SEASONAL VARIATIONS IN EMPLOYMENT IN CANADA

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PREFACE

The consideration of the problem of seasonality for thesis purposes was first suggested by my director of research, Professor E. F. Beach. In subsequent discussions, the scope of the planned thesis was narrowed down to the treatment of seasonality of employment. About the same time, the Economics and Research Branch of the Department of Labour began a project to study seasonal variations in employment in Canada and I was engaged as an assistant for the summer of 1952. Fortunately, therefore, my summer employment coincided, more or less, with my academic work and much of the material contained in this thesis was developed during those months. In working over and developing the concepts used in this thesis, I have benefitted from discussions with many persons at the Branch, in particular, G. Schonning and H. B. Neilly.

The typical seasonal variations in employment and unplaced applicants presented in this thesis and the results of the additive and multiplicative tests were computed under my direction during the summer months and are presented here through the courtesy of the Economics and Research Branch of the Department of Labour. I subsequently computed all the derived measures used in this thesis, such as the calendars of seasonal employment and unemployment, the amplitude of variations and all the results presented in the Appendix.

This thesis is mainly concerned with the quantitative aspect of the seasonal problem. The emphasis is on the measurement of the extent of seasonality in the various industries and regions, rather than on an examination of the particular causes of the seasonal movements in any group of industries with policy recommendations for mitigating these seasonal influences. The measurement of seasonal variations, the isolation of industries and regions most seriously affected by seasonal factors, can be considered the first step in an attempt to tackle the total seasonal problem. The Economics and Research Branch of the Department of Labour is now actively engaged in implementing the measures of seasonality with detailed industry information.

A. A.

CHAPTER I

THE CONCEPT OF SEASONALITY

Industrial and trade activity can be varied by changes in the supply of raw materials, labour, capital, demand for the final products and through the hampering or aiding of the production process. Where these changes are ultimately due to climatic and conventional seasons the consequent variations are called "seasonal variations".[1]

Seasonal variations arise from causes which can be grouped roughly as "external" and "internal".[2] The external causes are the climatic and conventional seasons which may be looked upon as furnishing the impulses from which economic seasonality flows. The internal causes are those "artificial" conditions in the economic structure which are directly affected by the external causes and transmit their influence, albeit in an altered form, to other economic factors. The artificial conditions in the economic structure of interest here (the word "artificial" is used in connection with the internal rather than the external causes to signify that they are more subject to the control of policy) are the state of

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1 - S. Kuznets classifies the industries experiencing seasonal variations into four main groups. (1) "Industries in which the supply of raw materials is subject to large seasonal variations while the demand for the finished products is rather constant." (2) "Industries in which not only the supply of raw materials but also the demand for the finished product is subject to large seasonal variations." (3) "Industries that utilize raw materials whose supply is continuous, subject to rather mild seasonal variations, but whose final product is subject to a seasonally variable demand." (4) Industries in which "neither the raw materials nor final demand but the productive process itself is subject to conspicuous primary seasonal influences". Kuznets, S., Seasonal Variations in Industry and Trade, New York, 1933, 21.

2 - This classification is due to Crum. W.L., "Progressive Variations in Seasonality", Journal of the American Statistical Association, XX, 48-64.

technology, and consumer and business reaction to the changing seasons. For example, summer operations in logging in the East are hampered because the present state of pest control has not resulted in the elimination of the mosquito and black-fly from the logging areas in the summer months, furthermore the methods for transporting logs at this time of year are limited and expensive. In this case the external factors directly traceable to climatic conditions, the insects and the condition of the terrain, work through the internal factors, that is, the methods, or lack of methods, for controlling insects and the means of transportation. An example of seasonal variations due to changes in consumer demand would be ice-cream production where the external factors, temperature changes, work through internal factors, first, consumer reactions to these temperature changes, and second, technological factors which do not permit constant year round production to meet a seasonally variable demand.

Seasonal variations are not uniform throughout the economy. They are more pronounced in certain industries and regions than in others. The reasons for this are clear since the external and internal causes of seasonality can vary from industry to industry and from region to region. An example can easily be obtained from an industry already mentioned, Logging. The active season for Logging in British Columbia is in the summer and in the fall with the slack period in the winter, while in Quebec, the slack season occurs in the summer with peak activity in the winter[3].

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3 - See below Chapter III, page 9a.

This lack of similarity in seasonality is due partly to climatic differences and partly to different transportation techniques in the two regions.

Seasonal variations in activity constitute a problem in that the smooth functioning of the economic system requires a steady and proportionate flow of the means of production (and incentives to production) in all its parts. Discontinuities or serious fluctuations in the supply of some of these materials, or in the ability to make use of the usual methods of production, leads to idle men and machines. The solution of the problem lies in bridging these discontinuities. For example; raw materials which are available only seasonally might be stored, for use in periods when they are not otherwise available; or products which have a seasonally variable demand might be produced at a constant rate throughout the year, building up and depleting inventories in slack and active seasons respectively. Where it is not possible to store raw materials or products for any length of time, it might be possible to undertake the production of commodities with complementary seasonal variations, thereby keeping the labour force employed the year round and perhaps using some of the same machines.[4] In this thesis the problem of limiting seasonal variations will be considered only in passing. Our main concern will be with measurement.

4.- This aspect of the problem is thoroughly explored, with many actual examples, in Smith, E.S., Reducing Seasonal Unemployment, New York, 1931.

The definition of seasonal variations given above is a causal one. Certain factors are considered "seasonal" and the changes in activity that can be attributed to them are called seasonal variations. This definition is attractive in that it corresponds to the layman's idea of a seasonal movement, and to the scientist's criterion of proper procedure since it goes from "cause" to "effect". However, whenever the primary aim has been to measure seasonal variations, a formal[5] definition, which defines a certain regular movement and then calls it seasonal, has usually been adopted. The second definition is required because of the difficulty of working with the first. As Kuznets writes:

> "The strict definition, if followed, would lead to the investigation of the records of variable precipitation, temperature and other climatic elements, the dates of planting and maturity of crops. These data would be combined with indexes measuring variations in the conventional seasons, and then correlated with the series that describe economic activity. The correlation of measures of both natural and conventional seasons with those of business activity might establish the amount of variation in economic activity associated with variations in all seasonal factors: and from these segregated variations typical seasonal changes could be derived.
>
> The difficulties of such a procedure are only too obvious. First, continuous data on variations in seasonal factors are seldom available for the entire area involved in the correlation. Second, the attempt to correlate economic series with a series describing variations in seasonal influences is beset with the usual grave difficulties of correlation analysis in time sequences, especially since in the projected analysis the dependent variable, an economic time series, is affected by many more factors than are enumerated in the independent variable, the seasonal changes. Both of the series involved are affected by

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5 - This distinction is pointed out by Mendershausen, H., "Eliminating Changing Seasonals by Multiple Regression Analysis", Review of Economic Statistics, XXI, 171.

> factors other than seasonal and these are often the preponderant influence. Longer cycles, secular movements and random changes must be segregated. The complex correlation analysis would be extremely labourious and the validity of its segregation of changes due specifically to seasonal factors would be very dubious."[6]

A formal definition, in addition to allowing us to use fairly simple mathematical tools, should not be too much at variance with the movement that would have been obtained by using the causal definition. The definition to be used here, i.e., "Seasonal variations are periodic changes with a period of one year", shall be examined in this light.

The external and internal causes of seasonal variations cannot be expected to give the regular pattern that is assumed by our definition. It is true that the climatic and conventional seasons are not all anchored to the same months each year. Thus activity associated with these factors will not be the same in corresponding months each year. The internal causes also are not fixed for any period of time. In the long run changes occur in the state of technology affecting the practicability of operations under previously unfavourable conditions and in business and consumer reaction to the changing seasons. For example, in the construction industry, changes have taken place in both the state of technology and habitual reactions to changes in climate since the pre-war years, mainly as a result of wartime needs and experiences, which have somewhat lessened the extent of seasonal variations in employment in this industry.[7]

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6 - Kuznets, op.cit., 24

7 - See below Chapter III, page 85.

In shorter periods of time, although technological factors remain fairly constant, consumer and business reaction is affected by the particular phase of the business cycle. The conditions limiting production in "unseasonal" periods do not, in most cases, achieve this result by making activity in these periods impossible, but rather by making it very costly.[8] In boom periods, high costs and resulting high prices, are not as great deterrents to sales as they are in normal periods. Thus more activity would tend to be scheduled for unseasonal periods. In depression periods, the opposite is the case. The tendency here would be to schedule activity for the favourable, low cost, periods. The business cycle may thus affect seasonal activity and any discussion of the latter may need to make reference to the former.

If we deal only with a relatively short period of time (five years in our case), then the long run factors will not, in general, have caused much change in the internal causes. Furthermore, in particular cases where innovations have occurred, the procedure can be re-evaluated in light of the changed conditions.[9] The cyclical and irregular fluctuations in these seasonal variations would still remain, but the seasonal values for, say, any particular month should not show too wide a dispersion around their mean since the average monthly weather conditions are fairly regular, while "mild" cycles should not cause too great a disturbance to these

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8 - An exception would probably be inland water transportation, but even here it might be possible to obtain some movement in winter by using a large number of ice breakers and sturdier ships.

9 - See below Chapter II, pages 38-40

values. In cases where the weather conditions are very irregular, or the cyclical fluctuations extreme, our results can be qualified by measures to be considered in later sections. Therefore our definition can serve as a useful starting point for an attempt to measure seasonal variations.

We have omitted from our definition a condition which is more often implied in the methods used for measuring seasonal variations than stated and which should be included here.[10] This condition states that the seasonal movement serves to redistribute throughout the twelve months what would have been the amount of activity for that period in the absence of seasonal variations. That is, average activity for any twelve-month period is not affected by seasonal factors, the favourable reaction in certain months being offset by unfavourable reaction in other months. This condition should not be taken to mean that in the absence of the cause of seasonality the average activity of any twelve-month period would not be affected; but rather as an indication of ignorance as to the changes that would occur, in general, if these seasonal influences were absent. The difficulty lies in imagining what a "non-seasonal" situation is like; for, in effect, the partitioning of economic activity into two categories, non-seasonal and seasonal, implies a certain (unknown) "twilight zone" which can be labelled non-seasonal. The tendency to consider only unfavourable weather conditions as "seasonal" should be avoided; seasonal influences work two ways, favouring and hampering. For example, assume twelve months of hypothetical "non-seasonal" con-

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10 - This condition is emphasized by Whelden, C.H., "The Trend-Seasonal Normal in Time-Series", Journal of the American Statistical Association, XXI, 321-329.

ditions for inland water transportation which result in a thin layer of ice on the lakes throughout the year which hampers shipping, but which can be overcome to a certain extent by increased expenditures. These increased costs will increase the price of lake shipping and thereby affect demand. What will the effect of these conditions be on average shipping activity as compared to a "normal" situation with some ice-free and some ice-bound months? Obviously we are in no position to answer this question and have thus adopted the middle road of assuming the effect of seasonal variations to be solely redistributional.

The definition of seasonal variations leaves open the question of whether the "periodic" change is in percentage terms or in absolute terms; that is, whether "the seasonal component of an economic time series is represented by a sequence of values to be added to, or multiplied, with the trend-and-business cycle component of the series."[11]

If the non-seasonal level of activity is constant, the question of multiplicativity (i.e. amplitude of seasonal variations directly proportional to the non-seasonal level of activity) or additivity (i.e. amplitude of seasonal variations independent of the non-seasonal level of activity) is unimportant, since both assumptions give the same value for the seasonal displacements[12] in absolute numbers. However when the non-seasonal level of activity is

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11 - Mendershausen, op.cit., 171

12 - Seasonal displacements are the differences between the actual and the non-seasonal values. If seasonality is additive, seasonal displacements in absolute figures will always be constant. If seasonality is multiplicative, seasonal displacements expressed as percentages of the non-seasonal level will always be constant.

changing, say increasing, the seasonal displacement in absolute numbers obtained when multiplicativity is assumed, will increase from the beginning to the end of the period because of the increase in the non-seasonal level of activity, while the seasonal displacements obtained when additivity is assumed will be the same for every year.[13]

If seasonality is, in fact, multiplicative, using the average seasonal movement in absolute figures to represent the seasonal variations in the period covered (which is what is done when seasonality is additive) will over-estimate the seasonal displacement for the beginning of the period and under-estimate it for the end. If seasonality is, in fact, additive, using the average seasonal variations, measured as percentages of their respective monthly non-seasonal values, to represent the seasonal movement in the period covered (which is what is done when seasonality is multiplicative) will under-estimate the seasonal displacement at the beginning of the period and over-estimate them at the end.

The applicability of either of these concepts depends on the changes (if any) in the internal causes associated with the changes in the non-seasonal level of activity and in their relative importance in determining the level of activity in general. When these factors remain unchanged, seasonality can be expected to be multiplicative since the "causes" of the seasonal variations

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13 - The writer was first made aware of the "additivity" or "multiplicativity" problem when reading Woytinsky, W.S., Seasonal Variations in Employment in the United States, New York, 1939.

are the same but are applied to a larger number. Thus changes in the seasonal component should be roughly in proportion to the changes in the other components. When changes have occurred in these causes there is no reason to expect seasonality to be multiplicative since the seasonal components in the two intervals will be determined not only from different bases, but also in a different manner. An example of the first type of change leading to multiplicative seasonality would be an increase in the construction of houses resulting from an increase in population, without any change in building techniques or in attitudes toward building under adverse conditions. There is no reason to expect seasonal movements, expressed as a percentage of non-seasonal activity, to differ before and after the increase in construction activity. This example can be used to illustrate the second type of change, leading to additive seasonality, if we add to it changes in building techniques and habitual attitudes leading to increased activity in unseasonal months. In this case the seasonal movement, expressed as a percentage of non-seasonal activity, will not be the same before and after the change. The difference between the seasonal movements of the two periods, expressed in absolute figures, may be less than the difference between the seasonal movement expressed in percentage terms. If this is the case, we say that seasonality is additive.

Changes are mainly of the latter type, since cyclical factors are sufficient to change the internal causes through their effect on consumer and business reaction. Consequently, there is no <u>a priori</u> reason for assuming a multiplicative seasonal index,

although this does not necessarily mean that seasonality is additive. Both these alternatives are extremes and in most cases one would expect to find a "combination" of both. There would be a certain "minimum" amount of seasonal variation irrespective, within limits, of the level of non-seasonal activity and also a "varying" amount depending on this level.

When the changes in the seasonal movement, expressed as a percentage of non-seasonal activity during the period covered, are smaller than the changes in the seasonal movement, expressed in absolute figures, seasonality during that period will be considered multiplicative. The variations in seasonal displacements can be more adequately explained by reference to variations in the non-seasonal level of activity rather than by reference to the influence of irregular factors. When the seasonal movement in absolute figures is more constant, seasonality is considered additive. The variations in seasonal displacements from the average seasonal activity for the period can be better explained by assuming them to be due to irregular factors rather than to changes in the general level of non-seasonal activity. In other works, we choose the assumption which results in the more constant seasonal movement.[14]

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14 - See below, Chapter II, pages 33-35, where the problem is further discussed and the procedure used justified. It is similar to the procedure in Woytinsky, op. cit.

Conclusion:

We have adopted the following as our definition of seasonal variations: "periodic changes with a period of twelve months which redistribute, but do not alter, the average yearly level of activity". Their periodic aspect serves to distinguish them from secular and irregular changes while their confinement to a period of one year distinguishes them from cyclical changes.

CHAPTER II

METHODS OF MEASURING SEASONAL VARIATIONS

A. Constant Seasonal Variations

The influence of all the factors affecting economic activity is reflected in economic time series.[1] To help analyze the regular, and irregular, movement and growth of the time series data, economists[2] have classified the various factors under four main headings, secular (T), cyclical (C), seasonal (S) and irregular (I). The influence of the secular factors is revealed in the long time tendency of the items in the series to grow, decline, or remain constant, regardless of the temporary seasonal, cyclical and irregular movements. Cyclical influences, usually reflecting the succession of prosperity and depression in general business conditions, manifest themselves in wavelike variations covering periods of a few years. Seasonal influences are periodic influences which redistribute throughout the twelve months what would have been the amount of activity for that period if these influences were absent and the only variation had been due to the non-seasonal activity of the period. Irregular influences comprise all causes of change that cannot be included under any of the other three components of total fluctuations.

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1. An economic time series is a series of economic data observed successively in time. Davis, H.T., The Analysis of Economic Time Series, Bloomington, 1941, 1-9.

2. E.g. Mitchell, W.C., Business Cycles - The Problem and its Setting, Vol. 1, New York, 1927, 212-261.

The measurement of seasonal variations consists in isolating the portion (positive or negative) of economic activity due to seasonal factors, from the portion due to the influence of the factors falling under the remaining three headings. The methods to be used in measuring seasonal variations will thus depend on (a) the character of the seasonal movement and (b) the nature of its combination with the non-seasonal level of activity to produce the actual movement recorded by the time-series data. In Chapter I it was decided to proceed initially on the assumption that a) the seasonal movement has a constant pattern with a period of twelve months and b) that it is combined with the non-seasonal factors in either an additive or multiplicative manner. Assuming seasonality additive we can present these statements symbolically in the following way: (a) If S_i is the seasonal component of the time series for the i^{th} sub-annual period[3] (e.g. the i^{th} month), then the sum of the S's for the periods covering a year is equal to zero (e.g. $\sum_{i=1}^{12} S_i = 0$, where the sub-annual period is equal to a month). b) The time series data for the i^{th} period equal $S_i + (TCI)_i$ where the item in the bracket represents the trend-cyclical-irregular component of the data.

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3 - Since, by assumption, the seasonal influences cancel out over periods of a year, their effect can be observed only in periods smaller than a year, or greater than a year by a non-integral factor, i.e., sub or super-annual periods. We deal only with sub-annual periods in the text because the seasonal movements observed when super-annual periods are used are the seasonal movements of the sub-annual period obtained by subtracting from the super-annual period of time the number of complete years contained in it. For example, if the super-annual period is equal to 27 months, the seasonal component included in its value is the same as the seasonal component of the corresponding quarterly period.

When seasonality is multiplicative the time series data are given by $a_i = S_i(TCI)_i$ with the S values now in relative, not absolute, terms. The restriction on the S values is now $\sum_{i=1}^{n}\left[(TCI)_i - S_i(TCI)_i\right]=0$. When $(TCI)_i = k$, $(i=1,2,\ldots,n)$ this expression is equal to, $nk = k\sum_{i=1}^{n} S_i$, or $\sum_{i=1}^{n} S_i = n$ (i.e., when the sub-annual period equals one month $\sum_{i=1}^{12} S_i = 12$), and this is the usual formulation. Ordinarily $(TCI)_i \neq k$ therefore the provision that $\sum_{i=1}^{n} S_i = n$ is not sufficient to ensure that $\sum_{i=1}^{n}\left[(TCI)_i - S_i(TCI)_i\right] = 0$. But the sum must still equal n in order that the expected value of the sum of the seasonally adjusted figures for any consecutive n periods covering a year equal the sum of the original data for these periods. This provision maximizes the probability that deviations of the actual, from the desired, results are distributed in a random manner with a consequent tendency to cancel.[4] If any particular year, divided into n sub-annual periods, is being studied with a view to determining the extent of seasonal displacement in that year, it would be advisable to adjust the index figures, not to total n, (although they should total n in obtaining the first seasonally adjusted figures), but to allow the average of the seasonally adjusted figures, to equal the average of the original data. This can be done by adding of the difference between the average of the actual and the average of the seasonally adjusted figures to the latter for each of the n periods, and dividing the results into the corresponding actual values for these periods.

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4 - Burns, A.R., and Mitchell, W.C., Measuring Business Cycles, New York, 1946, 51.

The choice of a sub-annual period as the unit for the measurement of seasonal variations should be governed by (1) the availability of data for that particular division of time, (2) the constancy of the seasonal factors at work throughout the period and (3) their regular annual recurrence in that period. A division into weeks would not satisfy conditions (1) and (3) since the weekly employment data available for any interesting industrial breakdown are non-existent, and the period is too short to be confident of a recurrence of identical seasonal factors (e.g. weather conditions). A division into quarters on the other hand violates (2), since it can accomodate quite a range of seasonal conditions. Dividing time into periods equal to one month comes closest to satisfying these conditions. There is now available a significant amount of monthly data, a month is short enought to preclude too many diverse seasonal elements, while long enough to expect a "rough" annual recurrence of the seasonal factors. We shall thus deal with monthly employment data in our study.

We will consider four of the better known methods for isolating and measuring the seasonal component of the time series data. I Method of Moving Averages; II Method of Monthly Means. III Ratio-to-Trend Method. IV Link-Relative Method. The first method will be dealt with at some length since it is recommended for use in the present study.

I. Method of Moving Averages[5]

The following are the steps taken when this method is

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5 - The method is outlined in most statistical texts, e.g., Croxton, F.E., and Cowden, D.J., Applied General Statistics, New York, 1939, 470 ff. or Arkin, H., and Colton, R., Statistical Methods, New York, 1935, 73.

used.

(1) Thirteen-month moving averages of the data are calculated with the two end-months being given half-weight.[6] The average values are placed opposite the seventh month, and the day (1st or 15th), for which the original data are valid. This average value is supposed to contain the trend and cyclical components for that month.

(2)a. If it is decided that the seasonal factor is additive, then the moving average value for each of the months is subtracted from the actual value for that month.

(2) b. If multiplicative, the actual data are divided by the corresponding moving average value.

(3) The set of values obtained under (a) or (b) are totalled and averaged for each month to remove irregular fluctuations.

(4) If the sum of the values obtained under (3) is not equal to 0 when additivity is assumed, or 12 (1200 in percentage terms) when multiplicativity is assumed, they are adjusted proportionately until their sum equals o or 12.

(5) These adjusted values represent the seasonal variations in absolute numbers, or as ratios of the non-seasonal values.

To test this method we shall first assume that seasonality is additive.

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6 - This is a short-cut method for centering the moving average data proposed by, Kuznets, S., Seasonal Variations in Industry and Trade, New York, 1933, 27.

a)(1). Assume that the actual data are the result of only two components, trend and seasonal, and that the trend can be accurately represented by a straight line.

The actual data for the i^{th} month is given by $a_i = t_i + S_i$ where $\sum_{i=1}^{12} S_i = 0$, and $S_i = S_{i+12}$, and $t_i = b + ic$, $(i = 1, 2, \ldots, n)$.

The first average value would be $\left(\sum_{i=1}^{12} a_i + \sum_{j=2}^{13} a_j\right)/24$ to be placed opposite the seventh month. If the method is accurate, this value should be equal to the trend component for the seventh month, in this case $b + 7c$.

$$\frac{\sum_{i=1}^{12} a_i + \sum_{j=2}^{13} a_j}{24} = \frac{\sum_{i=1}^{12}(b + ic + S_i) + \sum_{j=2}^{13}(b + jc + S_j)}{24}$$

$$= b + \frac{c}{24}\left[\sum_{i=1}^{12} i + \sum_{j=2}^{13} j\right] + \frac{1}{24}\left[\sum_{i=1}^{12} S_i + \sum_{j=2}^{13} S_j\right]$$

$$= b + \frac{168}{24} c + 0$$

$$= b + 7c,$$

, which is the required value.

Subtracting this value from the actual value for the seventh month, which is $b + 7c + S_7$, we obtain the seasonal value for this month. We can repeat the procedure for the eighth month, etc. It is obvious that the method will give the correct value in each case.

(2). Still dealing with only two components, trend and seasonal, we shall now consider the case where the change in the rate of growth is constant, i.e. where the trend is given by an equation of the second degree.

Let $t_i = b + ic + i^2 d$ be the trend value for the i^{th} month.

Then $a_i = b + ic + i^2 d$ and the moving average value for the seventh month is,

$$\frac{\sum_{i=1}^{12}(b + ic + i^2 d + S_i) + \sum_{j=2}^{13}(b + jc + j^2 d + S_j)}{24}$$

$$= b + \frac{c}{24}\left[\sum_{i=1}^{12} i + \sum_{j=2}^{13} j\right] + \frac{d}{24}\left[\sum_{i=1}^{12} i^2 + \sum_{j=2}^{13} j^2\right] = 0$$

$$= b + 7c + 61\tfrac{1}{6} d .$$

The trend value for the seventh month is therefore subtracting the moving average value from the actual figure for the seventh month will not give the correct seasonal value for that month. If d is positive the moving average value over-estimates the trend value (thus under-estimates the positive seasonal variation), while if d is negative the opposite error is made. The size of the error will depend on the absolute value of d.

