment variation to the Canadian economy. A particular methodology was developed and this was used to arrive at illustrative estimates of the amount by which the Canadian gross national product might be raised if seasonal underutilization of manpower were eliminated. For the year 1972, for example, it was estimated that GNP might have been higher by about 1.6 percent, or some 1.6 billion dollars at the prices prevailing in that year. It was recognized, and should be stressed again, that because of the conceptual problems and problems of estimation inherent in "what if" calculations of this sort, the results should be regarded merely as rough indicators of orders of magnitude.

LIST OF REFERENCES

[1] Bonin, Joseph M., "Seasonality and Economic Analysis", Southern Economic Journal, Vol. 33, No. 3 (January, 1968), pp. 383-391.

[2] Bonin, Joseph M. and William Y. Davis Jr., "Estimated Seasonal Components in Recorded Unemployment in 1970", Industrial and Labor Relations Review, Vol. 25, No. 3 (April, 1972), pp. 383-398.

[3] Bonin, Joseph M. and William Y. Davis Jr., "Labour-Force Responsiveness to Short Run Variations in Economic Opportunity", Southern Economic Journal, Vol. 38, No. 2 (October, 1971), pp. 161-172.

[4] Canada Department of Labour, Economics and Research Branch, The Impact of Winter on the Canadian Worker (Ottawa, 1965).

[5] Denton, Frank T., "A Note on Seasonal Fluctuations in Canadian Expenditure", Canadian Journal of Economics and Political Science, Vol. 30, No. 1 (February, 1964), pp. 120-125.

[6] Foster, Howard G., "Labor-Force Adjustments to Seasonal Fluctuations in Construction", Industrial and Labor Relations Review, Vol. 23, No. 4 (July, 1970), pp. 528-540.

[7] Gendreau, Nicole, "Youth Participation in the Labour Force: 1953-70", Notes on Labour Statistics, Statistics Canada (Catalogue 72-207, 1971), pp. 9-21.

[8] Hardy, H. M., "Seasonal Unemployment in Canada, 1955 to 1970", Unpublished M. A. Thesis, McMaster University (October, 1970).

[9] Hardy, H. M., "Seasonal Unemployment in Canada", Working Paper No. 70-21, Department of Economics, McMaster University (December, 1970).

[10] Hardy, H. M., "The Decline of Seasonal Unemployment in Canada from 1955 to 1970", Canada Manpower Review, Vol. 5, No. 3 (Third Quarter, 1972), pp. 9-11.

[11] Hartle, Douglas, "Seasonal Unemployment in Canada, 1951-7", Canadian Journal of Economics and Political Science, Vol. 24, No. 1 (February, 1958), pp. 93-98.

[12] Haythorne, George V., Construction and Inflation, Prices and Incomes Commission (Ottawa, 1973).

[13] Hicks, Peter, "New Data on the Student Labour Force in the Summer", Notes on Labour Statistics, Statistics Canada (Catalogue 72-207, 1971), pp. 25-26.

[14] Howenstein, E. Jay, "Programs for Providing Winter Jobs in Construction", Monthly Labour Review, Vol. 94, No. 2 (February, 1971), pp. 24-32.

[15] Kendall, M. G., and A. Stuart, The Advanced Theory of Statistics - Volume 3, 2nd Edition (London 1968).

[16] Klassen, Gertrude M., "Student Employment and Unemployment, Summer 1972", Canada Manpower Review, Vol. 6, No. 1 (First Quarter, 1973), pp. 1-10.

[17] Kuznets, Simon, Seasonal Variations in Industry and Trade (New York, 1933).

[18] Kyffin, A. E., "Student Employment and Unemployment, Summer 1970", Canada Manpower Review, Vol. 3, No. 4 (Fourth Quarter, 1970), pp. 19-29.

[19] Kyffin, A. E., "The Student Summer Employment Problem in 1970", Canada Manpower Review, Vol. 3, No. 2 (Second Quarter, 1970), pp. 29-50.

[20] Lovell, Michael C., "Seasonal Adjustment of Economic Time Series and Multiple Regression Analysis", Journal of the American Statistical Association, Vol. 58, No. 304 (December, 1963), pp. 993-1010.

[21] Melichar, Emanuel, "Least Squares Analysis of Economic Survey Data", Proceedings of the Business and Economic Statistics Section of the American Statistical Association, 1965, pp. 373-385.

[22] Myers, Robert J. and Sol Swerdloff, "Seasonality and Construction", Monthly Labor Review, Vol. 90, No. 9 (September, 1967), pp. 1-8.

[23] Perrella, Vera C., "Students and Summer Jobs", Monthly Labor Review, Vol. 94, No. 2 (February, 1971), pp. 55-62.

[24] Russell, Joe L., and Michael J. Pilot, "Seasonality in Construction: A Continuing Problem", Monthly Labor Review, Vol. 92, No. 12 (December, 1969), pp. 3-8.

[25] Sangster, D. J., "Student Employment and Unemployment, Summer 1971", Canada Manpower Review, Vol. 4, No. 4 (Fourth Quarter, 1971), pp. 9-16.

[26] "Seasonal Unemployment in Canada", Labour Gazette, Vol. 60, No. 5 (May, 1960), pp. 444-457.

[27] "Seasonal Unemployment in Canada - 2", Labour Gazette, Vol. 60, No. 6 (June, 1960), pp. 584-593.

[28] "Seasonal Unemployment in Canada - 3", Labour Gazette, Vol. 60, No. 7 (July, 1960), pp. 694-701.

[29] Shiskin, J., "Electronic Computers and Business Indicators", Journal of Business, Vol. 30, No. 4 (October, 1957), pp. 221-267.

[30] Shiskin, J. and H. Eisenpress, "Seasonal Adjustments by Electronic Computer Methods", Journal of the American Statistical Association, Vol. 52, No. 280 (December, 1957), pp. 415-449.

[31] Smith, David C., "Seasonal Unemployment and Economic Conditions" in Arthur M. Ross, ed., Employment Policy and the Labor Market (Berkeley, 1965).