(3). In the foregoing examples we assumed the presence of only two influences, trend and seasonal, but the results can be readily generalized to include the cases where cyclical factors are present. The effect of cyclical influences would be to make a straight line "normal" growth pattern of the type assumed in (a,1) very unlikely, and therefore this method would not give the exact seasonal values. The "normal" pattern would be curvilinear with peaks and troughs, and as we have seen (a,2) the moving average does not reach all the way up to the cyclical peak (d negative) nor all the way down to the cyclical trough (d positive). It will thus under-estimate or over-estimate the trend and cyclical components for these months. However, if a complete cycle is covered there will be a tendency for the deviations from the "true" values for each of the months to cancel, and the final seasonal index

might be a fairly accurate one (this will be so, even if a complete cycle is not covered, as long as the cycle is fairly "mild").[7]

(4) The verdict on this method when the effect of irregular fluctuations are introduced, depends on the "pattern" these fluctuations take. It can be assumed that they cancel out, (i) over a year, (ii) over any consecutive twelve-month period, (iii) for each month over the period of years being studied, or (iv) do not cancel over any regular period.

The moving average method and the subsequent averaging of the "residuals" (residuals are equal to the difference between the actual monthly values and the moving average values) for each month, will necessarily eliminate the effects of irregular influences only if both (ii) and (iii) hold. But they are mutually exclusive; if the irregular influences cancel out over all consecutive twelve month periods, each of the monthly values must be the same from year to year, and can thus not cancel to satisfy (iii). Therefore irregular influences will either be partly included in the moving average values for the various months, or they will not be averaged out by Step 3 (page 17) causing the value for the seasonal factor to deviate from the correct value. A properly chosen averaging process (even preliminary smoothing of the data) will, however, serve to diminish most of the effects of the irregular influences.

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7 - The behaviour of the moving average when dealing with a fairly severe cycle is illustrated in the Appendix, page 169. .

b)(1) Assume seasonal factor is multiplicative, and only trend and seasonal influences present, with trend being accurately represented by a straight line $t_i = b + ic$, $(i = 1, 2, \ldots, n)$, and $\sum_{i=1}^{12} S_i = 12$, $S_i = S_{i+12}$.

Moving average value for seventh month

$$= \frac{\sum_{i=1}^{12}(b+ic)S_i + \sum_{i=2}^{13}(b+jc)S_j}{24}$$

$$= \frac{(b+c)S_1 + (b+13c)S_{13} + 2\sum_{i=2}^{12}(b+ic)S_i}{24}$$

$$= \frac{2bS_1 + 14cS_1 + 2b\sum_{i=2}^{12}S_i + 2c\sum_{i=2}^{12} iS_i}{24}$$

$$= \frac{b}{12}\sum_{i=1}^{12}S_i + \frac{7c}{12}S_1 + \frac{c}{12}\sum_{i=2}^{12} iS_i$$

$$= b + \frac{c}{12}\left[7S_1 + \sum_{i=2}^{12} iS_i\right].$$

The correct trend value for the seventh month is $b + 7c$ and the moving average method will only give that value if $7S_1 + \sum_{i=2}^{12} iS_i = 84$. The "i" values are fixed, the S_i's variables in any particular example, and one cannot expect them always to be such as to give the correct answer. Similarly, when $t_i = b + ic + i^2d$; $c, d \neq 0$ and $\sum_{i=1}^{12} S_i = 12$, the method of moving averages will fail to exactly isolate the trend component. The reason for this failure can be deduced from the results obtained in (a). The moving average value for a given month (x) will exactly contain the trend component for that month only if, (1) the deviations of the actual, from the trend, values cancel out over the thirteen month period, with x as the mid-month, the end-months being given half-weight, and (2) the trend movement between the end months can be accurately represented by a straight line.

When seasonality is multiplicative the condition that seasonal variations not affect the average level of activity for

twelve-month periods requires a different set of seasonal relatives (ratios of actual to non-seasonal level of activity) for each twelve-month period, since the restriction on the S_i's would now be $\sum_{i=k}^{k+12} S_i x_i = \sum_{i=k}^{k+12} x_i$, $(k=1,2,\ldots,n)$. We could obtain these relatives by dividing the actual by the corresponding moving average values, only if the trend (or the trend-cyclical-irregular) component moves along a straight line. In all other cases these "seasonal" relatives would be affected by the defections of the moving average method, and these defections can only be removed (or at least weakened) by averaging which would destroy the identity of the original relatives. As previously stated no average relative seasonal index can be expected to "merely" redistribute non-seasonal activity. The condition $\sum_{i=1}^{12} S_i = 12$ is imposed because this maximizes the probability of the effect being merely redistributional. It is possible for the method to over-estimate the non-seasonal component for a month in one year, and under-estimate it in another year, allowing an averaging process to come closer to the "true" value.

(2) The previous considerations generally apply when cyclical and irregular influences are present. Errors will be introduced into the calculation of the seasonal factor which can be diminished by an averaging process.

Summary: It has been found that in the cases most likely to be encountered, the method of moving averages does not give the exact value for the seasonal factor. This is to be expected since the method makes only indirect (and therefore of necessity a rough) allowance for disturbing factors. However it eliminates

the major portion of the secular and cyclical movements,[8] and the averaging of selected residuals (or relatives) can be expected to remove the remainder.

II. Method of Monthly Means[9]

The following are the steps taken when this method is used.

(1) The average values for each month are computed.

(2) An estimate of the trend is obtained. A straight line trend is usually assumed and various methods have been used to estimate its value. A common method of determining the monthly increment of trend, is to compute the average monthly value for each of the first and second parts of the period covered, and divide the difference between the two by the number of months between their mid-points.

(3) This amount is subtracted from the average for the second month, twice this amount from the third,....., eleven times this amount from the twelfth month.

(4) The monthly average for the whole period is computed.

(5) This average value, is subtracted from, or divided into, the average for each of the months, depending on whether the seasonal factor is additive or multiplicative.

(6) The values thus obtained for each month are proportionately adjusted until their sum equals 0 or 12, in accordance with previous considerations.

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8 - See Appendix, page /69 .

9 - Croxton and Cowden; op.cit., 466-469. Arkin and Colton, op.cit., 71.

This method can be presented symbolically in a manner similar to the one used for the method of moving averages, but it is felt that this would unnecessarily lengthen this section and only the conclusions of such an investigation will be given.

If the data are subject only to a straight line trend and additive seasonal influences, this method will give the exact value of the seasonal factor. If the trend line is curvilinear the method will not give the correct value. This error can be expected to be greater than the corresponding error when using moving averages, because no allowance is made for this departure from a straight line trend. If the seasonal factor is multiplicative this method does not accurately remove trend. No special provision is made for cyclical and irregular influences, it is apparently hoped that the period covered is sufficiently long and regular to cause these disturbing influences to cancel. This is a stricter requirement than the one made by the method of moving averages.

III. Ratio-To-Trend Method[10]

In this method a trend line is usually computed by the method of least squares. The trend value for each month is substracted from,[11] or divided into, the corresponding actual monthly value in accordance with the principles previously stated.

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10 - This method was worked out independently by Falkner, H.D., "On the Measurement of Seasonal Variations"; Journal of the American Statistical Association, XIX, 167-192 and Hall, L.W., "Seasonal Variations as a Relative of Secular Trend" ibid., 156-166. See also Arkin and Colton, op.cit., 73.

11 - It should be noted that the proponents of this method, as its name indicates, assumed that seasonality was multiplicative, and did not consider this possibility.

The resulting values for each month are averaged to cancel the irregular and cyclical influences. The final step is the adjustment of these initial monthly indexes to permit their sum to equal zero or twelve.

The shortcomings of this method are its indirect handling of cyclical and irregular fluctuations, and its optimism with regard to the possibility of obtaining an accurate representation of trend. The data to be used in this study are available for too short a period, for any "direct" attempt to measure trend to lead to sufficiently accurate results.

IV. Method of "Link-Relatives"[12]

The method of link-relatives is usually set forth under the implicit assumption that the seasonal factor is multiplicative. In view of the possibility of encountering situations where seasonality is additive the method has been extended to cover this case as well. Under these conditions the method might be more appropriately called the method of "link-differences". The argument will attempt to set out the rules that should be followed when seasonality is additive and by analogy extend them to the multiplicative case.

a) Seasonality is Additive

The value for one month is "linked" to the value of the previous month by subtracting the latter value from the former. The result is called the link-difference value of the second month.

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12 - The method of link-relatives is due to Persons, W., "Indexes of Business Conditions"; The Review of Economic Statistics; Preliminary Volume, No. 1. See also, Crum, W.L., Patton, A.C., and Tebbut, A.R., Economic Statistics, New York, 326-342; and Croxton and Cowden, op.cit., 486-492.

It consists of the change in the trend-cyclical-irregular component from one month to the other, and the difference in their seasonal values. We can obtain a set of twelve link-differences, one for each month, by averaging (or taking the medians,[13] etc.) the link-differences for each month over the period of years covered. To move from the link-differences to our goal, the seasonal values for each of the months we need to adjust them for trend (it is assumed that the initial averaging removes the cyclical and irregular components) and for the seasonal value of the previous month. This can be done indirectly in the following way.

We take December as the base (any other month would do just as well) from which to measure trend, i.e. the trend component is taken to be zero for December, and we also assume its seasonal value is equal to zero. Therefore the average link-difference for January only includes the trend movement from December to January and January's seasonal value. Since February's link-difference is composed of the trend movement from February to January and the difference between their respective seasonal values, if we add the January difference to the February difference the result (which is called the "Chain-Difference" for February) would be equal to the trend movement from December to February plus the February seasonal value. This procedure of adding the previous month's chain-difference to the average link-difference is carried out for each month, including December. The December chain-difference, should, according to the above argument, consist solely of the trend movement for a twelve-month period (from December to December), and it can thus be used as the basis for adjusting

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13 - Persons, op.cit., 26, takes the median of the link-relatives.

the other chain-difference values for trend. If it is assumed that trend moves along a straight line $i/12$ of the December chain-difference, that is the trend component for a year, is subtracted from the $(i+1)^{st}$ month, where December is the first month.

The chain-differences adjusted for trend now contain only the seasonal values for each of the months with the December value as their base. In line with previous considerations the average of the seasonal values should in this case equal zero and the seasonal values with the December value as base will not satisfy this requirement unless the December value is in fact equal to zero. If it is greater than zero, the seasonal values are diminished by its absolute value, if it is smaller than zero, the seasonal values are increased by its absolute value. We can adjust for these discrepancies by subtracting from the adjusted chain differences their average value.

We can briefly illustrate the method when trend is given by the equation $t_i = b + ic$, where Dec. is $i=1$, $\sum_{i=1}^{12} S_i = 0$, $S_i = S_{i+12}$.

Link-Differences:

J	F	N	D
$b+2c+S_2-(b+c+S_1)$;	$b+3c+S_3-(b+2c+S_2)$; ....;	$b+12c+S_{12}-(b+11c+S_{11})$;	$b+13c+S_{13}-(b+12c+S_{12})$
$c+(S_2-S_1)$;	$c+(S_3-S_2)$; - - - -;	$c+(S_{12}-S_{11})$;	$c+(S_{13}-S_{12})$

Chain Differences:

J	F	N	D
$c+(S_2-S_1)$;	$2c+(S_3-S_1)$; . . . . . ;	$11c+(S_{12}-S_1)$;	$12c+(S_{13}-S_1)$

The yearly trend component is 12c, the monthly increase in the trend value is thus C.

The chain-differences adjusted for trend are;

$$\underset{J}{(S_2-S_1)};\ \underset{F}{(S_3-S_1)};\ \ldots\ldots\ldots;\ \underset{N}{(S_{12}-S_1)};\ \underset{D}{(S_{13}-S_1)}$$

The average is

$$\sum_{i=2}^{13}(S_i-S_1)/12 \quad = -S_1 \quad .$$

Subtracting this average value from each of the monthly values, will give us the correct seasonal values.

This method will not give the correct value when faced with a curvilinear trend, since it usually makes a straight line correction. One would expect the moving average to more closely approximate the trend in most cases. The method contemplates no direct allowance for the effects of cyclical fluctuations, but merely requires that the interval covered by the series be sufficiently long to ensure that the averages be satisfactorily typical. There is also an indirect tendency to minimize the influence of cycles because of the comparison, in the link-difference operation, of each month with that immediately preceding.[14] This fact tends in general to free the link-relatives from extreme cyclical disturbances. Linking consecutive months also tends to diminish irregular influences, since they are sometimes felt over periods of more than one month.

(b) Seasonality Multiplicative

The key to the "translation" of the method of link-differences to that of link-relatives is the correspondence of

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14 - The behaviour of the link-difference method when dealing with data containing cyclical factors is illustrated in the Appendix, page 173.

operations in additive groups with operations in multiplicative groups. The zero is replaced by one, addition by multiplication, subtraction by division. The steps to be taken can be itemized in the following way.

(1) a. If the seasonal factor is additive, from each month's value the previous month's value is subtracted.

b. If multiplicative, each month's value is expressed as a ratio of the preceding month's value.

(2) a. The link-differences are averaged separately for each month.

b. The link-relatives are averaged separately for each month.

(3) a. If additive, the average link-differences are chained together by successive addition; for example, the December value is set at 0, the January link-difference (which is also a chain-difference) is added to the February link-difference, the result the February chain-difference, is added to the March link-difference, etc.....

b. If multiplicative, the average link-relatives are chained to the preceding month's value by successive multiplication; for example, the December value is set at one, the January relative thus remains unchanged, the February link-relative is multiplied by the January relative to reduce them to the same base, the March relative by the new February chain-relative, etc.....

(4) a. If the December chain-difference differs from zero, $i/12$ of its value is subtracted from the $(i+1)^{st}$ month where $i = 1$ is December.

b. If the December chain-relative differs from one $i/12$ of the difference is subtracted from the $(i+1)^{st}$ month where $i=1$ is December.[15]

(5) a. The average of the adjusted chain-differences is subtracted from each of the adjusted chain-differences to obtain the typical seasonal variations.

b. The average of the adjusted chain-relatives is divided into each of the adjusted chain-relatives to obtain the seasonal index.

(6) a. The seasonal values are proportionately adjusted to average zero.

b. The seasonal values are proportionately adjusted to average one.

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15 - An alternative method of adjusting the chain-relatives is given by Persons; "The method of adjusting the chain indices with January as the base is as follows. (1) To adjust the discrepancy between consecutive Januaries, let $c_1, c_2, c_3, \ldots, c_{12}$ represent the chain relatives obtained by progressive multiplication of the medians of the link relatives $r_1, r_2, r_3, \ldots, r_{12}$ Since January is the base $c_1 = 100$, the product will not, in general, give 100 but something in excess or defect of 100, depending on the direction of the secular trend of the data. The discrepancy between successive January chain relatives is $100\, r_1 c_{12} \div 100$, or $r_1 c_{12}$. This discrepancy, due primarily to secular trend, is distributed according to the compound interest law among the chain relatives. Letting the percentage discrepancy for one month be d we have $(1+d)^{12} = r_1 c_{12}$. Solve for d by the use of logs.
Then, by logs find the values of:

$$100, \frac{c_2}{1+d}, \frac{c_3}{(1+d)^2}, \ldots\ldots, \frac{c_{12}}{(1+d)^{11}}$$

which is the chain series adjusted for discrepancy. Distribution of the discrepancy on the assumption that it is a uniform monthly increment does not give significantly different results." op.cit., 27.

The method of link-relatives will be illustrated for the case where the trend-cyclical-irregular component is constant. It is only in this case where the method can always be expected to give accurate results.

Let $t_i = c$ be the trend equation; $a_i = t_i s_i$; $\sum_{i=1}^{12} s_i = 12$, $s_i = s_{i+12}$.

LINK-RELATIVES:

J	F	M	...	O	N	D
$\frac{cs_2}{cs_1}$	$\frac{cs_3}{cs_2}$	$\frac{cs_4}{cs_3}$	...	$\frac{cs_{11}}{cs_{10}}$	$\frac{cs_{12}}{cs_{11}}$	$\frac{cs_{13}}{cs_{12}}$

CHAIN-RELATIVES:

J	F	M	...	O	N	D
$\frac{s_2}{s_1}$	$\frac{s_3}{s_1}$	$\frac{s_4}{s_1}$	...	$\frac{s_{11}}{s_1}$	$\frac{s_{12}}{s_1}$	$\frac{s_{13}}{s_1}$

The December Chain-relative equals one and there is no trend adjustment to be made.

Dividing the chain-relatives by their average we obtain the seasonal index.

V. Conclusion

Of the four methods of measuring seasonal variations, the methods of moving averages and link-relatives seem to be the most useful. There does not appear to be much difference between the methods with respect to accuracy, they have given much the same results whenever they were both used.[16] The link-relative method, however, more completely utilizes the data, since there is only one less link-relative than the number of months for which data are available, while there are twelve less relatives (residuals) when moving averages are used. This disadvantage

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16 - See Croxton and Cowden, op.cit., 482 and 489; also Appendix pages 169,173.

of the moving average method can be overcome to a certain extent by free-hand extension of the moving average curve.

The major advantage of the moving average method, and the reason why its use is recommended here, is its greater flexibility. The unaveraged residuals can be used to test for the additivity or multiplicativity of seasonality without much additional processing of the data,[17] whereas the unaveraged link-differences can only be made the basis of a test after much processing which considerably increases the time required by the link method.[18] The effectiveness of the test is also less certain.[19] If the data covering a complete cycle are not available, a moving average can be taken of the unaveraged residuals which removes most of the cyclical influence.[20] No adjustments have been proposed which achieve the same results for the link method.

The method of moving averages is a natural consequence of our definition of seasonal variations. Since, by definition, the seasonal influences merely redistribute activity throughout the twelve months, an average of the activity for twelve consecutive months will be affected only by secular, cyclical, and irregular factors. Errors are introduced when this average value is considered the non-seasonal value for the middle month. The

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17 - See above, next section.

18 - The method is outlined in the Appendix, pages 175-177.

19 - Ibid.

20 - See Appendix, page 170 . See also Woytinsky, W.S., Seasonal Variations in Employment in the United States, New York, 19-22.

placing of the average value is arbitrary, assuming that the trend-cyclical-irregular component moves along a straight line during this twelve-month period.

B. Additive or Multiplicative Test

Seasonal variations in a particular segment of the economy are multiplicative or additive depending on whether their magnitude (or amplitude) varies directly with changes in the non-seasonal level of activity, or is independent of these changes. Thus to determine whether seasonality is multiplicative or additive we have to compare the amplitude of the seasonal variations with the non-seasonal level of activity. The amplitude of the seasonal swings can be measured in various ways. For example, as the difference between the seasonal peak and the seasonal trough.[21] If measured in this way the amplitude depends only on these two values. A better measure would be one in which the twelve seasonal values entered, such as the sum of the absolute deviations of the seasonal values, for each month, from the non-seasonal values. The non-seasonal level of activity could be measured by the actual level of activity for the twelve month period.

We can present this symbolically.

When seasonality is additive, $a_i^j = t_i^j + s_i^j$ where a_i^j is the actual value for the i^{th} month in the j^{th} year, t_i^j is the trend value for the i^{th} month in the j^{th} year and s_i^j is the seasonal value for the i^{th} month in the j^{th} year, but since we assume seasonality constant $s_i^j = s_i^{j+1}$ $(j = 1, 2, \ldots, n)$,

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21 - See Woytinsky, op.cit., 137-140.

where n is the number of years covered. The amplitude of variations for the j^{th} year is $\sum_{i=1}^{12} |S_i^j|$.

When seasonality is multiplicative; $a_i^j = t_i^j s_i^j$ and amplitude of variations for the year is

The non-seasonal level of activity in both cases $\sum_{i=1}^{12} a_i^j = \sum_{i=1}^{12} t_i^j$

Assume seasonality additive; then comparing the value of the amplitude $\sum_{i=1}^{12} |S_i^j| a_0 j$ varies, with the value of the amplitude relative to non-seasonal activity $\sum_{i=1}^{12} |S_i^j| \Big/ \sum_{i=1}^{12} t_i^j$, we see that the former is constant while the latter varies because of the variation in the non-seasonal level of activity.

Assume seasonality multiplicative; then comparing the value of the amplitude $\sum_{i=1}^{12} |t_i^j (s_i^j - 1)$ as j varies with the value of the amplitude relative to the non-seasonal level of activity $\sum_{i=1}^{12} |t_i^j (s_i^j - 1)| \Big/ \sum_{i=1}^{12} t_i^j = \sum_{i=1}^{12} |S_i^j - 1|$ we see that the latter is constant while the former varies because of the variation in the non-seasonal level of activity.

Therefore, when seasonality is additive (multiplicative) the absolute (relative) amplitude of variations is constant, while the relative (absolute) amplitude of variations varies.

If the method of moving averages is accurate the absolute amplitude of variations can be obtained by subtracting the actual from the moving average values (that is, obtain residuals), while the relative amplitude is obtained by expressing the residuals for the year as a ratio of the sum of the moving average values for the year (or of the actual monthly values for the year). In other words we can test to determine whether seasonality is additive or multiplicative on the basis of the actual and the moving average

data. Neither the absolute nor the relative amplitude thus obtained should be expected to remain constant since we have seen in Chapter I that seasonality is only roughly constant, and in part A of this chapter that the moving average method does not give the precise values, but there is no reason to expect that these defections, except in borderline cases, will so affect these measures that the relative constancy of these measures would not be a fairly good indication of multiplicativity or additivity.[22]

In view of the above argument, the following are the steps to be taken in determining whether seasonality is to be treated as an additive or multiplicative factor.[23]

(1) Compute the absolute and relative magnitudes of variations for each year. The absolute magnitude will be expressed in the same units as the original values, the relative magnitude will be measured in percentages.

(2) Compute the averages of the absolute and relative magnitudes of variation for the observation period.

(3) Take the deviations of the yearly magnitudes from the averages and compute the mean deviations for the observation period.

(4) Express the mean deviations from the average absolute and relative magnitudes as a ratio of these averages, respectively.

(5) The smaller relative value of the mean deviation will indicate the better method of measuring the seasonal rhythm of the examined series.

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22 - This statement is amplified in the Appendix, pages 171-172.

23 - This method is very similar to the one outlined by Woytinsky, op.cit., 137-140.

C. Variable Seasonal Movements

In the foregoing sections it was assumed that the seasonal movements were constant with regard to both timing and magnitude. The possibility of variable seasonal movements was recognized in Chapter I, since, though the revolution of the earth shows, practically speaking, a perfect periodicity, the seasonal fluctuations of a particular economic phenomena may vary from one year to the next in consequence of variations in its determining factors. The specific weather conditions will deviate from the "normal" weather, and the artificial conditions transmitting the external causes will change over time. General-Economic- and where specific weather conditions interfere, meteorological-variates will have to be taken into account when explaining the seasonal phenomena during a sequence of years.[24]

Changes in seasonality may be of any form, gradual or abrupt, progressive or alternating, depending on the type of changes undergone by the causal factors. Corresponding to these different changes there are different ways of treating time series data. The methods for handling three types of postulated changes in the seasonal movements will be considered. I. Abrupt Changes; II. Gradual Changes; III. Short-term Temporary Changes.

Before dealing with these measures separately it should be noted that the last two use as their basic data the unaveraged

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24 - This particular formulation of the problem is mainly due to Mendershausen, H., "Eliminating Seasonals by Multiple Regression Analysis" - The Review of Economics Statistics, XXI, 171-172.

residuals (or relatives) obtained by the method of moving averages which is based on the assumption that seasonality is constant. Changing seasonality, as well as the disturbing factors previously noted, lead the method of moving averages to error. For example, assume seasonality additive, trend a straight line, and the seasonal values changing every calendar year (i.e. $\sum_{i=1+k}^{12+k} S_i = 0, (k = 0, 12, \ldots, 12n)$. Then the moving average value for the seventh month would be

$$\frac{\sum_{i=1}^{12} (b + ic + S_i) + \sum_{j=2}^{13} (b + jc + S_j)}{24} = b + 7c + (S_{13} - S_1).$$

which when subtracted from the actual value, would not give the correct seasonal value for the seventh month. If the change in seasonality is constant from year to year, the method will, however, accurately measure the difference between the seasonal values in corresponding months each year. For example, the moving average value for the 19th month is $\frac{\sum_{i=12}^{24} (b + ic + S_i) + \sum_{j=13}^{25} (b + jc + S_j)}{24}$ $= b + 19c + (S_{25} - S_{13})$. The apparent seasonal value for the 7th month is $S_7 - (S_{13} - S_1)$ the apparent seasonal value for the 19th month is $S_{19} - (S_{25} - S_{13})$. Comparing the two and remembering $(S_{25} - S_{13}) = (S_{13} - S_1)$, we find the difference between the apparent values is equal to the difference between the actual seasonal values $(S_{19} - S_7)$. The changes cannot be expected to show this regularity, but in any case, if the variations in the seasonal movements are fairly gradual, the errors introduced into the measurement of seasonality by the preliminary assumption that it is constant are not large enough to obscure any real changes that have taken place, nor to significantly alter their values.

I. Abrupt Changes in Seasonal Movements

If it is thought that abrupt changes in the seasonal movements have occurred (from knowledge of changes in the industry, or by the sharp changes in the seasonal values as measured by the method of moving averages) the time-series data are divided into two or more periods in accordance with the change in seasonality, and constant (or typical) seasonal variations are computed separately for each of these periods, making use of the methods previously described. In the present study, the post-war period is not sufficiently long to allow a dividing up of the time-series data for the computation of at least two typical indexes of seasonal variations. Comparison, if any, will have to be between the post-war and pre-war periods. This comparison should in many cases be meaningful since some changes have occurred in the artificial conditions. A comparison of seasonal indexes, relevant for different periods by focusing attention on the presence or absence of change, and thus indirectly on the reasons for these results, will be helpful in any discussion of policy.

In comparing two seasonal indexes we are interested in their (a) timing (pattern) and (b) magnitude (amplitude).

(a) A seasonal pattern can be characterized by the time of its peak, its trough, and the length of each of these. Although useful, this way of arranging the results may lead to difficulty in interpretation. We have a set of answers, all bearing on the same problem, but with no "objective" way of combining them to obtain a single answer. For this reason a single quantitative measure combining all these elements is useful, even though it

must be handled with caution. The measure used by Kuznets, the "Index of Similarity" is recommended.[25] This measure is a form of "first-moment" coefficient of correlation, it is preferred to the ordinary coefficient of correlation because of the latter's tendency to give undue weight to the concurrence of large residuals through the process of multiplication[26]. It is computed in the following way:

1) The deviations of the seasonal indexes (centered at zero) are added up for each period. (If seasonality is additive the seasonal values are already centered at zero, if multiplicative the desired result is obtained by subtracting one from each of the seasonal relatives.)

2) They are reduced to a common base (the deviations in the later period) by multiplying the deviations of the first period by a factor representing the ratio of the total deviations in the later period to the total deviations in the first period.

3) The difference between the adjusted deviations for each period, month by month, are summated without regard to sign, and divided by the base value.

4) The value obtained under (3) subtracted from 1 is the required value.

If there is perfect agreement between these indexes,

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25 - Kuznets, S., op.cit., 281-282.

26 - Gressens, O., and Mouzon, E.D., Jr., "The Validity of Correlation in Time Sequences and a New Coefficient of Similarity", Journal of the American Statistical Association, XXII, 483-492; Davies, G.R., "First Moment Correlation", ibid, XXV, 413-427.

the result under (3) will be zero and the coefficient + 1. If the movement of the two is perfectly inverse, the result under (3) will be - 2 and the final index of similarity will be - 1. If definite relationship is lacking, the index will tend to be zero.

It can be seen that this index of similarity measures the percentage of deviations (reduced to the same base, thus the question of amplitude is eliminated) that is common to the two seasonal swings being compared.

(b) In comparing the amplitude of seasonal variations between two periods, the average absolute deviations can be used. That is, the average absolute values of the seasonal variations.

II. Gradual Change in Seasonal Movements.

When gradual changes in the seasonal movements are suspected, it is usual to construct "moving" seasonal indexes. The "gross" seasonal values (the differences, or the ratios, between the actual and the moving average values) are arrayed for each month chronologically. One of the following procedures is then used:

(a) A straight (or other type) line is fitted to the actual values by the method of least squares.[27]

(b) A moving average (usually five items) is taken for each month's values.[28]

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27 - Snow, E.C., "Trade Forecasting and Prices", Journal of the Royal Statistical Society, XXXV, 334.

28 - Joy, M., and Thomas, W., "The Use of Moving Averages in the Measurement of Seasonal Variations". Journal of the American Statistical Association, XXIII, 241-252.

(c) A free hand line is drawn to trace the apparent change.

The seasonal values for the months in each year are then read from the resulting smoothed curves.[29]

The shortcomings of this general approach are well-stated by Kuznets.

> "All these methods introduce into the problem of measuring seasonal changes the difficulties of the procedure of establishing secular movements. These difficulties are especially formidable in series that cover a rather short period, for in such series the fitting of a line supposed to reflect secular movements is subject to considerable danger of distortion by the cyclical or random elements. Even if a moving average is fitted to the series to isolate the seasonal elements, the relative deviations from a moving average contain some part of the cyclical swing of the series. It is dangerous, therefore, to introduce mathematical curves describing the secular movement even for periods as long as fifteen years, unless it is certain that the cyclical and other elements present in the series balance. The same difficulty limits the use of the more elastic moving average fitted to deviations that measure the seasonal element. Even if the period over which the moving average is computed is varied with changes in the duration of cycles, the moving average cannot take account of short-time changes in amplitude of the cyclical element. And a moving average always leaves the ends of the smooth line to be finished free-hand. Any secular line obtained for a short series is subject to grave doubt. Only when a substantial period of time is covered can secular movements in seasonality be measured properly."[30]

In the present case the discussion of the methods of measuring long run changes in seasonality is somewhat superfluous due to the paucity of data at our disposal. The most we can hope for is to obtain some measure of short-term changes, which may

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29 - King, W.E., "An Improved Method for Measuring the Seasonal Factor", Journal of the American Statistical Association, XIX, 301-313.

30 - Kuznets, S., op.cit., 279.

or may not be temporary, since we are in fact only covering a short period. However, where these changes are all in the same direction use can be made of a method due to A Wald[31] which measures gradual changes in seasonal amplitude. It avoids the pitfalls mentioned above. It is based on the following assumptions:

1. The difference between the sum of the trend and the cycle and the centered twelve-month moving averages is negligible.

2. The arithmetic mean and the monthly means of the random component are very near to zero.

3. The seasonal variation is the product of two functions. One is strictly periodic with a period of twelve months, the other is not periodic but it changes its value only slowly with time. (It should be emphasized that Wald is assuming changes only in seasonal amplitude, not in seasonal pattern.)

4. Seasonality is additive.

The need for assumptions 1 and 2 is clear from our discussion above, on pages 19-24.

Wald then derives the centered twelve-month moving averages in the manner described above on page 17 . The residuals for each month are averaged over the period covered (he omits extreme values). The averages of the residuals are then adjusted to sum to zero. These averages, the "typical" seasonal variations are adjusted to allow for the gradual changes

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31 - A. Wald: Berechnung and Auachaltung von Saisonschwankungen (Vienna, 1936), as quoted in Tintner, G., "Econometrics", New York, 1951, 227-233. See also Mendershausen, H., "Methods of Computing and Eliminating Changing Seasonal Fluctuations", Econometrica, V, 249-250.

in amplitude in the following way:

Let S_{ij} be the seasonal value of the $j^{\underline{st}}$ month in the $i^{\underline{st}}$ year, a'_j the typical seasonal variation value for the $j^{\underline{st}}$ month, f_{ik} the actual value of the $k^{\underline{st}}$ month in the $i^{\underline{st}}$ year, f^*_{ik} the centered moving average value, then,

$$S_{ij} = \frac{a'_j\left\{\sum_{k=j-5}^{j+5} a'_k(f_{ik}-f^*_{ik}) + \frac{1}{2}\left[a'_{j+6}(f_{i,j+6}-f^*_{i,j+6}) + a'_{j-6}(f_{ij-6}-f^*_{ij-6})\right]\right\}}{\sum_{k=1}^{12}(a'_k)^2}$$

$(i=1,2,\ldots,N;\ j=1,2,\ldots,12)$

(The above notation is Tintner's.)

That is, the average seasonal value for a given month is adjusted by multiplying it with the coefficient of linear regression of the thirteen gross seasonal differences, on the "normal" seasonal differences of the year, in the middle of which the month is situated (the end-months being given half weight).

The validity of this general approach will be further considered in the following section when Kuznets method for measuring temporary changes in amplitude is considered.

III. Short-Term Temporary Changes of the Seasonal Movements

The external influences causing seasonal movements, the climatic and conventional factors, are generally the same for lengthy periods, and in a period of a few years there would not be many innovations resulting in a definite and continuing change in seasonality. This should not be taken to mean that seasonal movements will be constant for short periods, but that the changes will tend to be temporary, a result of exceptional weather conditions and possibly of the particular phase of the business cycle.

These influences are, in most cases, not strong enough to discredit a "typical" measure of seasonal variations for the period, but they should not be neglected in any description of, say, seasonal unemployment in a certain period, or in a particular year.

A seasonal index is an average and like all averages is the more meaningful the closer it is to the items it represents. As we have seen, seasonal movements can vary in timing, and in amplitude, from year to year, and the need for measures of its "representativeness" is evident. The measures considered are the ones put forward by Kuznets.[32]

a) Kuznets suggested that the coefficient of correlation be used to test the ability of the seasonal index to represent the timing of the seasonal movement in any particular year. (Note: The index of similarity cannot be used in comparing the seasonal index for a period with the residuals for a particular year within that period, because the latter contains irregular and cyclical elements which will give rise to unduly low values.) This test is valid only if the non-seasonal elements in the residuals are not correlated with the seasonal pattern, since they would otherwise affect the result. The coefficient of correlation measures the degree of association between the apparent seasonal movement for the year and the seasonal index. If its value is one the two are exactly proportional.

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32 - Kuznets, S., "Seasonal Pattern and Seasonal Amplitude: Measurement of Their Short-time Variations," Journal of the American Statistical Association, XXVII, 9-20.

The formula for the coefficient is:

$$r = \frac{\sum sd}{\sqrt{\sum s^2 d^2}}$$

where d = residuals corrected to sum to zero (or deviations of seasonal relatives from 1.00), for one year.

s = seasonal index (in similar form).

b) If r is large the amplitude should be tested on the assumption that the seasonal patterns are more or less the same, as well as the previous assumption concerning the non-seasonal elements. The measure of similarity in amplitude, the amplitude ratio, is given by the constant of the least squares regression line, with the seasonal index as the independent variable, and the adjusted seasonal observations for the year as the dependent variable. (Note: The simpler method of comparing amplitude by means of average deviations cannot be used here because the deviations of the moving average values from the original data contain some non-seasonal elements, and when added together arithmetically, they would tend to falsify the result.) If the amplitude is greater (smaller) in the given year, the ratio is greater (smaller) than one.

The formula is: $b = \frac{\sum sd}{\sum s^2}$

where d and s have their previous meanings.

The amplitude ratio has also been used to "Correct" the typical seasonal variations. If the seasonal index is based on residuals, the variations for each month are corrected by multiplying them by the value for the amplitude ratio. (e.g. if the typical seasonal value for January is ⁄51.0 and b = 0.90 , the corrected seasonal value would be ⁄45.9). If the

index is based on relatives, its deviations from 1.00 are corrected then added to 1.00 to form the corrected index. (e.g. if the seasonal relative equals 1.20 and b = 0.80 , deviation = ∓0.20 , corrected deviation ∓0.16 , and corrected seasonal relative 1.16.) The result is supposed to more closely approximate the seasonal movement in the particular year. Its use presupposes that no change in the seasonal pattern (as measured by r) has taken place, and that the amplitude ratio is an exact measure. Unfortunately, neither of these assumptions is generally correct. These measures give exact representations only in the following extreme cases:[33]

The amplitude ratio is accurate if the amplitude of the seasonal movement changes, but its form remains constant, without any "non-cancelling" non-seasonal elements in the residuals.

The coefficient of correlation is accurate if the form changes, either without accompanying changes in amplitude, or with exactly proportional changes in all the months of the year, and without any "non-cancelling" non-seasonal elements in the residuals.

These assumptions, (it should be noted that they are also required by Wald's method which was presented in the previous section,) limit the significance of these measures, but do not make them useless. They can serve as aids in examining the seasonal movements in any particular year if used with care.

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33 - Mendershausen;H., op.cit., 251.

The term "year" has been used loosely in the above discussion to signify any consecutive twelve month period. Instead of measuring b for a calendar year and thereby possibly breaking up a peak or trough period, it would be better to divide the data into periods coinciding with the character of the seasonal movement. Perhaps the best period to start with is the revival period, since the seasonal movement in the following twelve-months can be said to start to work itself out from that point, and the seasonal movement of the preceding twelve-months can be said to have worked itself out by that point. For example, in dealing with the Construction industry, whose season can be said to "start" in May, it would be advisable to measure b for twelve-month periods beginning with May.

The method proposed by Kuznets for correcting the average seasonal variations, and indicating the short time changes in seasonal variations, is identical to Wald's in its mechanics; the difference is that Kuznets uses one correction factor for each consecutive twelve-month period, while Wald uses a different factor for each month. Kuznets assumes changes of the seasonal movement to take place suddenly between the end of one twelve-month period and the beginning of the other, while Wald assumes them to be gradual. Wald's assumption is perhaps more reasonable than Kuznets'; but the difference in the results when these methods are used is not great, and in view of the drastic assumptions that have to be fulfilled if these methods are to be considered accurate, the "precision" gained using Wald's method is not very significant.

What we require is a rough indication of the correspondence of the "individual" seasonal movements to their average and Kuznets' measure is adequate for this purpose.

D. Deriving Seasonal Indexes

The seasonal index for a period is an average of the apparent seasonal movements in each of the years covered by that period. Depending on whether it is assumed that seasonality is additive or multiplicative, residuals or relatives are averaged. The principles followed are the same in both cases.

The residuals (relatives) contain part of the cyclical and irregular influences. These influences often give rise to "extreme" values which tend to divert the average from the "true" seasonal value. To overcome this difficulty "modified" means are usually computed by excluding the highest and lowest values before taking an average.[34] In the present study, the need for excluding extreme values was recognized, but the data were not available for periods sufficiently lengthy to allow exclusion (data for five years, 1947-51, were used,) instead, use of a "weighted" means was adopted. Normally five[35] different residual

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34 - Croxton and Cowden, op.cit., 482.

35 - The data being used in the present study of seasonality were available at the time of computation from January 1947 to April 1952. The moving-average method being used is "open-ended", that is, the method does not give moving average values for the first and last six months for which data are available. It was felt that it would be desirable to have moving average values for five complete years, 1947-1951, therefore recourse was had to "free-hand" methods. The actual employment and the moving average values were plotted on a graph. The graph was studied, and the moving average line was extended to cover the first six months of 1947, and the last two of 1951. In extending the line, an attempt was to, 1) continue its "apparent" trend, and 2) follow the observed relationship between the curve showing actual employment and the moving average line, in other years.

(relative) values were available for each month; these residuals (relatives) were ordered according to size. The second, third, and fourth items were each included in the total twice, the first and fifth items were circled and included only once. The sum was divided by the number of weights, eight. If some of the residuals were equal the method was modified.[36]

The average thus obtained, if in residual form, (it was adjusted, if necessary, so that the sum of the monthly values equalled zero) can be considered the "typical" seasonal variations during that period for that industry. If the seasonal index has been computed in relative form (the sum of the monthly values in this case will equal twelve instead of zero) the derivation of typical seasonal variations is more complicated. Perhaps the closest approximation to a typical seasonal variations value in this case would be obtained through use of an average seasonally adjusted value for each month. The latter is obtained by dividing the average actual employment for each month by its seasonal relative. Subtracting these values from the average actual employment for their respective months we obtain the typical seasonal variations.

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36 - If all, or four, of the residuals (relatives) were equal, the monthly index was given the value of the equal items. If three were equal, and in between the remaining two values, the usual procedure was adopted, the three equal items being treated as the middle items. If the remaining values were both higher or lower than the three, one of the three was circled along with the other extreme item. If two were equal and in between two of the unequal values, the usual procedure was adopted, with the third middle item also having double weight. If the two were extreme values one of the two was circled along with the other extreme item. If there were two sets of equal values, extreme items (only one of a pair of extreme values) were circled.

Two sets of typical seasonal variations, expressed as a percentage of average employment in the period, have been computed for Women's Clothing, 1) assuming seasonality is additive, 2) assuming seasonality is multiplicative.

TABLE I

Typical Seasonal Variations in Employment in Women's Clothing, Canada, 1947-1951

Base = Average Employment 1947 - 51

Month	Assuming Seasonality Additive o/o	Assuming Seasonality Multiplicative O/O
January	-3.8	-3.8
February	+2.8	+2.8
March	+5.2	+5.3
April	+6.3	+6.2
May	+4.6	+4.2
June	-0.9	-0.7
July	-4.7	-4.5
August	-6.9	-7.0
September	-2.6	-2.7
October	+0.6	+0.7
November	+1.1	+1.1
December	-1.4	-1.4

Using the methods described in section B of this chapter it was found that the seasonal movements in Women's Clothing tended to be multiplicative rather than additive, and at first sight it appears surprising that the results are in most cases very close. (The values are identical in four months, differ by 0.1% in five months, differ by 0.2% in two months, and by 0.4% in one month.) The reason the two approaches give almost identical results for "average" seasonal variations, even if seasonality is multiplicative, is that the procedure is essentially the same, average non-seasonal values are subtracted from average actual

values. The different routes taken and the rounding-off of figures that took place during the computations give rise to the slight difference in the results. We shall show that in the ideal case the results will be identical.

Assume the moving average method is precise, that is, the non-seasonal level moving (say, increasing) at a constant rate, seasonality multiplicative and constant from year to year when measured in relatives. Under these conditions the seasonal relatives for corresponding months in different years are equal to each other and thus to their average (the seasonal index). Using this seasonal index to adjust the actual values (dividing these values by the corresponding seasonal relatives), we can obtain the seasonal deviations in absolute numbers for each year (since seasonality is multiplicative and the non-seasonal level is increasing, the amplitude of variations, in absolute figures, is greater in each year than in the preceding year). Averaging these figures, for the number of years covered, we obtain the typical seasonal variations. When the residual method is used we get the deviations for each year in absolute figures directly, (if, as in this ideal case, the moving average method is precise, the values are equal to those obtained using the seasonal index). Averaging them, we obtain the typical seasonal variations, which under our assumptions is equal to the typical seasonal variations obtained using the seasonal relatives.

In practice the results will differ since the moving average method only approximates the "true" values, but the difference will not be very great. The residual method is much

shorter, and if all that is desired is the average seasonal variations, it should be used in preference to the relative method. If, however, it is the intention (as it is here) not only to measure seasonal variations, but to relate them, if possible, to the non-seasonal movement,[37] the relative method should be used whenever it is applicable.

E. Significance of Seasonal Indexes

The procedures described in other sections lead to the derivation of seasonal indexes which are essentially averages of the differences (or ratios) between actual employment and moving average values. The moving average does not contain all the random or cyclical elements present in the time series data, and the probability that these cyclical and random items will be completely cancelled when an average is taken, is so remote that even a series that by supposition is not subject to seasonal influence is likely to yield a set of indexes differing from zero (or 1.00), thus reading into the series a fictitious seasonal component. Such variations will likely be small, and thus not affect, to any great extent, any total estimates derived from these figures, such as, totals of seasonal employment and unemployment, but it is important to have some way of deciding whether the seasonal indexes obtained are significant.

A choice must be made from the several possible tests.[38] Some are quite rigid, being based on the theory of probability,

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37 - See Appendix, pages 178-181.

38 - Kuznets Lists and discusses the various tests. Kuznets, S, Seasonal Variations in Industry and Trade: New York, 31-40.

while others are more "rule of thumb" type. The latter should be sufficient for our purposes.

It is suggested that the following rules be used, one is "quantitative" the other "qualitative".

1) If the size and signs (positive or negative) of each of the monthly residuals are fairly constant from year to year, or at least the relative proportions of the monthly residuals are approximately the same each year, the seasonal index should be considered significant.

If, however, the individual residuals are not too large, and their signs are not the same throughout the period, they must be treated further before the question of significance is decided. If the non-persistence of pattern seems to be due to cyclical factors, a centered 12-month moving average of the first residuals should be taken.[39] These "second" moving average values should be added to the original moving average values in order to obtain a better representation of non-seasonal activity. If the "second" residuals (the difference between actual employment and the sum of the first and second moving averages) show a fairly consistent rhythm, the seasonal index derived from them should be considered significant. If their rhythm is not clear, and this vagueness cannot be attributed to cyclical influences, it should be concluded that the industry being dealt with is not afflicted

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39-- This is suggested by Woytinsky, W.S., op.cit., 19-22. The usefulness of this method in removing some of the disturbing influence of cyclical and irregular factors is indicated in the Appendix page 170.

with any significant degree of seasonality.

2)[40] An "accepted" seasonal index should conform to non-statistical data. The purpose of statistical analysis here, is to measure more precisely the influence of seasonal factors on a given branch of economic activity (employment). The nature of these factors and the general character of their influence is known, or should be ascertained, for any study dealing not only with description but also with explanation. Failure of a seasonal index to pass this test is an indication either of the unreliability of the index or of the insufficiency of the non-quantitative knowledge of the factors and influences involved. If this is the case, an attempt may be made to explain the seasonal index better, that is, to add further non-statistical data to the stock of knowledge and thus to restore the conformity between statistical measurement and qualitative data. If this fails, and upon further investigation of the reliability of the statistical index, the conclusion may be reached that it is not sufficiently significant.

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40 -This paragraph follows Kuznets' comments, op.cit., 39.

CHAPTER III

TYPICAL SEASONAL VARIATIONS IN EMPLOYMENT

A. Sources of Employment Data

The Dominion Bureau of Statistics publishes employment data gathered from three main sources. 1) A sample survey of households; 2) a census of all manufacturing firms; 3) a survey of all firms employing fifteen or more workers.

1) The Labour Force Survey was first published as a quarterly in November 1945[1]. Since December 1952 the surveys and the publications are conducted on a monthly basis. Enumerators interview the heads of the sample households and obtain information on the members in the household with regard to their labour force status in a particular week. That is, they attempt to determine whether the members were employed in that week, and if not employed whether they were actively looking for work, and thus still in the labour force, or not looking for work (such as housekeepers, students, etc.) and thus not in the labour force. If at work they obtain information on the occupation and industry.

The employment data turned up by the labour force survey was not used in this study because they are on a quarterly basis, and many seasonal variations would escape unnoticed. The industrial groupings[2] for which the information is available is

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1 - For a summary of the survey results see - "The Labour Force" - November 1945 - March 1952 - D.B.S. Reference Paper, No. 35.

2 - Agriculture; Forestry; Fishing and Trapping; Mining (includes quarrying); Manufacturing; Construction; Transportation (includes Storage and communication); Public Utilities; Trade; Finance, Insurance, (includes real estate), Service.

very broad and the component industries are not necessarily homogeneous with respect to seasonal variations. This publication is the only source of data for employment in Agriculture, and in Fishing and Trapping, and although the figures are not all that could be desired they may be used to indicate the extent of the seasonal variations in these industries.[3]

2) The Census of Industry publications[4] contain, among other things, monthly employment data. The employment for each month being reported at year's end. Since the returns come from all manufacturing firms, the publications are the source of the most complete monthly employment data. The figures were not used in this study because they were not classified according to the Standard Industrial Classification until 1949, and they are available approximately two years late. The figures for 1950 being released only recently. There is thus not enough suitable data to compute typical seasonal variations for the post-war period.

3) The employment data contained in the Employment and Payrolls publication have been classified according to the Standard Industrial Classification since November 1950. The monthly employment figures, starting with January 1947, have been reallocated to coincide with the new industrial groupings for all industries

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3 - In this case, the "weighted" thirteen-month moving average is turned into a weighted five-quarter moving average. For example, the formula for the first moving average value, valid for the third quarter, equals $\left(\sum_{i=1}^{4} a_i + \sum_{j=1}^{5} a_j\right)/8$ where the a's are the actual employment data.

4 - The annual "The Manufacturing Industries of Canada, D.B.S. and annual individual Industry reports.

for which employment figures are published on a national basis, and for most of these industries on a provincial basis.[5] They represent the longest, detailed, series of monthly employment for the post-war period, and all computations in this study were based on these figures.

The monthly surveys from which these figures are compiled relate to all the industries in the main non-agricultural industry groups.[6] The surveys attempt to cover all firms employing 15 or more persons, and no attempt is made to differentiate between classes of employees.[7] Being limited to firms employing 15 or more persons, the surveys will cover a varying percentage of total employment in the different industries depending on the size of the typical firms in the industry. For example, in Motor Vehicles, the coverage would be 100%, while in Bread and Bakery Products the coverage is probably less than 50%. "On the basis of available

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5 - See, "Employment, Payrolls and Average Weekly Earnings", D.B.S., 1947-1952, D.B.S. and "Employment, Payrolls and Average Weekly Earnings" - By Province and City, 1947-1950, D.B.S.

6.- "(1) Forestry (Mainly Logging), (2) Mining (including milling), quarrying and oil wells, (3) manufacturing, (4) construction, (5) transportation, storage and communication, (6) public utility operation, (7) trade, (8) finance, insurance and real estate, and (9) specified branches of the service industry, chiefly hotels, restaurents, laundries, dry cleaning plants, recreational and business services." Explanatory Notes I, Employment and Payrolls publication.

7 - The census of industry on the other hand, is interested in manufacturing workers.

material, it is estimated that the coverage in the various industries now ranges from about 58 p.c. in the hotel-and-restaurant and laundry-and-dry-cleaning group, and 60 p.c. in trade, to some 94 p.c. in mining and over 86 p.c. in manufacturing; the last two proportions are based on the statistics of the Annual Census of Industry relating to practically all establishments in the indicated industries. It is estimated that the composite index of employment in the major non-agricultural industrial groups relates to approximately 83 p.c. of the total paid workers in the same industries throughout Canada."[8]

To guard against an upward bias in statistics due to the steady growth in the number of firms reporting to the monthly survey, index numbers of employment are taken. "The index numbers of employment.....represent the percentage relationship between the employees of the establishments currently furnishing data.....and the corresponding 1939 average figures of these employers."[9] When a new firm is added to the survey, its employment, if any, in the base period, is added to the basic average before the employment index for any subsequent period is computed. If it was active in the base period this means that the addition of the new firm changes the quantitative significance of a unit index number. It now stands for more workers. If the new firm was not active in the base period, there is, of course, no change, a unit index number has the same significance before and after

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8 - Explanatory Notes I, Employment and Payrolls publication.

9 - Explanatory Notes II, Employment and Payrolls publication.

the introduction of the new firm.

The introduction of new firms to the group surveyed is apparently based on the assumption that the more firms included, the more reliable the employment indexes obtained are as indicators of the general employment situation. Unless all the index numbers of employment for earlier periods are revised to include employment in these firms, index numbers, computed before and after the change, are not strictly comparable. Any differences noted may only be apparent ones, due to changes in the number of firms taken to reflect total employment. However, in our measurement of seasonality, we must assume comparability since index numbers valid for different periods are added together and averaged. The assumption that must be fulfilled if our procedure is to be strictly justified is that (in opposition to the philosophy underlying the addition of new firms to the survey,) the movement of employment is the same in both the "old" and "new" firms (i.e. nothing is gained by the addition). This condition will not in general be satisfied, the effect of its non-fulfillment is similar to that of irregular influences. It is hoped that the effects are not too great and that they largely cancel out when averaging to obtain the seasonal movement.

The published index numbers must be revised if strikes have taken place, since "Workers on strike during the reported pay periods are not included in the statistics unless they draw pay from their employer, for example take paid holidays during the dispute. Workers laid off during the pay period as an indirect

effect of industrial disputes are not counted as employed."[10] Strikes, therefore cause the employment data to vary irregularly, and this variation may obscure and distort the seasonal patterns. The length of time for which adequate data are available is too short to allow some of the large deviations due to strikes to cancel, or to permit excluding those years in which strikes occurred. In view of these considerations the data were adjusted.[11]

"The questionnaire used in the monthly surveys asks employers to state the number of full-time, part-time and casual wage-earners and salaried employees drawing pay in the last pay periods in the month."[12] It can be seen from the above quotation that the employment figures are not average figures for each month, which our discussion in Chapter II led us to conclude were the most useful for computing seasonal variations, but figures relating to strategic pay periods in each month. This "deficiency" is present in all the D.B.S. data, the Labour Force Survey obtains

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10 - Explanatory Notes I, Employment and Payrolls publication.

11 - The steps taken were as follows:
1) A list of all strikes in Canada in which 500 or more workers took part, and which lasted long enough to possibly affect the D.B.S. employment indexes were compiled.
2) The employment indexes were then studied to determine whether or not they had been affected by strikes.
3) An adjustment was made if, and only if, the monthly figures in the strike free years showed a fairly regular pattern.
4) The adjustment attempted to bring the monthly figures in the strike years into line with the corresponding monthly figures for the strike free years, but the adjustment, in any case, was not greater (it may have been less) than the change indicated by comparing the number on strike and the total number employed in the base period.

12 - Explanatory Notes I, Employment and Payrolls publication.

information on a given week's activity, while the Census of Industry asks employment information for the last pay period in each month. The employment reported for the last pay period in each month is taken to be the employment at the first of the following month in these publications.

The typical seasonal variations in employment to be presented in this chapter will be given in both absolute numbers, and as percentages of average employment for the period 1947-51. Since they are based on Employment and Payrolls data the absolute figures can only be used to estimate the extent of seasonality in employment in the firms covered, and not for all the firms in the different industries. Any other estimate based on these figures, such as seasonal employment, will also be handicapped in this manner. The figures representing the typical seasonal variations in percentage terms can be used to estimate seasonality for all firms in the various industries, if, 1) a reliable estimate of total employment is available, and 2) seasonal movements are the same in the group of firms (belonging to the same industries) reporting to the Employment Section, and those not reporting.

The 1951 Census may provide the necessary employment figures, the information required to test 2) is more difficult to obtain. If it is assumed that seasonal variations in small firms have the same pattern and at least as large an amplitude as in the larger firms, the percentage figures of seasonal variations obtained from the Employment and Payrolls data, can be used with the Census employment figures to obtain minimum estimates of seasonal variations, since the excluded firms are mainly those employing less than 15 workers. This extension has not been carried out in this study.

B. Typical Seasonal Variations in Employment

Seasonal variations in activity are due to the lack of perfect compensation for seasonal variations in the controlling factors of production; supply of raw materials, demand, and the productive process itself. In analyzing seasonal movements in various industries, it is useful to classify the industries according to the factor primarily responsible for the variations. We will make use of three classes.[13]

I. Industries in which the supply of raw materials is subject to large seasonal variations while the demand for the finished product is rather constant.

II. Industries that utilize raw materials whose supply is fairly continuous, subject to rather mild seasonal variations, but whose final product is subject to a seasonally variable demand.

III. Industries in which neither the raw materials nor final demand, but the productive process itself is subject to conspicuous primary seasonal influences.

We consider in this chapter some of the typical seasonal variations in employment computed by the Economics and Research Branch, Department of Labour, in the summer of 1952,

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13 - This classification is based on Kuznets, S., op.cit., 20-22. Kuznets makes use of an additional class, containing industries in which both the supply of raw materials and the demand for the finished product are subject to large seasonal variations. It has been found difficult to pick out industries belonging to this category and it has thus been dropped. The "mild seasonal variations" clause in the description of our class II can accommodate the few industries that could possibly be classified in the excluded group.

on the basis of the Employment and Payrolls monthly indexes of employment, using the method of moving averages as presented in Chapter II. Although the Branch has computed seasonal variations for the separate industries on a provincial basis whenever the data were available, we will consider, for the most part, for lack of space and time, the variations obtained from national figures. The industries originally covered were all the non-agricultural industries for which the employment section of D.B.S. publishes monthly employment indexes. The results were examined in the light of the suggestions in the last section of Chapter II to determine their "significance", and some of the figures were considered too erratic to be taken as reliable indicators of seasonality in their present state. In addition, some of the industries whose seasonal figures were retained were affected by "incomplete" cycles in the period under consideration. Moving averages of the residuals have not as yet been taken to minimize this influence because of lack of time. These figures have however been automatically corrected to a certain extent when they were adjusted to total zero,[14] and it is felt that the cyclical influences still present are not large enough to invalidate the results.

Certain industries have been chosen for separate treatment on the basis of their importance in the over-all seasonal picture, and for the availability of computations of seasonal

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14 - See Appendix pages 176-179.

variations for the pre-war period.[15] It is also necessary that the classification used in the pre-war period should closely correspond to the Standard Industrial Classification for these industries. The discussion of seasonality will not try to be exhaustive but will attempt to point up certain of the characteristics of the seasonal movements in these industries as revealed by the measures considered in Chapter II.

I. Seasonal Variations in Employment in Group I Industries.

a) Meat Products Industry

Seasonal variations in employment in the Meat Products industry[16] is due to the seasonal marketing of livestock by farmers. These seasonal variations in the flow of raw materials directly affect activity since the industry cannot act as a stabilizer by "storing" the raw materials and producing at a regular rate the year round without incurring very high costs. The general practice is to pasture cattle and lambs from spring

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15 - These computations are available in the Economics and Research Branch, Department of Labour. They were originally worked out on the assumption that seasonality was multiplicative. The assumption was tested using the additive or multiplicative test described in Chapter II, if seasonality was shown to be additive, the final stages of the original computations were reworked to obtain typical seasonal variations on the basis of residuals.

16 - A useful study of this industry, from which most of the descriptive material used here was obtained is available in the Labour Gazette. "Seasonal Variations of Employment in the Meat Products Industry" Labour Gazette, XLVII, 1215-1225.

until early fall when good pasture land is available. Thus the marketing of cattle and lambs reaches a peak in the fall. Some cattle are winter-fed for late-winter, spring and summer delivery, reducing the seasonal amplitude to a certain extent but not sufficiently to eliminate the marked seasonal movement. Different breeding and feeding practices of hogs, between the Prairies region, and Quebec and Ontario, has resulted in different seasonal patterns of marketing and thus slaughtering. In the east two litters of hogs are raised each year, one for market in the spring the other in the fall. The spring marketing of hogs in the east diminishes the amplitude of variations in the east as compared to the amplitude of variations in the west.

The typical seasonal variations (in percentage and absolute terms) for employment in the Meat Products industry for six of the provinces are given in Table II, along with the value of their average absolute deviations, measuring the amplitude of variation, and the results of the additive or multiplicative test. The results of these tests indicate a difference between the prairies and the east, other than in the size of their variations. The values for both the additive and multiplicative assumption are greater in the west than in the east, indicating the presence of changing seasonality and/or large irregular deviations. Since the mean deviations for the multiplicative assumption are smaller in the prairies and greater in the east, the tentative hypothesis, that the raising (and marketing) of livestock in the prairies is subject to a greater extent to cyclical influences

TABLE II

Typical Seasonal Variations in Employment
in Meat Products by Province 1941 - 1951

1-Seasonal Variations in Absolute Figures;[17]
2.Seasonal Variations in Percentage;[18]

	Quebec		Ontario		British Columbia	
Month	(1)	(2)	(1)	(2)	(1)	(2)
January	- 20	- 0.5	± 70	±0.9	±40	±2.9
February	-120	- 3.1	-140	-1.9	-40	-2.9
March	-190	- 5.1	-290	-3.9	-60	-4.4
April	-180	- 4.8	-330	-4.4	-40	-2.9
May	-130	- 3.5	-190	-2.5	-40	-2.9
June	- 70	- 1.9	-	0	-30	-2.2
July	- 60	- 1.6	±220	±3.0	0	0
August	± 10	± 0.3	±290	±3.9	±30	±2.2
September	±110	± 2.9	±170	±2.3	0	0
October	±180	± 4.8	- 30	-0.4	0	0
November	±200	± 5.3	±110	±1.5	±60	±4.4
December	±260	± 6.9	±120	±1.6	±70	±5.1
Ampl of Variations:[19]		3.4		2.2		2.5
Add. Ratio:[20]		0.196		0.100		0.335
Mult. Ratio:[21]		0.235		0.119		0.352

	Manitoba		Saskatchewan		Alberta	
Month	(1)	(2)	(1)	(2)	(1)	(2)
January	±190	± 5.9	±120	± 8.1	±140	± 4.2
February	-100	- 3.1	- 50	- 3.4	- 20	- 0.6
March	-360	-11.1	-210	-14.2	-190	- 5.8
April	-470	-14.5	- 70	- 4.7	-280	- 8.6
May	-430	-13.3	-210	-14.2	-260	- 8.0
June	-200	- 6.2	-150	-10.2	- 60	- 1.8
July	± 30	± 0.9	0	0	± 40	± 1.2
August	±150	± 4.6	± 70	± 4.7	± 70	± 2.1
September	±140	± 4.3	± 10	± 0.7	± 30	± 0.9
October	± 60	± 1.9	± 30	± 2.0	± 10	± 0.3
November	±360	±11.1	±140	± 9.5	±160	± 4.9
December	±640	±19.8	±310	±20.9	±370	±11.3
Ampl of Variations:		8.1		7.7		4.1
Add. Ratio:		0.366		0.462		0.278
Mult. Ratio:		0.281		0.305		0.236

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17 - The seasonal variations in absolute figures indicate the average deviations of the non-seasonal from the actual values, for each month, during the period covered.

(Footnotes cont'd. on page 66-a)

Footnotes from page 66 (Continued).

18 - The season variations in percentages express the seasonal variations in absolute figures as a percentage of the average employment for the period covered.

19 - Stands for amplitude of variations. It is equal to the average absolute value of the typical seasonal variations expressed as a percentage of the average employment for the period covered. The reasons for accepting this value as a measure of amplitude are discussed above, Chapter II, Section B.

20 - Stands for additive ratio. Its significance and method of derivation are described above, Chapter II, Section B.

21 - Stands for multiplicative ratio. Its significance and method of derivation are described above, Chapter II, Section B.

than in the east, suggests itself. To "test" this hypothesis would require a more intensive study of the Meat Products industry than is possible here, it is left as one of the suggestions raised by this study.

In Table III are presented the typical seasonal variations for Meat Products in Canada for three periods, 1923-29, 1932-39, and 1947-51, along with their average absolute seasonal deviations, and with the "index of similarity" comparing the seasonal patterns of the earlier periods with the post-war period. Both the seasonal pattern and amplitude have undergone substantial changes.

The large values obtained for the mean deviations in the additive and multiplicative tests for seasonality in Meat Products in Canada, in the post-war period, raise the possibility of a change in seasonality during this period. The measures proposed by Kuznets for measuring short-time changes in seasonal pattern and amplitude were computed. They are tabulated in Table IV. The r values are all greater than 85 p.c. except for the first year. The low value in that year is due to the country-wide strike at the end of September. This strike affected the last pay period in September, and thus the employment figure for October 1. The October employment figure was adjusted upward for this strike, but no adjustment was made in the November figure which was inflated by the increase in activity due to the backlog of work caused by the strike. It is this large "irregular" fluctuation which has affected r in 1947. Even though the r values

TABLE III

Typical Seasonal Variations in Employment
in Meat Products in Canada

1. Seasonal Variations in Absolute Figures;
2. Seasonal Variations in Percentage Figures:

	1947 - 1951		1932 - 1939[23]		1923 - 1929[23]	
Month	(1)	(2)	(1)	(2)	(1)	(2)
January	+ 620	+2.9		-0.3		+0.1
February	- 490	-2.3		-1.8		-0.7
March	-1350	-6.5		-3.5		-2.9
April	-1550	-7.4		-3.3		-3.4
May	-1310	-6.3		-2.8		-4.0
June	- 520	-2.5		-0.5		-2.5
July	+ 150	+0.7		+0.4		-2.0
August	+ 570	+2.7		+0.8		-1.3
September	+ 450	+2.2		+0.3		+1.5
October	+ 280	+1.3		+1.6		+2.2
November	+1140	+5.4		+5.0		+5.3
December	+2000	+9.6		+4.1		+7.7
Ampl. of Variations:	4.2		2.0		2.8	
Index of Similarity:[22]	0		0.62		0.52	
Add. Ratio:	0.284					
Mult. Ratio:	0.281					

TABLE IV

Measures of Short-Time Changes in Seasonality in Meat Products[23a]

	1947	1948	1949	1950	1951
r	0.84	0.95	0.95	0.91	0.89
b	1.56	1.21	1.09	0.74	0.56

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22 - The method for deriving this measure and its significance are explained above, Chapter II, Section C, I. The seasonal variations in the period 1947-1951 are taken as the base. The results indicate the similarity between the seasonal patterns in each of the two pre-war periods and the seasonal pattern in the base period.

23 - Average employment in absolute figures for this period, and the results of the additive or multiplicative test, were not available when this table was compiled. Typical seasonal variations were computed on the assumption that seasonality was multiplicative.

23a- The methods for deriving these measures and their significance are explained above, Chapter II, Section C, III.

are not large enough to indicate a strictly constant pattern they are perhaps large enough not to derive measures of the amplitude ratios of all significance. We may conclude from the b values that the amplitude of variations has been steadily diminishing in the post-war period, tending to return to the pre-war situation.[24]

b) All Other Industries

The remaining industries whose seasonal variations are due to variable supplies of raw materials include most of the Food and Beverages industries, and the Tobacco and Tobacco Products industry. The peak periods generally occur in late summer and fall with the trough periods in the spring. The timing of the seasonal movements can be expected to vary to a certain extent with variations in the harvesting seasons. The mean deviations for both the additive and multiplicative assumptions are quite close and small in most cases, indicating the absence of large irregular influences and of significant changes in the non-seasonal level during the period covered. The results are given in Table V.

II. Seasonal Variations in Employment in Group II Industries.

a) Trade

Seasonal variations in employment in Trade arise from seasonally variable consumer demand and seasonal variations in the supply of certain commodities, such as fruits and vegetables.

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24 - This diminishing amplitude of variations is also clearly shown when Wald's method for measuring changing seasonal amplitude is used. See Appendix page 182.

TABLE V

Typical Seasonal Variations in Employment
in Group I Industries, for Canada, 1947-1951

1. Seasonal Variations in Absolute Figures:
2. Seasonal Variations in Percentage Figures:

	Dairy Products		Canned and Cured Fish		Grain Mill Prod.		Other Goods	
Month	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
January	- 590	- 6.7	-1600	-20.4	-230	-3.0	+ 110	+ 0.4
February	- 840	- 9.6	-1630	-20.8	-200	-2.6	- 880	- 3.2
March	- 870	- 9.9	-2190	-28.0	-200	-2.6	-1030	- 3.9
April	- 610	- 7.0	-2220	-28.3	-130	-1.7	-1570	- 5.9
May	- 170	- 1.9	-1200	-15.3	- 60	-0.8	-1500	- 5.6
June	+ 450	+ 5.1	+ 200	+ 2.6	- 60	-0.8	-1380	- 5.2
July	+ 950	+10.9	+1300	+16.6	+110	+1.4	- 750	- 2.8
August	+1010	+11.5	+2420	+30.9	+ 90	+1.2	- 930	- 3.5
September	+ 780	+ 8.9	+2760	+35.2	+210	+2.7	+ 60	+ 0.2
October	+ 310	+ 3.5	+1730	+22.1	+240	+3.1	+1850	+ 6.9
November	- 20	- 0.2	+ 710	+ 9.1	+160	+2.1	+3250	+12.2
December	- 370	- 4.2	- 280	- 3.6	+ 50	+0.6	+2730	+10.2
Ampl. of Variations:		6.6		19.4		1.9		5.0
Add. Ratio:		0.102		0.147		0.197		0.125
Mult. Ratio:		0.083		0.121		0.216		0.115

	Canned and Preserved Fruits & Vegetables		Distilled & Malt Liquors		Tobacco & Tobacco Products	
Month	(1)	(2)	(1)	(2)	(1)	(2)
January	-3620	-29.1	+140	+1.0	+1200	+11.5
February	-3890	-31.3	-510	-3.7	+1600	+15.3
March	-4800	-38.6	-530	-3.8	+1290	+12.3
April	-5130	-41.3	-560	-4.0	+ 350	+ 3.3
May	-4680	-37.7	-420	-3.0	- 770	- 7.4
June	-3800	-30.6	-170	-1.2	- 800	- 7.7
July	+ 340	+ 2.7	+270	+1.9	- 760	- 7.3
August	+3380	+27.2	+480	+3.4	- 980	- 9.4
September	+7180	+57.8	+620	+4.4	- 670	- 6.4
October	+11950	+96.2	+190	+1.4	- 430	- 4.1
November	+3160	+25.4	+180	+1.3	- 480	- 4.6
December	- 110	- 0.9	+300	+2.2	+ 430	+ 4.1
Ampl. of Variations:		34.9		2.6		7.8
Add. Ratio:		0.0577		0.106		0.0347
Mult. Ratio:		0.0702		0.100		0.0610

The former directly influences activity and employment in Retail Trade, but it is anticipated and transmitted to activity and employment in Wholesale Trade and in Manufacturing. The latter directly affects wholesalers who, whenever possible, store the commodities in excess of present requirements. With the exception of British Columbia the amplitude of variations is smaller in Wholesale than in Retail Trade.

1) Retail Trade

The average amplitude of seasonal variations in employment in Retail Trade is small compared to the difference between its peak and trough, indicating that, except for the Christmas season, employment is fairly steady. There is not much difference between seasonal variations in the post-war and pre-war periods with regard to amplitude or pattern. Tests show seasonality to be multiplicative in all three periods, with smaller values for the mean deviations in each successive period, as the seasonal influences have apparently become more settled, and the irregular influences diminished. There is not much difference between the provincial values.

Table VI. Typical Seasonal Variations in Employment in Retail Trade, for Canada. Page 72.

Table VII. Typical Seasonal Variations in Employment in Retail Trade, by Provinces, 1947-1951. Page 73.

2) Wholesale Trade

With the exception of British Columbia, seasonal variations in employment in Wholesale Trade in the provinces are

TABLE VI

Typical Seasonal Variations in Employment
in Retail Trade, for Canada

1. Seasonal Variations in Absolute Figures;
2. Seasonal Variations in Percentages;

	1947-1951		1932-1939		1922-1929	
Month	(1)	(2)	(1)	(2)	(1)	(2)
Jan.	+18,150	+9.3	+9,600	+9.8	+6,890	+9.0
Feb.	- 5,070	-2.6	-2,640	-2.7	-610	-0.8
Mar.	-6,420	-3.3	-4,110	-4.2	-2,530	-3.3
Apr.	-6,290	-3.2	-3,430	-3.5	-1,680	-2.2
May	-3,590	-1.8	-1,570	-1.6	-1,000	-1.3
June	-2,980	-1.5	-780	-0.8	-1,230	-1.6
July	-2,240	-1.1	+290	+0.3	-1,450	-1.9
Aug.	-5,190	-2.7	-1.860	-1.9	-1,680	-2.2
Sept.	-5,560	-2.8	-2,450	-2.5	-2,070	-2.7
Oct.	-640	-0.3	-100	-0.1	-1,300	-1.7
Nov.	+3,790	+1.9	+1,170	+1.2	+770	+1.0
Dec.	+16,060	+8.2	+5,780	+5.9	+6,200	+8.1
Ampl.of Variations:	3.2		2.9		3.0	
Index of Similarity:			0.74		0.79	
Add. Ratio:	0.061		0.109		0.167	
Mult. Ratio:	0.046		0.073		0.084	

TABLE VII

Typical Seasonal Variations in Employment in Retail Trade, by Province, 1947-1951.

1. Seasonal Variations in Absolute Figures;
2. Seasonal Variations in Percentages;

	Nova Scotia		Quebec		Ontario	
Month	(1)	(2)	(1)	(2)	(1)	(2)
Jan.	+470	+7.0	+3530	+8.2	+8130	+10.0
Feb.	-280	-4.2	-1040	-2.4	-1790	-2.1
Mar.	-260	-3.9	-1440	-3.3	-2440	-2.9
Apr.	-230	-3.4	-730	-1.7	-1580	-1.9
May	-210	-3.1	-730	-1.7	-1210	-1.5
June	-150	-2.2	-530	-1.2	-1050	-1.3
July	-100	-1.5	-730	-1.7	-510	-016
Aug.	-260	-3.9	-1330	-3.1	-2220	-2.7
Sept.	-120	-1.8	-1360	-3.1	-2860	-3.4
Oct.	+90	+1.3	-20	-0.0	-1260	-1.5
Nov.	+330	+4.9	+750	+1.7	+930	+1.1
Dec.	+710	+10.5	+3280	+7.6	+5890	+7.1
Ampl.of Variations:	4.0		3.0		3.0	
Add. Ratio:	0.0729		0.104		0.054	
Mult. Ratio:	0.0826		0.139		0.070	

	Manitoba		Alberta		British Columbia	
Month	(1)	(2)	(1)	(2)	(1)	(2)
Jan.	+1660	+10.6	+1080	+9.0	+1620	+7.3
Feb.	-560	-3.6	-330	-2.8	-500	-2.2
Mar.	-810	-5.2	-480	-4.0	-680	-3.1
Apr.	-440	-2.8	-410	-3.4	-360	-1.6
May	-520	-3.3	-350	-2.9	-450	-2.0
June	-530	-3.4	-220	-1.8	-400	-1.8
July	-200	-1.3	-100	-0.8	-460	-2.1
Aug.	-340	-2.3	0	0.0	-520	-2.3
Sept.	-540	-3.4	-10	-0.1	-500	-2.2
Oct.	-10	-0.0	+10	+0.1	+160	+0.7
Nov.	+340	+2.3	+130	+1.1	+250	+1.1
Dec.	+1900	+12.1	+710	+5.9	+1800	+8.1
Ampl.of Variations:	4.2		2.7		2.9	
Add. Ratio:	0.134		0.134		0.137	
Mult. Ratio:	0.131		0.084		0.125	

limited. The mean deviations for both the additive and multiplicative assumptions are fairly large, with not much difference between them. If asked to comment on the nature of seasonality in these cases one would have to consider them to be "borderline" cases, where the influence of irregular disturbances on the average seasonal amplitude is of about equal magnitude to the influence of changes in the non-seasonal level. It is interesting to note that the mean deviations for Canada are generally smaller indicating that many of the irregular factors cancel out for the country as a whole, resulting in a more stable seasonal movement.

Table VIII. Typical Seasonal Variations in Employment in Wholesale Trade by Provinces 1947-1951. Page 75.

The seasonal variations in employment in Wholesale Trade for the pre-war and post-war periods have roughly the same amplitude with some dissimilarity in pattern. In each successive period the ratio of the mean deviation, obtained using the additive assumption, to the mean deviation of the multiplicative assumption, is smaller. In the post-war period this ratio is slightly smaller than one, and irregular influences have had more affect on the amplitude of variations than changes in the non-seasonal level.

Table IX. Typical Seasonal Variations in Employment in Wholesale Trade for Canada. Page 76.

b) Coal Mining

The seasonal movements in employment in the Coal Mining industry, as the case of Wholesale Trade, points up the need for studying the variations in the regions separately.

TABLE VIII

Typical Seasonal Variations in Employment
in Wholesale Trade, by Province, 1947-1951.

1. Seasonal Variations in Absolute Figures;
2. Seasonal Variations in Percentages;

	Nova Scotia		Quebec		Ontario	
Month	(1)	(2)	(1)	(2)	(1)	(2)
Jan.	+30	+0.9	-30	-0.1	+170	+0.5
Feb.	+40	+1.2	-230	-0.9	+60	+0.2
Mar.	-20	-0.6	-260	-1.0	+80	+0.2
Apr.	-80	-2.3	-280	-1.0	-170	-0.5
May	-120	-3.5	-320	-1.3	-270	-0.8
June	-120	-3.5	-90	-0.3	-250	-0.7
July	-100	-2.9	+60	+0.3	+190	+0.5
Aug.	-50	-1.5	+50	+0.2	+60	+0.2
Sept.	-10	-0.3	+150	+0.6	+80	+0.2
Oct.	+100	+2.9	+260	+1.1	-80	-0.2
Nov.	+190	+5.5	+320	+1.3	-40	-0.1
Dec.	+160	+4.7	+280	+1.2	+110	+0.3
Ampl.of Variations:	2.5		0.8		0.4	
Add. Ratio:	0.318		0.254		0.196	
Mult. Ratio:	0.304		0.286		0.164	

	Manitoba		Alberta		British Columbia	
Month	(1)	(2)	(1)	(2)	(1)	(2)
Jan.	-30	-0.3	+20	+0.3	-770	-6.2
Feb.	-50	-0.5	-60	-0.9	-890	-7.2
Mar.	-140	-1.4	-100	-1.5	-960	-7.8
Apr.	-160	-1.6	-110	-1.6	-1200	-9.7
May	-150	-1.5	-40	-0.6	-1240	-10.0
June	-110	-1.1	+10	+0.1	-1010	-8.2
July	+40	+0.4	+50	+0.7	-760	-6.1
Aug.	+160	+1.6	+120	+1.7	+220	+1.8
Sept.	+160	+1.6	+100	+1.4	+670	+5.4
Oct.	+50	+0.5	+30	+0.4	+2320	+18.7
Nov.	+120	+1.2	-30	-0.4	+2350	+19.0
Dec.	+100	+1.0	+30	+0.4	+1230	+9.9
Ampl.of Variations:	1.1		0.8		9.2	
Add. Ratio:	0.196		0.198		0.191	
Mult. Ratio:	0.199		0.230		0.179	

TABLE IX

Typical Seasonal Variations in Employment
in Wholesale Trade, for Canada.

1. Seasonal Variations in absolute figures;
2. Seasonal Variations in Percentages;

	1947 - 1951		1932 - 1939		1922 - 1929	
Month	(1)	(2)	(1)	(2)	(1)	(2)
January	-660	-0.7	-370	-1.2	-170	-0.6
February	-1200	-1.2	-580	-1.9	-540	-1.9
March	-1630	-1.6	-760	-2.5	-800	-2.8
April	-2180	-2.2	-640	-2.1	-740	-2.6
May	-2360	-2.3	-490	-1.6	-460	-1.6
June	-1690	-1.7	-150	-0.5	-290	-1.0
July	-420	-0.4	-30	-0.1	+ 30	+0.1
August	+800	+0.8	+210	+0.7	+260	+0.9
September	+1350	+1.3	+490	+1.6	+570	+2.0
October	+2860	+2.8	+860	+2.8	+660	+2.3
November	+3110	+3.1	+830	+2.7	+800	+2.8
December	+2010	+2.0	+490	+1.6	+600	+2.1
Ampl. of Variations:	1.7		1.6		1.7	
Index of Similarity			0.62		0.62	
Add. Ratio	0.175		0.113		0.224	
Mult. Ratio	0.181		0.104		0.175	

TABLE X

Typical Seasonal Variations in Employment
In Coal Mining, by Province, 1947-1951.

1. Seasonal Variations in Absolute Figures;
2. Seasonal Variations in Percentages;

	Nova Scotia		Alberta		British Columbia	
Month	(1)	(2)	(1)	(2)	(1)	(2)
January	-440	-3.4	+540	+7.1	+40	+1.7
February	+320	+2.4	+540	+7.1	+80	+3.5
March	-90	-0.7	+480	+6.3	+80	+3.5
April	- 50	-0.4	+ 50	+0.7	+50	+2.1
May	+20	+0.2	-360	-4.7	0	0.0
June	-110	-0.8	-520	-6.8	-30	-1.3
July	0	0.0	-410	-5.4	-40	-1.7
August	+120	+0.9	-490	-6.4	-50	-2.1
September	-110	-0.8	-240	-3.1	-40	-1.7
October	+80	+0.6	-160	-2.1	-70	-3.0
November	+90	+0.7	+120	+1.6	-40	-1.7
December	+140	+1.1	+480	+6.3	-	0.0
Ampl . of Variations:	1.0		4.8		1.9	
Add. Ratio:	0.588		0.244		0.406	
Mult. Ratio:	0.604		0.237		0.394	

Seasonal variations in employment are a relatively minor problem to the industry in Nova Scotia and British Columbia, but much more important in Alberta. This fairly acute local problem is hidden in measures of seasonal variations obtained from national figures since employment in the other two provinces is more than twice as great as in the latter.

Table X Seasonal Variations in Employment in Coal Mining, by Province, 1947-1951. Page 76.

The amplitude of seasonal variations in employment in the industry in Canada in the post-war period is smaller than in either of the two pre-war periods for which seasonal variations have been computed. The seasonal pattern has also undergone considerable changes as reflected by the index of similarity. Since the non-seasonal level within each of the three periods is fairly constant, the mean deviations for both the additive and multiplicative assumptions are approximately equal in these periods. The mean deviations for the three provinces are all greater than the deviations for Canada. The large values for the former are due to fairly significant irregular fluctuations which cancel out, to a certain extent, when added together, resulting in a more stable seasonal movement in Canada than in any of its components.

Table XI Seasonal Variations in Employment in Coal Mining for Canada: 1947-1951; 1922-1929; 1932-1939. Page 78.

c) <u>All Other Group II Industries</u>.

The amplitude of variations in the remaining Group II industries show a range of from 1.0 p.c. in Motor Vehicle Parts and Accessories to 9.8 p.c. in Other Beverages, with a mean of

TABLE XI

Seasonal Variations in Employment in Coal Mining for Canada: 1947-1951; 1922-1929; 1932-1939.

(1) Seasonal Variations in Absolute Figures;
(2) Seasonal Variations in Percentages

	1947 - 1951		1932 - 1939		1922 - 1929	
Month	(1)	(2)	(1)	(2)	(1)	(2)
January	+150	+0.6	+1,690	+6.9	+1,420	+4.8
February	+890	+3.7	+1,390	+5.7	+1,180	+4.0
March	+530	+2.2	+ 930	+3.8	+ 60	+0.2
April	+410	+1.7	+ 370	-1.5	- 620	-2.1
May	-130	-0.5	-1,590	-6.5	-1,000	-3.4
June	-760	-3.1	-1,660	-6.8	-1,120	-3.8
July	-590	-2.4	-1,930	-7.9	-1,060	-3.6
August	-590	-2.4	-1,660	-6.8	-1,000	-3.4
September	-490	-2.0	- 710	-2.9	- 650	-2.2
October	-200	-0.8	+ 680	+2.8	+ 210	+0.7
November	+180	+0.7	+1,390	+5.7	+1,120	+3.8
December	+610	+2.5	+1,660	+6.8	+1,420	+4.8
Ampl. of Variations:	1.9		5.3		3.1	
Index of Similarity:			0.39		0.32	
Add. Ratio:	0.209		0.125		0.235	
Mult. Ratio:	0.199		0.125		0.236	

2.4 p.c.. Most of the items are clustered round this mean value. The active season for the industries belonging to the textile products group, and to the clothing group, occurs in late winter and early spring. For most of the other industries the active season occurs in the second half of the year with a peak around August. The mean deviations show seasonality to have been additive in about half of the industries during the period studied.

Table XII Typical Seasonal Variations in Employment in Group II Industries, for Canada, 1947-1951. Pages 80, 81, etc.

III. Seasonal Variations in Employment in Group III Industries.

a) Construction.

Seasonal variations in activity in the construction industry have shown a steady decline in amplitude through the years. The external causes of seasonality, the climatic conditions, have not been subject to any monotonic change, but the internal causes of seasonality which transmit the influence of these external factors, have undergone substantial changes. Technical changes have lessened the effect of cold-weather on building, for example, concrete work can now be carried on under freezing temperatures. In line with technical advances customary attitudes toward winter building have been slowly changing, partly as a result of wartime experiences. Since winter work involves greater costs, the boom conditions of this industry in the post-war period, with their concomitant disregard for costs within a certain range, have also helped to reduce seasonal amplitude. The figures in Table XIII comparing post-war and pre-war seasonal movements in this industry illustrate this statement.

TABLE XII

Typical Seasonal Variations in Employment
in Group II Industries, for Canada, 1947-1951

(1) Seasonal Variations in Absolute Figures;
(2) Seasonal Variations in Percentages;

	Bread and Other Bakery Products		Other Beverages		Boots and Shoes (except Rubber)		Other Leather Goods	
Month	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Jan.	-120	-0.8	-250	-4.4	-410	-2.1	-340	-3.0
Feb.	-180	-1.1	-540	-9.5	+290	+1.5	+120	+1.1
Mar.	-310	-2.0	-620	-11.0	+540	+2.8	+400	+3.5
Apr.	-450	-3.0	-540	-9.5	+590	+3.1	+310	+2.7
May	-420	-2.8	-210	-3.7	+460	+2.4	+80	+0.7
June	-170	-1.1	+190	+3.4	-80	-0.4	-180	-1.6
July	+260	+1.7	+710	+12.5	-230	-1.2	-280	-2.5
Aug.	+380	+2.5	+840	+14.8	-160	-0.8	-310	-2.7
Sept.	+410	+2.7	+730	+12.9	+50	+0.3	-210	-1.9
Oct.	+240	+1.6	+160	+2.8	-160	-0.8	+10	+0.1
Nov.	+210	+1.4	-150	-2.6	-520	-2.7	+160	+1.4
Dec.	+210	+1.4	-340	-6.0	-310	-1.6	+250	+2.2
Ampl.of Variations:	1.8		7.8		1.6		2.0	
Add. Ratio:		0.099		0.300		0.152		0.089
Mult. Ratio:		0.087		0.219		0.183		0.138

	Textile Products (except Clothing)		Cotton Yarn and Broad Woven Gds		Woollen Goods		Clothing (Textile & Fur)	
Month	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Jan.	+50	+0.1	-40	-0.2	+20	+0.1	-2310	2.5
Feb.	+590	+0.8	+380	+1.5	+290	+2.0	+1600	+1.7
Mar.	+1760	+2.4	+570	+2.3	+450	+3.1	+2770	+3.0
Apr.	+1710	+2.4	+500	+2.0	+440	+3.0	+3110	+3.3
May	+680	+0.9	+320	+1.3	+170	+1.2	+2150	+2.3
June	-150	-0.2	+60	+0.2	+20	-/0.1	+230	+0.2
July	-680	-0.9	-130	-0.5	-140	-1.0	-1700	-1.8
Aug.	-1560	-2.2	-290	-1.2	-410	-2.8	-3960	-4.2
Sept.	-1220	-1.7	-530	-2.1	-260	-1.8	-2180	-2.3
Oct.	-980	-1.4	-420	-1.7	-350	-2.4	-460	-0.5
Nov.	-340	-0.5	-290	-1.2	-260	-1.8	+500	+0.5
Dec.	+200	+0.3	-150	-0.6	+90	+0.6	+290	+0.3
Ampl.of Variations:	1.2		1.2		1.7		1.9	
Add. Ratio:		0.052		0.231		0.247		0.146
Mult. Ratio:		0.059		0.274		0.246		0.122

TABLE XII (Continued)

Month	Men's Clothing (1)	Men's Clothing (2)	Women's Clothing (1)	Women's Clothing (2)	Knit Goods (1)	Knit Goods (2)	Fur Goods (1)	Fur Goods (2)
Jan.	-920	-3.0	-830	-3.8	+60	+0.2	+50	-1.1
Feb.	+230	+0.8	+610	+2.8	+670	+2.7	-200	-4.6
Mar.	+440	+1.4	+1160	+5.3	+770	+3.1	-110	-2.5
Apr.	+680	+2.2	+1350	+6.2	+630	+2.6	-60	-1.4
May	+610	+2.0	+920	+4.2	+290	+1.1	+30	+0.7
June	+380	+1.3	-160	-0.7	-100	-0.4	+110	+2.5
July	+70	+0.2	-980	-4.5	-530	-2.1	+50	+1.1
Aug.	-750	-2.5	-1520	-7.0	-1120	-4.5	-40	-0.9
Sept.	-530	-1.7	-580	-2.7	-860	-3.5	-50	-1.1
Oct.	-290	-1.0	+150	+0.7	-410	-1.7	+50	+1.1
Nov.	0	0.0	+240	+1.1	+140	+0.6	+120	+2.7
Dec.	+100	+0.3	-310	-1.4	+510	+2.1	+130	+3.0
Ampl.of Variations:		1.4		3.4		2.1		1.9
Add. Ratio:		0.197		0.270		0.195		0.265
Mult. Ratio:		0.177		0.191		0.216		0.281

Month	Hats and Caps (1)	Hats and Caps (2)	Furniture (1)	Furniture (2)	Other Wood Products (1)	Other Wood Products (2)	Agricultural Implements (1)	Agricultural Implements (2)
Jan.	-180	-4.2	+390	+1.9	-400	-3.1	-390	-2.3
Feb.	+100	+2.3	+560	+2.8	-740	-5.8	+30	+0.2
Mar.	+180	+4.2	+550	+2.7	-580	-4.5	+330	+1.9
Apr.	+170	+4.0	+390	+1.9	-360	-2.8	+670	+3.9
May	+100	+2.3	-20	-0.1	-230	-1.8	+690	+4.0
June	0	0.0	-230	-1.1	+90	+0.7	+580	+3.4
July	-110	-2.6	-390	-1.9	+410	+3.2	+440	+2.6
Aug.	-100	-2.3	-550	-2.7	+410	+3.2	+110	+0.6
Sept.	+10	+0.2	-480	-2.4	+500	+3.9	-270	-1.6
Oct.	0	0.0	-380	-1.9	+440	+3.4	-640	-3.7
Nov.	-50	-1.2	-120	-0.6	+360	+2.8	-870	-5.1
Dec.	-120	-2.8	+330	+1.6	+110	+0.9	-660	-3.9
Ampl.of Variations		2.2		1.8		3.0		2.8
Add. Ratio		0.217		0.312		0.178		0.288
Mult.Ratio		0.214		0.315		0.167		0.304

TABLE XII (Continued)

Month	Heating & Cooking Appliances (1)	(2)	Iron Castings (1)	(2)	Motor Vehicles (1)	(2)	Motor Vehicle Parts & Accessories (1)	(2)
Jan.	+60	+0.8	-370	-1.9	-200	-0.7	-420	-2.3
Feb.	+140	+1.7	+400	-+2.0	-680	-2.4	-290	-1.6
Mar.	-10	-0.1	+450	+2.3	-260	-0.9	-110	-0.6
Apr.	-110	-1.3	+490	+2.5	-630	-2.2	+20	+0.1
May	-250	-3.1	+240	+1.2	-570	-2.0	+180	+1.0
June	-290	-3.6	+50	+0.3	-60	-0.2	+280	+1.5
July	-240	-3.0	-160	-0.8	+610	+2.2	+350	+1.9
Aug.	-120	-1.5	-540	-2.7	+640	+2.3	+200	+1.1
Sept.	-30	-0.4	-380	-1.9	+350	+1.2	+90	+0.5
Oct.	+160	+2.0	-170	-0.9	+500	+1.8	0	0.0
Nov.	+330	+4.1	-90	-0.5	+330	+1.2	+20	+0.1
Dec.	+360	+4.4	+130	+0.7	0	0.0	-310	-1.7
							1.0	
Ampl.of Variations:	2.2		1.5		1.4		0.359	
Add. Ratio:		0.248		0.087		0.288		0.300
Mult. Ratio:		0.269		0.142		0.144		

Month	Shipbuilding and Repairing (1)	(2)	Aluminum Products (1)	(2)	Non-Metallic Mineral Products (1)	(2)	Clay Products (1)	(2)
Jan.	-1760	-9.6	-200	-3.1	-830	-3.3	-220	-4.0
Feb.	-1270	-6.9	-150	-2.3	-710	-2.9	-270	-4.9
Mar.	-410	-2.2	-100	-1.6	-930	-3.7	-340	-6.1
Apr.	+420	+2.3	+40	+0.6	-720	-2.9	-240	-4.3
May	+430	+2.3	+170	+2.7	-220	-0.9	-170	-3.1
June	+520	+2.8	+150	+2.3	+350	+1.4	+110	+2.0
July	+380	+2.1	+190	+3.0	+720	+2.9	+270	+4.9
Aug.	+630	+3.4	+70	+1.1	+830	+3.3	+240	+4.3
Sept.	+1010	+5.5	+10	+0.2	+730	+2.9	+260	+4.7
Oct.	+440	+2.4	-60	-0.9	+450	+1.8	+220	+4.0
Nov.	+50	+0.3	-20	-0.3	+200	+0.8	+120	+2.2
Dec.	-460	-2.5	-100	-1.6	+100	+0.4	+30	+0.5
Ampl.of Variations:	3.5		1.6		2.3		3.8	
Add. Ratio:		0.149		0.486		0.149		0.163
Mult. Ratio:		0.216		0.463		0.108		0.156

TABLE XII (Continued)

Month	Glass and Glass Products (1)	(2)	Products of Petroleum and Coal (1)	(2)	Acids, Alkalis and Salts (1)	(2)	Transportation (1)	(2)
Jan.	-160	-2.3	-170	-1.7	-150	-2.5	-5360	-2.2
Feb.	-120	-1.8	-300	-3.0	-80	-1.3	-10600	-4.4
Mar.	-170	-2.5	-210	-2.1	-80	-1.3	-11190	-4.7
Apr.	-80	-1.2	-150	-1.5	-60	-1.0	-9700	-4.0
May	+110	+1.6	-90	-0.9	-60	-1.0	-7910	-3.3
June	+130	+1.9	+130	+1.3	+50	+0.8	+920	+0.4
July	+260	+3.8	+240	+2.4	+170	+2.8	+6750	+2.8
Aug.	+200	+2.9	+310	+3.1	+80	+1.3	+11090	+4.6
Sept.	+90	+1.3	+260	+2.6	+140	+2.3	+9890	+4.1
Oct.	-60	-0.9	+90	+0.9	+70	+1.1	+8540	+3.6
Nov.	-80	-1.2	-50	-0.5	-30	-0.5	+4060	+1.7
Dec.	-130	-1.9	-110	-1.1	-50	-0.8	+3460	+1.4
Ampl.of Variations:		1.9		1.8		1.4		3.1
Add. Ratio:		0.396		0.070		0.312		0.149
Mult. Ratio:		0.371		0.082		0.283		0.140

Month	Steam Railways Transportation (1)	(2)	Telegraphs (1)	(2)	Truck Transportation (1)	(2)
Jan.	+640	+0.4	-120	-1.5	-100	-0.8
Feb.	-2330	-1.5	-190	-2.4	-350	-2.9
Mar.	-3610	-2.3	-290	-3.6	-380	-3.2
Apr.	-3080	-1.9	-230	-2.9	-420	-3.5
May	-2330	-1.5	-220	-2.7	-170	-1.4
June	-1760	-1.1	-60	-0.7	+200	+1.7
July	+850	+0.5	+170	+2.1	+170	+1.4
Aug.	+3610	+2.3	+320	+4.0	+240	+2.0
Sept.	+3080	+1.9	+320	+4.0	+180	+1.5
Oct.	+3610	+2.3	+190	+2.4	+290	+2.4
Nov.	+1380	+0.9	+90	+1.1	+280	+2.3
Dec.	-210	-0.1	+20	+0.2	+230	+1.9
Ampl.of Variations:		1.4		2.3		2.1
Add. Ratio:		0.232		0.096		0.067
Mult. Ratio:		0.222		0.069		0.092

TABLE XII (Concluded)

Month	Grain Elevators (1)	(2)	Storage and Warehouse (1)	(2)	Communications (1)	(2)	Electric Light and Power (1)	(2)
Jan.	-50	-0.4	-80	-2.2	-580	-1.3	-690	-2.1
Feb.	-570	-5.1	-210	-5.7	-900	-2.0	-1110	-3.4
Mar.	-770	-6.9	-250	-6.8	-980	-2.2	-1290	-4.0
Apr.	-630	-5.6	-270	-7.3	-790	-1.7	-1400	-4.3
May	-280	-2.5	-130	-3.5	-620	-1.4	-1120	-3.5
June	-140	-1.2	+70	+1.9	+90	+0.2	+110	+0.3
July	+70	+0.6	+20	+0.5	+830	+1.8	+1050	+3.2
Aug.	+80	+0.7	+100	+2.7	+1480	+3.3	+1720	+5.3
Sept.	+170	+1.5	+70	+1.9	+1160	+2.5	+1670	+5.2
Oct.	+760	+6.8	+200	+5.4	+470	+1.0	+760	+2.4
Nov.	+800	+7.1	+320	+8.6	+60	+0.1	+290	+0.9
Dec.	+590	+5.3	+160	+4.3	-190	-0.4	-20	-0.1
Ampl.of Variations:	3.6		4.2		1.5		2.9	
Add. Ratio:	0.097		0.157		0.100		0.068	
Mult. Ratio:	0.119		0.157		0.179		0.157	

Month	Other Public Utilities (1)	(2)	Services (1)	(2)	Hotels and Restaurants (1)	(2)	Laundries and Dry Cleaning Plants (1)	(2)
JAN.	-140	-3.2	-2400	-3.1	-1550	-3.3	-510	-2.6
Feb.	-140	-3.2	-2690	-3.5	-2070	-4.5	-360	-1.8
Mar.	-210	-4.8	-3490	-4.5	-2610	-5.6	-530	-2.7
Apr.	-170	-3.9	-3040	-3.9	-2530	-5.5	-290	-1.5
May	-60	-1.4	-2020	-2.6	-1810	-3.9	+100	+0.5
June	+70	+1.6	-60	-0.1	-420	-0.9	+310	+1.6
July	+110	+2.5	+3400	+4.4	+2390	+5.2	+500	+2.8
Aug.	+190	+4.4	+5090	+6.5	+4200	+9.1	+450	+2.3
Sept.	+170	+3.9	+4690	+6.0	+4120	+8.9	+210	+1.1
Oct.	+120	+2.8	+2030	+2.6	+1720	+3.7	+210	+1.1
Nov.	+60	+1.4	-240	-0.3	-370	-0.8	+80	+0.4
Dec.	0	0.0	-1220	-1.6	-1090	-2.4	-180	-0.9
Ampl.of Variations:	2.8		3.3		4.5		1.6	
Add. Ratio:	0.229		0.020		0.040		0.168	
Mult. Ratio:	0.201		0.036		0.028		0.170	

TABLE XIII

Typical Seasonal Variations in Employment in Construction, for Canada.

(1) Seasonal Variations in Absolute Figures;
(2) Seasonal Variations in Percentages;

	1947 - 1951		1932 - 1939		1922 - 1929	
Month	(1)	(2)	(1)	(2)	(1)	(2)
January	-21,040	-11.0	-11,760	-17.4	-15,140	-25.7
February	-34,230	-17.9	-14,400	-21.3	-18,500	-31.4
March	-40,820	-21.4	-13,050	-19.3	-18,500	-31.4
April	-36,860	-19.3	-15,580	-22.9	-18,330	-31.1
May	-19,360	-10.1	-10,010	-14.8	- 8,600	-14.6
June	∔ 1,860	∔ 1.0	∔ 1,350	∔ 2.0	∔ 6,540	∔11.1
July	∔16,600	∔ 8.7	∔10,680	∔15.8	∔17,680	∔30.0
August	∔29,430	∔15.4	∔13,520	∔20.0	∔21,390	∔36.3
September	∔32,790	∔17.2	∔14,870	∔22.0	∔18,740	∔31.8
October	∔29,790	∔15.6	∔15,140	∔22.4	∔14,140	∔24.0
November	∔25,960	∔13.6	∔ 9,800	∔14.5	∔ 7,190	∔12.2
December	∔15,890	∔ 8.3	- 1,150	- 1.7	- 6,360	-10.8
Ampl of Variations:	13.3		16.2		24.2	
Index of Similarity			0.79		0.66	
Add. Ratio:	0.068		0.345		0.242	
Mult. Ratio:	0.061		0.255		0.065	

TABLE XIV

Measures of Short-Time Changes in Seasonality in Construction

May - May	1947 - 1948	1948- 1949	1949 - 1950	1950 - 1951
r	0.99	0.997	0.996	0.9
b	1.09	1.08	1.05	0.93

Table XIII. Typical Seasonal Variations in Employment in Construction, for Canada, 1947-1951; 1932-1939; 1922-1929 on Page 85.

As was to be expected from the small values obtained from the mean deviations in the additive or multiplicative test, the seasonal pattern and amplitude have not varied greatly during the 1947-1951 period. The r and b values for four 12-month, May to May, periods, given in Table XIV show little change.

Table XIV. Measures of Short-Time Changes in Seasonality in Construction on Page 85.

The two major component industries of the Construction industry group; Buildings and Structures, and Highways, Bridges and Street Construction, have different amplitudes, the latter being more than twice as great as the former. It is still very difficult to build roads in the winter in Canada. Substantial differences also exist within each of these industries in different provinces due to different climatic conditions.

Table XV. Typical Seasonal Variations in Employment in Building and Structures in Canada and Provinces, 1947-1951 on Page 87.

Table XVI. Typical Seasonal Variations in Employment in Highways, Bridges, and Street Construction, Canada and Provinces 1947-1951 on Page 88.

b) Forestry (Chiefly logging)

The amplitude of the seasonal movement in Forestry

TABLE XV

Typical Seasonal Variations in Employment in Buildings and Structures, Canada and the Provinces, 1947-1951.

(1) Seasonal Variations in Absolute Figures;
(2) Seasonal Variations in Percentages;

	Canada		Nova Scotia		Quebec		Ontario	
Month	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
January	- 7,610	- 6.6	-220	- 5.0	-2870	- 9.4	-1910	- 4.0
February	-12,430	-10.7	-390	- 8.9	-4220	-13.8	-3370	- 7.0
March	-15,290	-13.2	-710	-16.2	-5520	-18.0	-4410	- 9.2
April	-13,670	-11.8	-350	- 8.0	-5390	-17.6	-3820	- 8.0
May	- 9,750	- 8.4	-620	-14.1	-3610	-11.8	-2580	- 5.4
June	- 1,420	- 1.2	-260	- 5.9	- 480	- 1.6	- 790	- 1.6
July	+ 5,460	+ 4.7	-180	- 4.1	+1860	+ 6.1	+1640	+ 3.4
August	+ 9,280	+ 8.0	+ 50	+ 1.1	+3950	+12.9	+1970	+ 4.1
September	+12,860	+11.1	+670	+15.3	+4980	+16.2	+2880	+ 6.0
October	+12,480	+10.8	+680	+15.5	+4590	+15.0	+3380	+ 7.0
November	+12,520	+10.8	+770	+17.5	+4010	+13.1	+4040	+ 8.4
December	+ 7,560	+ 6.5	+540	+12.3	+2660	+ 8.7	+2960	+ 6.2
Ampl. of Variations:		8.7		10.3		12.0		5.9
Add. Ratio:		0.153		0.199		0.082		0.166
Mult. Ratio		0.077		0.233		0.069		0.076

	Manitoba		Saskatchewan		Alberta		British Columbia	
Month	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
January	- 620	-10.4	-460	-13.0	-550	-10.6	-1410	-12.1
February	-1100	-18.4	-740	-20.9	-660	-12.8	-1500	-12.9
March	-1140	-19.1	-870	-24.6	-900	-17.4	-1320	-11.3
April	- 960	-16.1	-880	-24.8	-810	-15.6	-520	- 4.5
May	- 910	-15.2	-520	-14.7	-390	- 7.5	-160	- 1.4
June	- 380	- 6.4	+160	+ 4.5	+320	+ 6.2	+620	+ 5.3
July	+ 360	+ 6.0	+430	+12.1	+460	+ 8.9	+630	+ 5.4
August	+ 790	+13.2	+670	+18.9	+710	+13.7	+690	+ 5.9
September	+1090	+18.2	+580	+16.4	+680	+13.1	+1510	+13.0
October	+1080	+18.1	+560	+15.8	+530	+10.2	+1010	+ 8.7
November	+1240	+20.7	+790	+22.3	+470	+ 9.1	+490	+ 4.2
December	+ 520	+ 8.7	+280	+ 7.9	+120	+2.3	+ 30	+ 0.3
Ampl. of Variations:		14.2		16.3		10.6		7.1
Add. Ratio:		0.125		0.054		0.284		0.130
Mult. Ratio:		0.089		0.071		0.103		0.128

TABLE XVI

Typical Seasonal Variations in Employment in Highways, Bridges and Street Construction, Canada and the Provinces, 1947-1951

(1) Seasonal Variations in Absolute Figures;
(2) Seasonal Variations in Percentages;

	Canada		Nova Scotia		New Brunswick		Quebec	
Month	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Jan.	-13,670	-17.9	-3460	-31.1	-1020	-16-1	-4210	-20.4
Feb.	-21,960	-28.8	-3520	-31.6	-2510	-41.4	-7090	-34.4
Mar.	-25,800	-33.8	-6070	-54.5	-2810	-46.3	-7700	-37.4
Apr.	-23,070	-30.2	-5310	-47.7	-1830	-30.2	-8590	-41.7
May	- 9,740	-12.7	-3710	-33.3	+ 510	+ 8.4	-2000	- 9.7
June	+ 3,160	+ 4.1	-1320	-11.8	+1330	+21.9	+1350	+ 6.6
July	+12,300	+16.1	+2680	+24.1	+1260	+20.8	+3040	+14.8
Aug.	+20,500	+26.8	+3530	+31.7	+1450	+23.9	+7470	+36.3
Sept.	+19,310	+25.3	+3430	+30.8	+1630	+26.9	+6290	+30.6
Oct.	+17,000	+22.3	+5060	+45.4	+1140	+18.8	+4930	+23.9
Nov.	+13,410	+17.6	+4980	+44.7	+ 250	+ 4.1	+4170	+20.3
Dec.	+ 8,450	+11.2	+3680	+33.0	+ 600	+ 9.9	+2380	+11.6
Ampl.of Variations:		20.6		35.0		22.4		24.0
Add. Ratio:		0.103		0.245		0.188		0.082
Mult. Ratio:		0.092		0.135		0.154		0.069

	Ontario		Saskatchewan		Alberta		British Columbia	
Month	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Jan.	-1550	- 8.2	- 640	-20.3	- 550	-11.1	-1170	-14.0
Feb.	-2300	-12.2	-1360	-43.2	-1420	-28.6	-1580	-18.9
Mar.	-3460	-18.3	-1380	-43.9	-1430	-28.8	-1630	-19.5
Apr.	-3000	-15.8	-1350	-42.9	-1430	-28.8	- 940	-11.2
May	-1790	- 9.5	-1210	-38.5	- 630	-12.7	- 220	- 2.6
June	+ 210	+ 1.1	+ 610	+19.4	+ 380	+ 7.6	+ 500	+ 6.0
July	+1570	+ 8.2	+ 940	+29.9	+ 730	+14.7	+1030	+12.3
Aug.	+3000	+15.7	+1150	+36.6	+1090	+21.9	+1350	+16.2
Sept.	+2860	+15.0	+1190	+37.8	+1250	+25.2	+1290	+15.4
Oct.	+2180	+11.4	+ 980	+31.2	+1380	+27.8	+ 860	+10.3
Nov.	+1540	+ 8.0	+ 640	+20.3	+ 590	+11.9	+ 580	+ 6.9
Dec.	+ 840	+ 4.4	+ 420	+13.4	+ 50	+ 1.0	- 70	- 0.8
Ampl.of Variations:		10.7		31.5		18.3		11.2
Add. Ratio:		0.113		0.030		0.228		0.185
Mult. Ratio:		0.110		0.018		0.111		0.129

in the post-war period is much smaller than in the pre-war years. The seasonal pattern has also undergone substantial changes, the trough month moving from late to early summer, reflecting perhaps the increased importance of late summer and fall activity in British Columbia. Seasonality of employment is clearly multiplicative in all these periods.

Table XVII. Typical Seasonal Variations in Employment in Forestry[25] in Canada, 1947-1951; 1932-1939; 1922-1929 on Page 90.

An unexpected difference between the results for British Columbia on the one hand, and Quebec and Ontario on the other, is that seasonality in the former seems to be additive while in the latter multiplicative. This may be due to the higher percentage of firms in British Columbia working the year round. In the east, the hiring and cutting in the winter months depends on the market expectations for the coming year. The greater the actual (or expected) demand the greater the employment in these months. If the demand is high enough certain firms will lengthen their periods of operation to include "unseasonal" months, but the main impact will be on the peak months. In British Columbia however, where the

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25 - The classification Forestry used for the employment figures in 1947-1951, and the classification Logging used for the pre-war figures are not strictly comparable, the former grouping being slightly broader, the difference however is not large enough to explain the significant changes that have taken place in the two periods.

TABLE XVII

Typical Seasonal Variations in Employment in Forestry[25], for Canada

(1) Seasonal Variations in Absolute Figures;
(2) Seasonal Variations in Percentages;

	1947-1951		1932-1939		1922-1929	
Month	(1)	(2)	(1)	(2)	(1)	(2)
Jan.	+23,900	+30.0	+17,940	+50.9	+12,920	+39.7
Feb.	+15,520	+19.5	+15,830	+44.9	+15,850	+48.7
Mar.	+11,690	+14.7	+ 7,160	+20.3	+12,730	+39.1
Apr.	- 6,390	- 8.0	- 8,710	-24.7	- 6,410	-19.7
May	-28,870	-36.3	-11,810	-33.5	- 7,910	-24.3
June	-16,860	-21.2	- 9,870	-28.0	- 5,920	-18.2
July	-11,190	-14.1	-10,640	-30.2	-10,220	-31.4
Aug.	-14,180	-17.8	-13,390	-38.0	-12,860	-39.5
Sept.	-13,660	-17.2	-14,910	-42.3	-10,420	-32.0
Oct.	- 1,970	- 2.5	- 6,130	-17.4	- 5,500	-16.9
Nov.	+15,760	+19.8	+11,070	+31.4	+ 3,940	+12.1
Dec.	+26,180	+32.9	+23,620	+67.0	+13,770	+42.3
Ampl.of Variations:	19.5		35.7		30.3	
Index of Similarity:			0.53		0.56	
Add. Ratio:	0.236		0.307		0.147	
Mult. Ratio:	0.116		0.097		0.103	

seasonal variations occur mainly in the inland operations, with coastal firms maintaining fairly steady employment, changes in demand may affect seasonal and "non-seasonal" firms unequally, producing changes in the amplitude of variations that can be more satisfactorily explained by reference to the effect of irregular influences than to changes in the non-seasonal level of activity.

Table XVIII. Typical Seasonal Variations in Employment in Forestry for Quebec and British Columbia, 1947-1951 on Page 92.

The seasonal patterns for Canada and Quebec are fairly constant from year to year in the post-war period, but the pattern in British Columbia has been subject to marked irregular changes due mainly to adverse weather conditions. Practically all woods operations were stopped for a time in the summer of 1951 due to drought. The amplitude ratios for this province are not too reliable in view of these erratic changes in pattern.

Table XIX. Short-Time Changes in Seasonality of Employment in Forestry on Page 92.

c) Pulp and Paper Mills

Of the three industries, chosen for separate comment here, whose seasonal variations are due to difficulties in producing under adverse weather conditions, the amplitude of variations is smallest in the Pulp and Paper industry. This is because the main operations in this industry are not

TABLE XVIII

Typical Seasonal Variations in Employment in Forestry by Province, 1947-1951

(1) Seasonal Variations in Absolute Figures;
(2) Seasonal Variations in Percentages;

	Quebec		Ontario		British Columbia	
Month	(1)	(2)	(1)	(2)	(1)	(2)
Jan.	+13,140	+39.8	+7,300	+32.7	-1,340	- 9.0
Feb.	+ 8,640	+25.6	+7,660	+34.3	-4,150	-27.8
Mar.	+ 6,890	+20.4	+6,370	+28.6	-3,700	-24.8
April	- 4,720	-14.0	- 160	- 0.7	-1,650	-11.1
May	-17,200	-51.0	-8,790	-39.4	+ 390	+ 2.6
June	- 9,430	-28.0	-6,140	-27.5	+1,550	+10.4
July	- 7,110	-21.1	-5,270	-23.6	+1,610	+10.8
Aug.	- 7,020	-20.8	-6,060	-27.2	+ 860	+ 5.8
Sept.	- 6,640	-19.7	-5,240	-23.5	+1,250	+ 8.4
Oct.	- 770	- 2.3	- 900	- 4.0	+1,770	+11.9
Nov.	+ 9,630	+28.6	+3,810	+17.1	+2,090	+14.0
Dec.	+14,350	+42.6	+7,390	+33.1	+1,360	+ 9.1
Ampl.of Variations:	26.2		24.3		12.1	
Add. Ratio:	0.171		0.194		0.263	
Mult. Ratio:	0.119		0.127		0.351	

TABLE XIX

Measures of Short-Time Changes in Seasonality of Employment in Forestry, 1947-1951

Region	Measure	1947	1948	1949	1950	1951
Canada	r	0.92	0.98	0.97	0.90	0.98
	b	0.98	1.23	1.01	0.89	0.79
Quebec	r	0.94	0.99	0.98	0.93	0.98
	b	0.87	1.20	1.17	0.99	0.75
British Columbia	r	0.78	0.91	0.97	0.97	0.63
	b	0.42	0.90	1.68	1.44	0.61

affected by climate, being sheltered in plants, it is subsidiary activities carried on out of doors which account for the seasonal variations in this industry.[26] The main such activity which is discontinued in the winter months is in the preparation of logs for the mills, such as "barking".

There is some regional variation in this industry's seasonal movement, both with regard to amplitude and to pattern. The British Columbia mills have the smallest amplitude while those in Quebec have the largest. The discrepancy between British Columbia and Quebec can perhaps be explained by the milder British Columbia climate, but is not obvious why the size of the amplitude in Ontario is closer to the British Columbia than to the Quebec value.

Table XX. Typical Seasonal Variations in Employment in Pulp and Paper Mills, by Province, 1947-1951 on Page 94.

The amplitude of variations are roughly the same in the pre-war and post-war periods. Some changes have occurred in the seasonal pattern and in the nature of seasonality as indicated by the additive or multiplicative test. In the twenties the differences between the amplitude of variations in each year were more subject to irregular influences than to changes in the non-seasonal level. In the two later periods the opposite is the case, seasonality being multiplicative.

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26 - Some of the seasonal movement may also be due to shortage of raw materials, i.e. logs, in the late winter because of limited storage facilities.

TABLE XX

Typical Seasonal Variations in Employment
in Pulp and Paper Mills, by Province,
1947-1951

(1) Seasonal Variations in Absolute Figures;
(2) Seasonal Variations in Percentages;

	New Brunswick		Quebec		Ontario		British Columbia	
Month	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Jan.	-180	-5.2	-1130	-4.7	-630	-3.7	-100	-2.2
Feb.	-230	-6.7	-1350	-5.6	-460	-2.7	-120	-2.6
Mar.	-230	-6.7	-1380	-5.7	-430	-2.5	-130	-2.9
Apr.	-200	-5.8	-1200	-5.0	-500	-2.9	-130	-2.9
May	- 80	-2.3	- 700	-2.9	-480	-2.8	-100	-2.2
June	∔110	∔3.2	∔ 390	∔1.6	∔ 20	∔0.1	- 10	-0.2
July	∔170	∔4.9	∔1270	∔5.3	∔560	∔3.3	∔150	∔3.3
Aug.	∔180	∔5.2	∔1550	∔6.4	∔750	∔4.4	∔140	∔3.1
Sept.	∔200	∔5.8	∔1490	∔6.2	∔780	∔4.6	∔ 90	∔2.0
Oct.	∔200	∔5.8	∔1010	∔4.2	∔470	∔2.8	∔ 80	∔1.8
Nov.	∔ 90	∔2.6	∔ 420	∔1.7	∔ 90	∔0.5	∔ 80	∔1.8
Dec.	- 20	∔0.6	- 310	-1.3	-120	-0.7	∔ 70	∔1.5
Ampl.of Variations:	4.6		4.2		2.6		2.2	
Add. Ratio:	0.225		0.084		0.144		0.401	
Mult. Ratio:	0.237		0.058		0.118		0.390	

Table XXI. Typical Seasonal Variations in Employment in Pulp and Paper Mills for Canada, 1947-1951; 1932-1939; 1922-1929 on Page 96.

d) All Other Group III Industries

The remaining Group III industries also have their trough period in the winter months, with the active season occurring in the summer and fall months. The amplitude of variations are quite large with, excepting Oil and Natural Gas, small values for the mean deviations obtained in the additive or multiplicative tests. In all cases the difference between the additive and multiplicative values is small indicating once more that the irregular factors influencing the amplitude of variations are as important as the changes in the non-seasonal level for the period covered in this study.[27]

Table XXII. Typical Seasonal Variations in Employment in Group III Industries, for Canada, 1947-1951 on Page 97.

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27 - A comparison of the mean deviation values, obtained in the additive or multiplicative test, for industry groups and for their component industries, and for an industry using national figures and for the same industry by provinces, confirms Woytinsky's finding with American data, that seasonality apparently varies widely for individual industries, but not so widely for industry groups. W.S. Woytinsky, Op. Cit.

TABLE XXI

Typical Seasonal Variations in Employment
in Pulp and Paper Mills, for Canada.

(1) Seasonal Variations in Absolute Figures;
(2) Seasonal Variations in Percentages;

	1947-1951		1932-1939		1922-1929	
Month	(1)	(2)	(1)	(2)	(1)	(2)
Jan.	-2,090	-4.1	-1,110	-4.2	-1,810	-6.2
Feb.	-2,280	-4.5	-1,350	-5.1	-1,370	-4.7
Mar.	-2,280	-4.5	-1,410	-5.3	-1,110	-3.8
April	-2,060	-4.1	-1,140	-4.3	-1,020	-3.5
May	-1,330	-2.6	- 980	-3.7	- 320	-1.1
June	± 540	±1.1	± 290	±1.1	± 930	±3.2
July	±2,230	±4.4	±1,030	±3.9	±1,400	±4.8
Aug.	±2,750	±5.4	±1,460	±5.5	±1,430	±4.9
Sept.	±2,690	±5.3	±1,300	±4.9	±1,400	±4.8
Oct.	±1,770	±3.5	±1,090	±4.1	± 910	±3.1
Nov.	± 660	±1,3	± 900	±3.4	± 230	±0.8
Dec.	- 560	-1.1	- 80	-0.3	- 530	-1.8
Ampl.of Variations:	3.5		3.8		3.6	
Index of Similarity:			0.81		0.75	
Add. Ratio:	0.111		0.180		0.102	
Mult. Ratio:	0.083		0.150		0.136	

TABLE XXII

Typical Seasonal Variations in Employment
in Group III Industries, for Canada, 1947-1951

(1) Seasonal Variations in Absolute Figures;
(2) Seasonal Variations in Percentages;

	Oil and Natural Gas		Non-Metal Mining		Saw and Planing Mills		Water Transportation	
Month	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Jan.	-330	-5.0	- 800	-7.2	-4250	-8.3	-2560	-8.7
Feb.	-440	-6.6	-1010	-9.1	-4070	-8.0	-6570	-22.3
March	-430	-6.5	-1020	-9.1	-3540	-7.0	-6550	-22.2
April	-390	-5.9	- 770	-6.9	-2720	-5.3	-4990	-16.9
May	-340	-5.1	-470	-4.2	-2480	-4.9	- 480	- 1.6
June	+ 80	+1.2	+ 130	+1.2	+1110	+2.2	+2750	+ 9.3
July	+270	+4.1	+ 790	+7.1	+3880	+7.6	+3760	+12.7
Aug.	+410	+6.2	+1220	+10.9	+5020	+9.9	+3920	+13.3
Sept.	+410	+6.2	+1150	+10.3	+4760	+9.3	+3500	+11.9
Oct.	+290	+4.4	+ 580	+5.2	+3200	+6.3	+3040	+10.3
Nov.	+310	+4.7	+240	+2.1	+1140	+2.2	+1890	+ 6.2
Dec.	+150	+2.3	- 60	-0.5	-2100	-4.1	+2310	+ 7.8
Ampl.of Variations:	4.9		6.2		6.3		11.9	
Add. Ratio:	0.193		0.086		0.070		0.026	
Mult. Ratio:	0.216		0.084		0.077		0.053	

	Steam Railways: Maintenance of Ways & Structures	
Month	(1)	(2)
Jan.	-2840	- 7.3
Feb.	-2590	- 6.6
March	-1820	- 4.7
April	-2210	- 5.7
May	-4650	-11.9
June	- 310	- 0.8
July	+1830	+ 4.7
Aug.	+3920	+10.0
Sept.	+3890	+10.0
Oct.	+3070	+ 7.9
Nov.	+1780	+ 4.6
Dec.	- 120	- 0.3
Ampl.of Variations:	6.2	
Add. Ratio:	0.092	
Mult. Ratio:	0.072	

CHAPTER IV

SEASONAL EMPLOYMENT

A. The Concept and Measurement

Typical seasonal variations in employment indicate the extent to which employment has, on the average, been redistributed by seasonal factors within a twelve month period.[1] This redistribution of employment is brought about by the creation and suspension of "seasonal" jobs depending on whether or not the seasonal factors are propitious for the particular type of economic activity being considered. Since seasonal variations have a twelve month period the creation and suspension of all "seasonal" jobs will be repeated every twelve months. This repetitive characteristic serves to distinguish "seasonal" jobs from other types of jobs, and thus "seasonal" employment from other types of employment. Making use of it we define seasonal employment as recurring employment lasting for at least one, but not more than eleven, months of the year. This definition allows us to measure seasonal employment from typical seasonal variations in employment.

a) To simplify the discussion in its first stages we assume that the level of non-seasonal employment is constant throughout the period under consideration, and make use of Figure 1.

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1 - In other words figures representing seasonal variations in employment indicate the extent to which "normal" seasonal factors can be expected to increase or decrease employment in each month over the non-seasonal level.

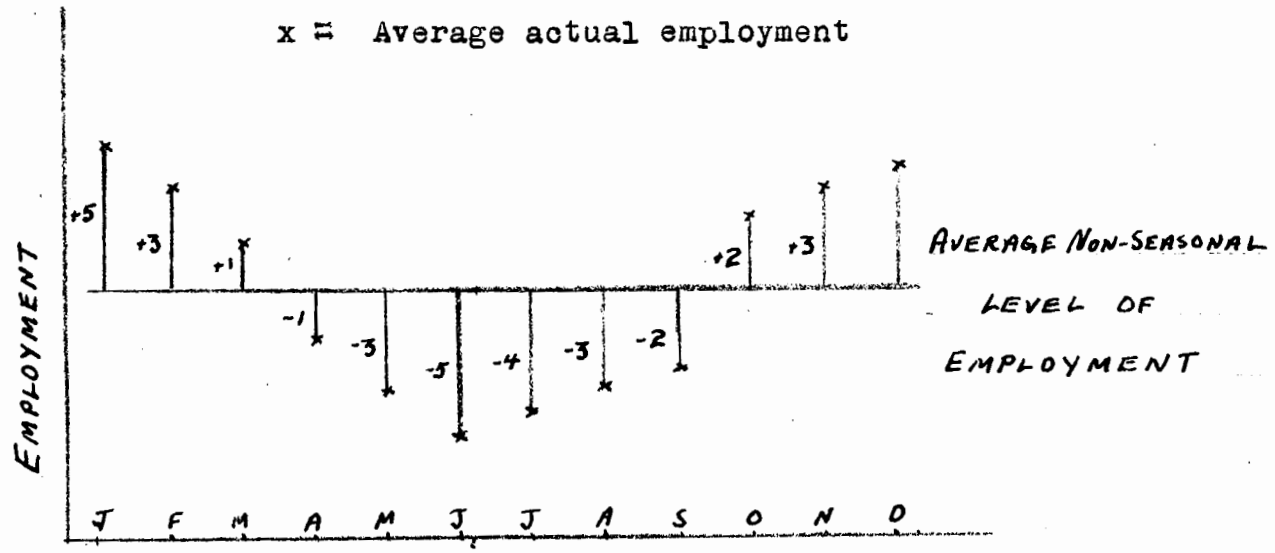

FIGURE 1

±5, ±3, etc., are the typical seasonal variations for January, February, etc.

Making use of our definition we see that seasonal employment in January is ten, that is ten of the jobs available in January do not last for a continuous twelve-month period. Similarly seasonal employment in February is eight, in March six, etc.. The general rule is obvious; "The amount of seasonal employment for any month can be obtained by subtracting from this month's typical seasonal value the trough month's value."[2]

b) Assume a changing non-seasonal level of employment.

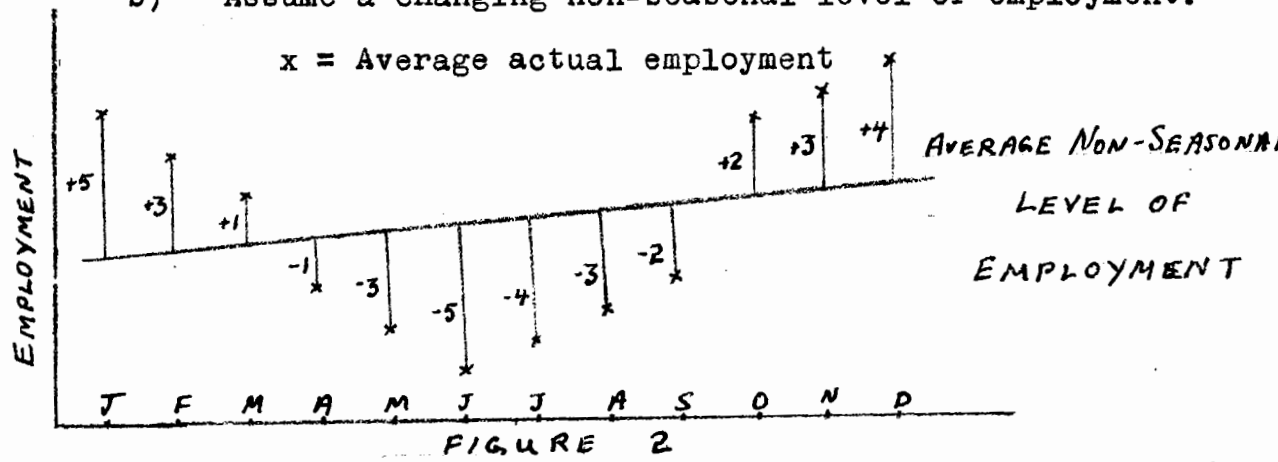

FIGURE 2

The typical seasonal variations are the same as in Fig. 1.

2 - This is similar to the rule used by Woytinsky, op.cit., 30-33.

The use of our definition of seasonal employment in this case requires more sophistication. In our first example it was obvious that ten of the jobs available in January disappear in June, and reappear again in the following January, but this is not the case when non-seasonal employment is rising (falling). The number of jobs disappearing is ten minus the non-seasonal increase (decrease) from January to June, while the number appearing from June to January is ten plus the non-seasonal increase (decrease) in this interval.

The observed changes in total employment are always net changes, the resultants of changes in seasonal, and in non-seasonal, employment. For analytical purposes it is necessary to go beyond the net changes to their components. Comparing the example in Figure 2 with the example in Figure 1, we see that the difference in total employment in June as compared to January is due solely to differences in the non-seasonal level of employment. The redistribution of employment by seasonal factors is the same in both cases, and thus seasonal employment, which is the result of this redistribution, should be the same in both cases. The amount of seasonal employment for any particular month can still be found by subtraction from the month's seasonal deviation, the trough month's deviation. In other words, all that is needed for estimating seasonal employment, say, for an industry, is its set of typical seasonal variations in employment, the movement of non-seasonal

employment is irrelevant.[3]

B. Interpretation of Measures of Seasonal Employment

The measure of seasonal employment, as defined above, for any particular month, indicates the maximum number of jobs, existing in that month, which will disappear at some time during the succeeding eleven months (appear again in twelve, disappear again in eleven, etc.), if non-seasonal employment remains constant. The usefulness of the figure is limited by the fact that it is indefinite in a certain range, it indicates the number that will disappear, at some time in the succeeding year, but does in no way describe the manner in which they will disappear, whether abruptly or gradually. This defect can be remedied by listing the month-to-month changes in seasonal employment.

The seasonal employment figures arranged in this manner indicate the typical changes in seasonal employment from one month to the other[4]. The difference between these values

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3 - This is strictly the case only when seasonality is additive, when seasonality is multiplicative the redistribution of employment due to seasonal factors changes, in absolute values, as non-seasonal employment changes, thus altering the amount of seasonal employment. But given the redistribution effect in absolute numbers, the multiplicativity of seasonality does not affect our general rule.

4 - When seasonality is multiplicative the "typical" changes (i.e. the average changes over the period covered by the original computations) should be supplemented by a percentage figure which will allow for variations in the absolute value of the seasonal movements as non-seasonal activity changes. The percentage figure is the seasonal relative for that month. The change in seasonal employment from one month to the other should be worked out anew each year in the following way: (a) Divide the actual employment in each month by its seasonal relative. (b) Subtract this value from the actual employment value to obtain the seasonal value in absolute numbers for this month in the particular year under study. (c) Compare the value obtained under (b) with the values calculated for the adjacent months in a similar manner to measure the month-to-month changes in seasonal employment.

and the actual change from one month to the other can be considered the change in non-seasonal employment for this period if it is assumed, that, (1) the seasonal factors at work during the time for which we want to estimate the non-seasonal component have the same effect as the seasonal factors at work during the period for which the seasonal variations have been computed, and (2) the measurement of seasonal variations is accurate. Neither of these assumptions can be expected to hold exactly, the influence of seasonal factors is variable within a certain range[5], and the measures of seasonal variations obtained using the method of moving averages are only good approximations[6]. These considerations limit the significance of the exact division of particular changes in monthly employment into seasonal and non-seasonal components, but do not rob it of all significance. These figures are a useful starting point for the analysis of employment changes, they can be supplemented by the analyst's knowledge of aberrations in the seasonal factors, such as "unseasonal" weather conditions, and thus meet, partly at least, objection (1).

C. Industrial and Regional Groupings

In choosing any group of firms (such as an industry) as the unit for which seasonal variations in employment are to be computed, it is implicitly assumed that only the net effect

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5 - See above Chapter I, pages 5-6.

6 - See above Chapter II, pages 22-23.

of any difference in the individual firms' reactions to seasonal influences is significant. That is, if, of two firms included in the group, one increases seasonal employment in a particular season while the other decreases seasonal employment, only the net increase or net decrease, increasing or decreasing total seasonal employment, should be taken into account. This lumping together of firms, (industries, etc.) which have different seasonal patterns, under-estimates the amount of seasonal employment in the group, since the algebraic sum of the seasonal variations of the firms constituting the group is smaller than the sum of the absolute values of the variations (except where the seasonal patterns are identical, and then the two sums are equal). This dampens the redistribution effect which determines the amount of seasonal employment.

The lumping together of different firms is, or is not, justified depending on the purpose of the study. If it is proposed to estimate total seasonal employment for the economy as a whole (that is, the total number of seasonal jobs), firms should be grouped together for the computation of seasonal variations only if their seasonal patterns are the same. If, however, one is interested in measuring changes in total seasonal employment, all firms can be grouped together. For example, let firms A and B have typical seasonal variations given below. The values for (A + B) are the variations observed if the

employment figures for the two firms are grouped before computing[7].

TABLE XXIII

	Typical Seasonal Variations			Seasonal Employment				Changes	
	1	2	3	4	5	6	7	8	9
	A	B	(A≠B)	A	B	A≠B	(A≠B)	A≠B	(A≠B)
J	-12(T)	≠ 8	- 4	0	18	18	10	-14	-14
F	-10	- 4	-14(T)	2	6	8	0	-10	-10
M	- 8	≠ 2	- 6	4	12	16	8	≠ 8	≠ 8
A	- 6	≠10(P)	≠ 4	6	20	26	18	≠10	≠10
M	- 4	≠ 2	- 2	8	12	20	12	- 6	- 6
J	- 2	-10(T)	-12	10	0	10	2	-10	-10
J	≠ 2	- 6	- 4	14	4	18	10	≠ 8	≠ 8
A	≠ 4	≠ 4	≠ 8	16	14	30	22	≠12	≠12
S	≠ 6	≠10(P)	≠16(P)	18	20	38	30	≠ 8	≠ 8
O	≠ 8	-10(T)	- 2	20	0	20	12	-18	-18
N	≠10	- 4	≠ 6	22	6	28	20	≠ 8	≠ 8
D	≠12(P)	- 2	≠10	24	8	32	24	≠ 4	≠ 4

P = peak
T = trough

The number of seasonal jobs in the group made up of firms A and B, for each month, is given in column (6). Comparing columns (6) and (7) we see that combining the employment figures for the two months before computing seasonal variations would

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7 - This is the justification for the procedure used. Let employment for A be given by ai, for B by bi, and thus for (A ≠ B) given by ai ≠ bi (i = 1, 2,.....).

Let trend-cyclical-irregular component in i^{th} month for A be given by ti^a, for B by ti^b.

Assume seasonality additive and let seasonal value for i^{th} month in A be given by S_i^a, in B by S_i^b

$$ai = t_i^a \neq S_i^a; \quad bi = t_i^b \neq S_i^b$$

$$a_i \neq b_i = t_i^a \neq t_i^b \neq S_i^a \neq S_i^b$$

In other words, $S_i^a \neq S_i^b$ is the seasonal value of the i^{th} month for (A ≠ B).

under-estimate the number of seasonal jobs in the group. Comparing columns (8) and (9) we see that this difference does not however affect the values representing the month-to-month changes in seasonal employment.

In the present study we are interested in both the level of seasonal employment, and the changes in this level. We are interested in the latter as an aid in the analysis of actual employment changes and for this purpose not only the net figures, but also the components of these figures are significant. In considering the seasonal employment changes for the economy as a whole, or for a region, the individual industry movements which combine to give the final result are certainly of importance. Therefore, in order to satisfy both the above purposes of the present study, an industrial and regional grouping which only includes firms with identical seasonal patterns is required. For the reasons discussed in Chapter III, the breakdown we will use is the one for which index numbers of monthly employment are given in the D.B.S. Employment and Payrolls publication.

The month-to-month changes in seasonal employment are to be presented in a "calendar"[8] of the following form.

The calendars for all industries will be combined to show the diverse tendencies in the various industries for each month and the net effect.

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8 - The form of this calendar is due to Woytinsky, op.cit., 97-111.

TABLE XXIV

Calendar of Changes in Seasonal Employment in the Saw and Planning Mills Industry, Quebec, 1947-1951.

	Seasonal Employment Conditions	Seasonal Employment Higher ≠ Lower - than Previous Month
J	Lowest Point	-890
F	Slack Season	≠100
M	Slack Season	≠100
A	Slack Season	≠ 90
M	End of Slack Season	≠210
J	Beginning of Active Season	≠1,190
J	Active Season	≠950
A	Highest Point	≠480
S	Active Season	-210
O	Active Season	-400
N	End of Active Season	-650
D	Beginning of Slack Season	-970

The raw materials for our calendar will be the typical seasonal variations, in absolute figures, for the industries on a national basis, given in Chapter III. These figures will enable us to obtain the total month-to-month changes, but in many cases the industrial grouping is broad and not all of the component industries are reported separately (e.g. Textile Products) and therefore many of the individual movements escape notice. Similarly the reliance solely on national figures will obscure some of the variations in provincial figures. These limitations are necessary in this study because of lack of time and space to process the additional computations which are available, and because some of the computations do not exist due to gaps in employment data. Whenever the typical seasonal variations in employment are available for an

industry group[9] as a whole and only for some of its component industries, or for an industry nationally and not all of the provinces, the typical seasonal variations can be extended one step further than available material, in the following way.

The seasonal variations for a group (e.g. Canada or Industry group) are equal to the algebraic sum of the seasonal variations of its components[10] (e.g. provinces or individual industries). Therefore if no employment figures are given for an industry in one province(s), its (net) seasonal variations in the missing province(s) can be derived by computing the variations using national figures, and separately for each of the reported provinces. The difference between those two is equal to the seasonal variations for that industry in the missing province(s). The same procedure is used to estimate the seasonal variations for missing industries from the seasonal variations in the industry group and the reported industries.

The method can be illustrated symbolically. Let:

X_1 be the January seasonal variation value for an industry

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9 - Any "industry" which is broken down into component industries in the publication is called here an industry group; e.g. Construction, which is divided into Buildings and Structures, and Highways, Bridges and Street Construction, is for our purposes and industry group. An industry for which no further breakdown is given, e.g. Buildings and Structures, is called an individual industry.

10 - See Note 7.

for all of Canada (or for an industry group), X_2 be the February value etc. — Y_1^1 be the January seasonal variation value for an industry for the province [1](or for an individual industry[1] for all of Canada); — Y_2^1 be the February value, etc.

— Y_1^{11} be the January seasonal variation value for the same industry in province [11](or for individual industry[11] in the same industry group for all of Canada); Y_2^{11} be the February value, etc.

Assuming the national (or industry group) and provincial (or industry) seasonal indexes have been computed, the results are arranged in the following manner:

Typical Seasonal Variations in Absolute Numbers			Difference
Month	Can. (Ind. Group)	Prov. Total (Comp. Ind. Total)	(Equals typical net seasonal variations of missing province(s) (industries) in absolute numbers.)
(1)	(2)	(3)	(4)
J	X_1	$Y_1(= Y_1^1 + Y_1^{11} + Y_1^{111} \ldots)$	$X_1 - Y_1$
F	X_2	$Y_2(= Y_2^1 + Y_2^{11} + Y_2^{111} \ldots)$	$X_2 - X_2$
M	X_3	$Y_3(= Y_3^1 + Y_3^{11} + Y_3^{111} \ldots)$	$X_3 - X_3$
A	X_4	$Y_4(= Y_4^1 + Y_4^{11} + Y_4^{111} \ldots)$	$X_4 - X_4$
-	-	----------	-------
-	-	----------	-------
-	-	----------	-------

From these figures of typical seasonal variations the volume of seasonal employment and unemployment can be

estimated as previously explained.[11]

D. Calendar of Seasonal Employment[12]

The following calendar enables us to observe the net affect of the diverse seasonal movements on seasonal employment[13]. It should not be interpreted as showing the changes in total seasonal employment for Canada since it includes only non-agricultural industries, and not all of these. This lack of complete coverage leads to results which do not wholly agree with related data.

If the size of the labour force remains constant the seasonal pattern in employment should be the exact opposite of the seasonal pattern in unemployment. However the net seasonal movement for all industries presented in this calendar and the net seasonal movements in unemployment for Canada, based on the number of unplaced applicants registered with the National Employment Service, to be given in the next

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11 - For example, in Table XXIII, above, assume that the B and (A + B) figures are given, it is obvious that the A figures can be easily obtained using this method.

12 - The level of seasonal employment in any industry, for any month, can be obtained from the month-to-month changes presented in the seasonal calendar below, in the following way: Starting at the trough month where, by definition, seasonal employment is zero we add together the month-to-month changes until we reach the given month. The result is the seasonal employment for that month in that industry. For example; seasonal employment in Men's Clothing in March is equal + 1150 (Change from trough month, January, to next month, February,) plus + 210 (Change from February to next month, March), which equals 1360.

13 - In some cases where total employment in the component industries for which employment data is published, and for which seasonality has been considered to be significant in this study, does not equal total employment in the industry group, the month-to-month changes in seasonal employment are shown for the industry group as well. In obtaining the net change for all industries, only the industry group figures are used.

chapter do not have exactly opposite seasonal patterns. The trough for the former occurs sometime between April 1 and May 1 and the peak for the latter at approximately the middle of March. While the peak of the former occurs between December 1 and January 1 and the trough for the latter at approximately the middle of September. The discrepancy of one month in the spring seems to be due to the large decrease in seasonal employment in Forestry which is not fully offset by increases in the industries included in our calendar. Changes in industries not included, such as Agriculture might have been sufficient to offset declines in Forestry employment. The larger discrepancy in the fall would certainly be partly due to the increasing employment in Forestry which would be offset by decreasing employment in Agriculture if the figures for this industry were available. The increase in the December seasonal employment is due to the sharp rise in employment in Retail Trade. This increase in employment will be greater than the induced decrease in unplaced applicants, since many of those hired are temporary entrants to the labour force who do not register with the National Employment Service.

CALENDAR OF SEASONAL EMPLOYMENT - JANUARY

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Forestry	Beginning of Active Season	-2280
Mining	Beginning of Slack Season	-2300
Coal Mining	Active Season	- 460
Oil and Natural Gas	Beginning of Slack Season	- 480
Non-Metal Mining	Slack Season	- 740
Food and Beverages		
Meat Products	End of Active Season	-1380
Dairy Products	Slack Season	- 220
Canned and Cured Fish	Slack Season	-1320
Canned and Preserved Fruits & Vegetables	Slack Season	-3510
Grain Mill Products	Trough	- 280
Bread & Other Bakery Products	Beginning of Slack Season	- 330
Distilled & Malt Liquors	End of Active Season	- 160
Other Beverages	Slack Season	+ 90
Other Foods	End of Active Season	-2620
Tobacco & Tobacco Products	Active Season	+770
Leather Products		
Boots & Shoes (except rubbers)	Slack Season	- 100
Other Leather Products	Trough	- 590
Textile Products (except Clothing)	Beginning of Active Season	- 150
Cotton, Yarn & Broad Woven Goods	End of Slack Season	+120
Woollen Goods	Beginning of Active Season	- 70

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Clothing (Textile & Fur)	Secondary Trough	-2600
Men's Clothing	Trough	-1020
Women's Clothing	Secondary Slack Season	- 520
Knit Goods	Active Season	- 450
Fur Goods	Beginning of Slack Season	- 180
Hats & Caps	Trough	- 60
Wood Products		
Saw & Planing Mills	Trough	-2150
Furniture	Active Season	+ 60
Other Wood Products	Slack Season	- 510
Paper Products	Slack Season	-1770
Pulp & Paper Mills	Slack Season	-1530
Agricultural Implements	End of Slack Season	+ 270
Heating & Cooking Appliances	Temporary Decrease	- 300
Iron Castings	" "	- 500
Transportation Equipment	Beginning of Slack Season	-2010
Motor Vehicles	" " "	- 210
Motor Vehicle Parts	Trough	- 110
Shipbuilding & Repairing	"	-1300
Non-Metallic Mineral Products	Beginning of Slack Season	- 930
Clay Products	" " "	- 250
Glass & Glass Products	Slack Season	- 30
Products of Petroleum & Coal	" "	- 60

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Acids, Alkalis & Salts	Trough	- 100
Construction	Beginning of Slack Season	-36930
Buildings & Structures	" " "	-15170
Highways, Bridges & Streets	" " "	-22210
Transportation	" " "	- 8820
Steam Railways		
Maintenance of Ways & Structures	Slack Season	- 2720
Transportation	Temporary Increase	+ 850
Telegraphs	Beginning of Slack Season	- 140
Truck Transportation	" " "	- 330
Water Transportation	" " "	- 4870
Storage		
Grain Elevators	Beginning of Slack Season	- 640
Storage & Warehouse	" " "	- 240
Communication	Slack Season	- 390
Public Utility Operations		
Electric Light & Power	Slack Season	- 670
Other Public Utilities	Beginning of Slack Season	- 140
Wholesale Trade	" " "	- 2670
Retail Trade	Peak	+2090
Service	Slack Season	- 1180
Hotels & Restaurants	" "	- 460
Laundries & Dry Cleaning	" "	- 330
All Industries		-74,570

FEBRUARY

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER / LOWER - THAN PREVIOUS MONTH
Forestry	Active Season	- 8380
Mining	Slack Season	/ 400
Coal Mining	Peak	/ 740
Oil and Natural Gas	Trough	- 110
Non-Metal Mining	Slack Season	- 210
Food and Beverages		
Meat Products	Beginning of Slack Season	- 1110
Dairy Products	Slack Season	- 250
Canned and Cured Fish	Slack Season	- 30
Canned & Preserved Fruits and Vegetables	Slack Season	- 270
Grain Mill Products	Slack Season	/ 30
Bread & Other Bakery Products	Slack Season	- 60
Distilled & Malt Liquors	Beginning of Slack Season	- 650
Other Beverages	Slack Season	- 290
Other Foods	Beginning of Slack Season	- 990
Tobacco and Tobacco Products	Peak	/ 400
Leather Products		
Boots and Shoes	Beginning of Active Season	/ 700
Other Leather Products	Beginning of Active Season	/ 460
Textile Products	Active Season	/ 540
Cotton Yarn & Broad Woven Goods	Beginning of Active Season	/ 420
Woollen Goods	Active Season	/ 270

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER / LOWER- THAN PREVIOUS MONTH
Clothing	Beginning of Active Season	/ 3910
Men's Clothing	Beginning of Active Season	/ 1150
Women's Clothing	Beginning of Active Season	/ 1440
Knit Goods	Active Season	/ 610
Fur Goods	Trough	- 150
Hats and Caps	Beginning of Active Season	/ 280
Wood Products		
Saw & Planing Mills	Slack Season	/ 180
Furniture	Peak	/ 170
Other Wood Products	Trough	- 340
Paper Products	Slack Season	- 130
Pulp & Paper Mills	Trough	- 190
Agricultural Implements	Normal Activity	/ 420
Heating & Cooking Appliances	End of Active Season	/ 80
Iron Castings	Beginning of Active Season	/ 770
Transportation Equipment	Trough	- 1910
Motor Vehicles	Trough	- 480
Motor Vehicle Parts	Slack Season	/ 130
Shipbuilding and Repairing	Slack Season	/ 490
Non-Metallic Mineral Products	Slack Season	/ 120
Clay Products	Slack Season	- 50
Glass & Glass Products	Slack Season	/ 40

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Products of Petroleum and Coal	Trough	- 130
Acids, Alkalis, Salts	Slack Season	+ 70
Construction	Slack Season	-13190
Buildings & Structures	Slack Season	- 4820
Highways, Bridges & Streets	Slack Season	- 8290
Transportation	Slack Season	- 5240
Maintenance of Ways & Structures	Slack Season	+ 250
Transportation	Slack Season	- 2970
Telegraphs	Slack Season	- 70
Truck Transportation	Slack Season	- 250
Water Transportation	Trough	- 4010
Storage		
Grain Elevators	Slack Season	- 520
Storage & Warehouse	Slack Season	- 130
Communication	Slack Season	- 320
Public Utility Operation		
Electric Light & Power	Slack Season	- 420
Other Public Utilities	Slack Season	—— ——
Wholesale Trade	Slack Season	- 540
Retail Trade	Beginning of Slack Season	-23220
Service	Slack Season	- 290
Hotels & Restaurants	Slack Season	- 520
Laundries & Dry Cleaning	Slack Season	+ 150
All Industries		-50,960

MARCH

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER / LOWER - THAN PREVIOUS MONTH
Forestry	End of Active Season	- 3830
Mining	Trough	- 880
Coal Mining	Active Season	- 360
Oil & Natural Gas	Slack Season	/ 10
Non-Metal Mining	Trough	- 10
Food and Beverages		
Meat Products	Slack Season	- 860
Dairy Products	Trough	- 30
Canned & Cured Fish	Slack Season	- 560
Canned & Preserved Fruits and Vegetables	Slack Season	- 910
Grain Mill Products	Slack Season	——
Bread & Other Bakery Products	Slack Season	- 130
Distilled & Malt Liquors	Slack Season	- 20
Other Beverages	Trough	- 80
Other Foods	Slack Season	- 150
Tobacco & Tobacco Products	Active Season	- 310
Leather Products		
Boots and Shoes	Active Season	/ 250
Other Leather Products	Peak	/ 280
Textile Products	Peak	/ 1170
Cotton Yarn & Broad Woven Goods	Peak	/ 190
Woollen Goods	Peak	/ 160

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER / LOWER - THAN PREVIOUS MONTH
Clothing	Active Season	/ 1170
Men's Clothing	Active Season	/ 210
Women's Clothing	Active Season	/ 550
Knit Goods	Peak	/ 100
Fur Goods	Slack Season	/ 90
Hats & Caps	Peak	/ 80
Wood Products		
Saw & Planing Mills	Slack Season	/ 530
Furniture	Active Season	- 10
Other Wood Products	Slack Season	/ 160
Paper Products	Trough	- 160
Pulp & Paper Mills	Trough	— —
Agricultural Implements	Beginning of Active Season	/ 330
Heating and Cooking Appliances	Normal Activity	- 150
Iron Castings	Active Season	/ 50
Transportation Equipment	End of Slack Season	/ 3120
Motor Vehicles	Slack Season	/ 420
Motor Vehicle Parts	End of Slack Season	/ 180
Shipbuilding & Repairing	End of Slack Season	/ 860
Non-Metallic Mineral Products	Trough	- 220
Clay Products	Trough	- 70
Glass & Glass Products	Trough	- 50

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER / LOWER - THAN PREVIOUS MONTH
Products of Petroleum & Coal	Slack Season	/ 90
Acids, Alkalis, & Salts	Slack Season	——
Construction	Trough	- 6590
Buildings & Structures	Trough	- 2860
Highways, Bridges & Streets	Trough	- 3840
Transportation	Trough	- 590
Steam Railways		
Maintenance of Ways & Structures	Slack Season	/ 770
Transportation	Trough	- 1280
Telegraphs	Trough	- 100
Truck Transportation	Slack Season	- 30
Water Transportation	Slack Season	/ 20
Storage		
Grain Elevators	Trough	- 200
Storage & Warehouses	Slack Season	- 40
Communication	Trough	- 80
Public Utility Operation		
Electric Light & Power	Slack Season	- 180
Other Public Utilities	Trough	- 70
Wholesale Trade	Slack Season	- 430
Retail Trade	Trough	- 1350
Service	Trough	- 800
Hotels & Restaurants	Trough	- 540
Laundries & Dry Cleaning	Trough	- 170
All Industries		-11,510

APRIL

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER / LOWER - THAN PREVIOUS MONTH
Forestry	Beginning of Slack Season	-13,080
Mining	Slack Season	/ 480
Coal Mining	End of Active Season	- 120
Oil & Natural Gas	Slack Season	/ 40
Non-Metal Mining	Slack Season	/ 250
Food & Beverages		
Meat Products	Trough	- 200
Dairy Products	Slack Season	/ 260
Canned & Cured Fish	Trough	- 30
Canned & Preserved Fruits & Vegetables	Trough	- 330
Grain Mill Products	Slack Season	/ 70
Bread & Other Bakery Products	Trough	- 140
Distilled & Malt Liquors	Trough	- 30
Other Beverages	Slack Season	/ 80
Other Foods	Trough	- 540
Tobacco & Tobacco Products	End of Active Season	- 940
Leather Products		
Boots and Shoes	Peak	/ 50
Other Leather Products	Active Season	/ 280
Textile Products	Active Season	- 50
Cotton Yarn & Broad Woven Goods	Active Season	- 70
Woollen Goods	Active Season	- 10
Clothing	Peak	/ 340

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Men's Clothing	Peak	+ 240
Women's Clothing	Peak	+ 190
Knit Goods	Active Season	- 140
Fur Goods	End of Slack Season	+ 50
Hats & Caps	Active Season	- 10
Wood Products		
Saw & Planing Mills	Slack Season	+ 820
Furniture	End of Active Season	- 160
Other Wood Products	Slack Season	+ 220
Paper Products	Slack Season	+ 80
Pulp & Paper Mills	Slack Season	+ 220
Agricultural Implements	Active Season	+ 340
Heating & Cooking Appliances	Beginning of Slack Season	- 100
Iron Castings	Peak	+ 40
Transportation Equipment	Normal Activity	+ 350
Motor Vehicles	Slack Season	- 370
Motor Vehicle Parts	Normal Activity	+ 130
Shipbuilding & Repairing	Beginning of Active Season	+ 830
Non-Metallic Mineral Products	Slack Season	- 210
Clay Products	Slack Season	+ 100
Glass & Glass Products	End of Slack Season	+ 90
Products of Petroleum & Coal	Slack Season	+ 60
Acids, Alkalis, & Salts	Slack Season	+ 20
Construction	Slack Season	+ 3960

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Buildings & Structures	Slack Season	+ 1620
Highways, Bridges & Streets	Slack Season	+ 2730
Transportation	Slack Season	+ 1490
Steam Railways		
Maintenance of Ways & Structures	Slack Season	- 390
Transportation	Slack Season	+ 530
Telegraphs	Slack Season	+ 60
Truck Transportation	Trough	- 40
Water Transportation	Slack Season	+ 1560
Storage		
Grain Elevators	Slack Season	+ 140
Storage & Warehouse	Trough	- 20
Communication	Slack Season	+ 190
Public Utility Operation		
Electric Light & Power	Trough	- 110
Other Public Utilities	Slack Season	+ 40
Wholesale Trade	Slack Season	- 550
Retail Trade	Slack Season	+ 130
Service	Slack Season	+ 450
Hotels & Restaurants	Slack Season	+ 80
Laundries & Dry Cleaning	End of Slack Season	+ 240
All Industries		-11,600

M A Y

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER / LOWER - THAN PREVIOUS MONTH
Forestry	Trough	-22480
Mining	Slack Season	- 260
Coal Mining	Beginning of Slack Season	- 540
Oil & Natural Gas	End of Slack Season	/ 50
Non-Metal Mining	End of Slack Season	/ 300
Food and Beverages		
Meat Products	Slack Season	/ 240
Dairy Products	End of Slack Season	/ 440
Canned and Cured Fish	End of Slack Season	/ 1020
Canned & Preserved Fruits & Vegetables	Slack Season	/ 450
Grain Mill Products	Slack Season	/ 70
Bread & Other Bakery Products	Slack Season	/ 30
Distilled & Malt Liquors	Slack Season	/ 140
Other Beverages	End of Slack Season	/ 330
Other Foods	Slack Season	/ 70
Tobacco & Tobacco Products	Beginning of Slack Season	- 1120
Leather Products		
Boots and Shoes	Active Season	- 130
Other Leather Products	End of Active Season	- 90
Textile Products	End of Active Season	- 1030
Cotton Yarn & Woven Goods	Active Season	- 180
Woollen Goods	Active Season	- 270
Clothing	Active Season	- 960

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER / THAN PREVIOUS MONTH	LOWER - THAN PREVIOUS MONTH
Men's Clothing	Active Season		- 70
Women's Clothing	Active Season		- 430
Knit Goods	End of Active Season		- 340
Fur Goods	Beginning of Secondary Active Season	/ 90	
Hats & Caps	End of Active Season		- 70
Wood Products			
Saw & Planing Mills	Slack Season	/ 240	
Furniture	Beginning of Slack Season		- 410
Other Wood Products	End of Slack Season	/ 130	
Paper Products	End of Slack Season	/ 620	
Pulp & Paper Mills	End of Slack Season	/ 730	
Agricultural Implements	Peak	/ 20	
Heating & Cooking Appliances	Slack Season		- 140
Iron Castings	Active Season		- 250
Transportation Equipment	Normal Activity	——	——
Motor Vehicles	Slack Season	/ 60	
Motor Vehicle Parts	Beginning of Active Season	/ 160	
Shipbuilding & Repairing	Active Season	/ 10	
Non-Metallic Mineral Products	End of Slack Season	/ 500	
Clay Products	End of Slack Season	/ 70	
Glass & Glass Products	Beginning of Active Season	/ 190	
Products of Petroleum & Coal	End of Slack Season	/ 60	
Acids, Alkalis, & Salts	End of Slack Season	—	—

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Construction	End of Slack Season	+17500
Buildings & Structures	Slack Season	+ 3920
Highways, Bridges & Streets	End of Slack Season	+13330
Transportation	End of Slack Season	+ 1790
Steam Railways		
Maintenance of Ways & Structures	Trough	- 2440
Transportation	Slack Season	+ 750
Telegraphs	Slack Season	+ 10
Truck Transportation	End of Slack Season	+ 250
Water Transportation	End of Slack Season	+ 4510
Storage		
Grain Elevators	Slack Season	+ 350
Storage & Warehouse	End of Slack Season	+ 140
Communication	End of Slack Season	+ 170
Public Utility Operation		
Electric Light & Power	End of Slack Season	+ 280
Other Public Utilities	End of Slack Season	+ 110
Wholesale Trade	Trough	- 180
Retail Trade	Slack Season	+ 2700
Service	Slack Season	+ 450
Hotels & Restaurants	Slack Season	+ 720
Laundries & Dry Cleaning	Beginning of Active Season	+ 390
All Industries		+ 80

J U N E

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER / LOWER - THAN PREVIOUS MONTH
Forestry	Slack Season	/12010
Mining	End of Slack Season	/ 890
Coal Mining	Trough	- 630
Oil & Natural Gas	Beginning of Active Season	/ 420
Non-Metal Mining	Beginning of Active Season	/ 600
Food & Beverages		
Meat Products	End of Slack Season	/ 790
Dairy Products	Beginning of Active Season	/ 620
Canned & Cured Fish	Beginning of Active Season	/ 1400
Canned & Preserved Fruits and Vegetables	Slack Season	/ 880
Grain Mill Products	End of Slack Season	—— ——
Bread & Other Bakery Products	End of Slack Season	/ 250
Distilled & Malt Liquors	End of Slack Season	/ 250
Other Beverages	Beginning of Active Season	/ 400
Other Foods	Slack Season	/ 630
Tobacco & Tobacco Products	Slack Season	- 30
Leather Products		
Boots and Shoes	Beginning of Slack Season	- 540
Other Leather Products	Beginning of Slack Season	- 260
Textile Products	Beginning of Slack Season	- 830
Cotton Yarn & Broad Woven Goods	End of Active Season	- 260
Woollen Goods	End of Active Season	- 150
Clothing	End of Active Season	- 1920

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Men's Clothing	Active Season	- 230
Women's Clothing	Beginning of Slack Season	- 1080
Knit Goods	Beginning of Slack Season	- 390
Fur Goods	Secondary Peak	+ 80
Hats & Caps	Normal Activity	- 100
Wood Products		
Saw & Planing Mills	Beginning of Active Season	+ 3590
Furniture	Slack Season	- 210
Other Wood Products	Beginning of Active Season	+ 320
Paper Products	Active Season	+ 1860
Pulp & Paper Mills	Active Season	+ 1870
Agricultural Implements	Active Season	- 110
Heating & Cooking Appliances	Trough	- 40
Iron Castings	End of Active Season	- 190
Transportation Equipment	Beginning of Active Season	+ 800
Motor Vehicles	End of Slack Season	+ 510
Motor Vehicle Parts	Active Season	+ 100
Shipbuilding & Repairing	Active Season	+ 90
Non-Metallic Mineral Products	Beginning of Active Season	+ 570
Clay Products	Beginning of Active Season	+ 280
Glass & Glass Products	Active Season	+ 20
Products of Petroleum & Coal	Beginning of Active Season	+ 220
Acids, Alkalis, Salts	Beginning of Active Season	+ 110
Construction	Beginning of Active	+21220

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Building & Structures	End of Slack Season	+ 8330
Highways, Bridges, & Streets	Beginning of Active Season	+12900
Transportation	Beginning of Active Season	+ 8830
Steam Railways		
Maintenance of Ways & Structures	End of Slack Season	+ 4340
Transportation	End of Slack Season	+ 630
Telegraphs	End of Slack Season	+ 160
Truck Transportation	Beginning of Active Season	+ 370
Water Transportation	Beginning of Active Season	+ 3230
Storage		
Grain Elevators	End of Slack Season	+ 140
Storage & Warehouse	Beginning of Active Season	+ 200
Communication	Beginning of Active Season	+ 710
Public Utility Operation		
Electric Light & Power	Beginning of Active Season	+ 1230
Other Public Utilities	Beginning of Active Season	+ 130
Wholesale Trade	Slack Season	+ 670
Retail Trade	Slack Season	+ 610
Service	End of Slack Season	+ 1960
Hotels & Restaurants	End of Slack Season	+ 1390
Laundries & Dry Cleaning	Active Season	+ 210
ALL Industries		+57,160

J U L Y

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER / LOWER - THAN PREVIOUS MONTH
Forestry	Slack Season	/ 5670
Mining	Active Season	/ 1670
Coal Mining	Slack Season	/ 170
Oil & Natural Gas	Active Season	/ 190
Non-Metal Mining	Active Season	/ 660
Food and Beverages		
Meat Products	Beginning of Active Season	/ 670
Dairy Products	Active Season	/ 500
Canned & Cured Fish	Active Season	/ 1100
Canned & Preserved Fruits & Vegetables	Beginning of Active Season	/ 4140
Grain Mill Products	Beginning of Active Season	/ 170
Bread & Other Bakery Products	Beginning of Active Season	/ 430
Distilled & Malt Liquors	Beginning of Active Season	/ 440
Other Beverages	Active Season	/ 520
Other Foods	Slack Season	/ 630
Tobacco and Tobacco Products	Slack Season	/ 40
Leather Products		
Boots and Shoes	Slack Season	- 540
Other Leather Products	Slack Season	- 100
Textile Products	Slack Season	- 530
Cotton Yarn & Broad Woven Goods	Beginning of Slack Season	- 190
Woollen Goods	Beginning of Slack Season	- 160

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER / LOWER - THAN PREVIOUS MONTH
Clothing	Beginning of Slack Season	-1930
Men's Clothing	End of Active Season	- 210
Women's Clothing	Slack Season	- 820
Knit Goods	Slack Season	- 430
Fur Goods	End of Secondary Active Season	- 60
Hats & Caps	Secondary Slack Season	- 110
Wood Products		
Saw & Planing Mills	Active Season	/ 2770
Furniture	Slack Season	- 160
Other Wood Products	Active Season	/ 320
Paper Products	Active Season	/ 2020
Pulp & Paper Mills	Active Season	/ 1690
Agricultural Emplements	Active Season	- 140
Heating & Cooking Appliances	Slack Season	/ 50
Iron Castings	Beginning of Slack Season	- 210
Transportation Equipment	Active Season	/ 210
Motor Vehicles	Active Season	/ 770
Motor Vehicle Parts	Peak	/ 70
Shipbuilding & Repairing	Active Season	- 140
Non-Metallic Mineral Products	Active Season	/ 370
Clay Products	Peak	/ 160
Glass & Glass Products	Peak	/ 130
Products of Petroleum & Coal	Active Season	/ 110
Acids, Alkalis & Salts	Peak	/ 120

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
CONstruction	Active Season	+14740
Buildings & Structures	Beginning of Active Season	+ 6880
Highways, Bridges & Streets	Active Season	+ 9140
Transportation	Active Season	+ 5830
Steam Railways		
Maintenance of Ways & Structures	Beginning of Active Season	+ 2140
Transportation	Beginning of Active Season	+ 2610
Telegraphs	Beginning of Active Season	+ 230
Truck Transportation	Active Season	- 30
Water Transportation	Active Season	+ 1010
Storage		
Grain Elevators	Beginning of Active Season	+ 210
Storage & Warehouse	Temporary Decrease	- 50
Communication	Active Season	+ 740
Public Utility Operation		
Electric Light & Power	Active Season	+ 940
Other Public Utilities	Active Season	+ 40
Wholesale Trade	End of Slack Season	+ 1270
Retail Trade	Slack Season	+ 740
Service	Beginning of Active Season	+ 3460
Hotels & Restaurants	Active Season	+ 2810
Laundries & Dry Cleaning	Peak	+ 250
All Industries		+46,260

A U G U S T

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER / LOWER - THAN PREVIOUS MONTH
Forestry	Slack Season	- 2990
Mining	Peak	/ 470
Coal Mining	Slack Season	— —
Oil & Natural Gas	Peak	/ 140
Non-Metal Mining	Peak	/ 430
Food and Beverages		
Meat Products	Active Season	/ 420
Dairy Products	Peak	/ 60
Canned & Cured Fish	Active Season	/ 1120
Canned & Preserved Fruits & Vegetables	Active Season	/ 3040
Grain Mill Products	Active Season	- 20
Bread & Other Bakery Products	Active Season	/ 120
Distilled & Malt Liquors	Active Season	/ 210
Other Beverages	Peak	- 180
Tobacco & Tobacco Products	Trough	- 220
Leather Products		
Boots & Shoes	Slack Season	/ 70
Other Leather Products	Secondary Trough	- 30
Textile Products	Trough	- 880
Cotton Yarn & Broad Woven Goods	Slack Season	- 160
Woollen Goods	Trough	- 270
Clothing	Trough	- 2260
Men's Clothing	Secondary Trough	- 820

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Women's Clothing	Trough	- 540
Knit Goods	Trough	- 590
Fur Goods	Secondary Slack Season	- 90
Hats & Caps	Secondary Slack Season	+ 10
Wood Products		
Saw & Planing Mills	Peak	+ 1140
Furniture	Trough	- 160
Other Wood Products	Active Season	——
Paper Products	Active Season	+ 160
Pulp & Paper Mills	Peak	+ 520
Agricultural Implements	End of Active Season	- 330
Heating & Cooking Appliances	Slack Season	+ 120
Iron Castings	Trough	- 380
Transportation Equipment	Active Season	——
Motor Vehicles	Peak	+ 30
Motor Vehicle Parts	Active Season	- 150
Shipbuilding & Repairing	Active Season	+ 250
Non-Metallic Mineral Products	Peak	+ 110
Clay Products	Active Season	- 30
Glass & Glass Products	Active Season	- 60
Products of Petroleum & Coal	Peak	+ 70
Acids, Alkalis & Salts	Active Season	- 90

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Construction	Active Season	+12830
Buildings & Structures	Active Season	+ 3820
Highways, Bridges & Streets	Peak	+ 8200
Transportation	Peak	+ 4340
Steam Railways		
Maintenance of Ways & Structures	Peak	+ 2090
Transportation	Peak	+ 2860
Telegraphs	Peak	+ 150
Truck Transportation	Active Season	+ 70
Water Transportation	Peak	+ 160
Storage		
Grain Elevators	Active Season	+ 10
Storage & Warehouse	Active Season	+ 80
Communication	Peak	+ 650
Public Utility Operation		
Electric Light & Power	Peak	+ 670
Other Public Utilities	Peak	+ 1810
Wholesale Trade	Beginning of Active Season	+ 1220
Retail Trade	Slack Season	- 2950
Service	Peak	+ 1690
Hotels & Restaurants	Peak	+ 1810
Laundries & Dry Cleaning	Active Season	- 110
All Industries		+20,140

SEPTEMBER

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER / LOWER - THAN PREVIOUS MONTH
Forestry	Slack Season	/ 520
Mining	Active Season	- 230
Coal Mining	Slack Season	/ 110
Oil & Natural Gas	Peak	——
Non-Metal Mining	Active Season	- 70
Food & Beverages		
Meat Products	Active Season	- 120
Dairy Products	Active Season	- 230
Canned & Cured Fish	Peak	/ 340
Canned & Preserved Fruit & Vegetables	Active Season	/ 3800
Grain Mill Products	Active Season	/ 120
Bread & Other Bakery Products	Peak	/ 30
Distilled & Malt Liquors	Peak	/ 140
Other Beverages	Active Season	- 110
Other Foods	Beginning of Active Season	/ 990
Tobacco & Tobacco Products	Slack Season	/ 310
Leather Products		
Boots & Shoes	Temporary Increase	/ 210
Other Leather Products	End of Slack Season	/ 100
Textile Products	Slack Season	/ 340
Cotton Yarn & Broad Woven Goods	Trough	- 240
Woollen Goods	Slack Season	/ 150

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Clothing	Slack Season	+ 1780
Men's Clothing	Slack Season	+ 220
Women's Clothing	End of Slack Season	+ 940
Knit Goods	Slack Season	+ 260
Fur Goods	Secondary Slack Season	- 10
Hats & Caps	Temporary Increase	+ 110
Wood Products		
Saw & Planing Mills	Active Season	- 260
Furniture	Slack Season	+ 70
Other Wood Products	Peak	+ 90
Paper Products	Peak	+ 290
Pulp & Paper Mills	Active Season	- 60
Agricultural Implements	Beginning of Slack Season	- 380
Heating & Cooking Appliances	End of Slack Season	+ 90
Iron Castings	Slack Season	+ 160
Transportation Equipment	Active Season	- 310
Motor Vehicles	Active Season	- 290
Motor Vehicle Parts	End of Active Season	- 110
Shipbuilding & Repairing	Peak	+ 380
Non-Metallic Mineral Products	Active Season	- 100
Clay Products	Active Season	+ 20
Glass & Glass Products	End of Active Season	- 110
Products of Petroleum & Coal	Active Season	- 50

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Acids, Alkalis & Salts	Active Season	+ 60
Construction	Peak	+ 3360
Buildings & Structures	Peak	+ 3580
Highways, Bridges & Streets	Active Season	- 1190
Transportation	Active Season	- 1200
Steam Railways		
Maintenance of Ways & Structures	Active Season	- 30
Transportation	Active Season	- 630
Telegraphs	Peak	
Truck Transportation	Active Season	- 60
Water Transportation	Active Season	- 420
Storage		
Grain Elevators	Active Season	+ 90
Storage & Warehouse	Active Season	- 30
Communication	Active Season	- 320
Public Utility Operation		
Electric Light & Power	Active Season	- 50
Other Public Utilities	Active Season	- 20
Wholesale Trade	Active Season	+ 550
Retail Trade	Trough	- 370
Service	Active Season	- 400
Hotels & Restaurants	Active Season	- 80
Laundries & Dry Cleaning	Active Season	- 240
All Industries		+ 9,260

OCTOBER

INDUSTRIES	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Forestry	End of Slack Season	+11690
Mining	Active Season	- 640
Coal Mining	End of Slack Season	+ 280
Oil & Natural Gas	Active Season	- 120
Non-Metal Mining	Active Season	- 570
Food & Beverage		
Meat Products	Active Season	- 170
Dairy Products	End of Active Season	- 470
Canned & Cured Fish	Active Season	- 1030
Canned & Preserved Fruit & Vegetables	Peak	+ 4770
Grain Mill Products	Peak	+ 30
Bread & Other Bakery Products	Active Season	- 170
Distilled & Malt Liquors	Active Season	- 430
Other Beverages	End of Active Season	- 570
Other Foods	Active Season	+ 1790
Tobacco & Tobacco Products	Slack Season	+ 240
Leather Products		
Boots & Shoes	Beginning of Slack Season	- 210
Other Leather Products	Beginning of Clack Season	+ 220
Textile Products	Slack Season	+ 240
Cotton Yarn & Broad Woven Goods	Slack Season	+ 110
Woollen Goods	Slack Season	- 90

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Clothing	End of Slack Season	+ 1720
Men's Clothing	End of Slack Season	+ 240
Women's Clothing	Beginning of Active Season	+ 730
Knit Goods	End of Slack Season	+ 450
Fur Goods	Secondary Active Season	+ 100
Hats & Caps	Normal Activity	- 10
Wood Products		
Saw & Planing Mills	Active Season	- 1560
Furniture	Slack Season	+ 100
Other Wood Products	Active Season	- 60
Paper Products	Active Season	- 580
Pulp and Paper Mills	Active Season	- 920
Agricultural Implements	Slack Season	- 370
Heating & Cooking Appliances	Beginning of Slack Season	+ 190
Iron Castings	Slack Season	+ 210
Transportation Equipment	Peak	+ 460
Motor Vehicles	Active Season	+ 150
Motor Vehicle Parts	Normal Activity	- 90
Shipbuilding & Repairing	Active Season	- 570
Non-Metallic Mineral Products	Active Season	- 280
Clay Products	Active Season	- 40
Glass & Glass Products	Beginning of Slack Season	- 150
Products of Petroleum	End of Active Season	- 170

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Acids, Alkalis & Salts	End of Active Season	- 70
Construction	Active Season	- 3000
Buildings & Structures	Active Season	- 380
Highways, Bridges & Streets	Active Season	- 2310
Transportation	Active Season	- 1350
Steam Railways		
Maintenance of Ways & Structures	Active Season	- 820
Transportation	Active Season	+ 530
Telegraphs	Active Season	- 130
Truck Transportation	Peak	+ 110
Water Transportation	Active Season	- 460
Storage		
Grain Elevators	Active Season	+ 590
Storage & Warehouse	Active Season	+ 130
Communication	Active Season	- 690
Public Utility Operations		
Electric Light & Power	Active Season	- 910
Other Public Utilities	Active Season	- 50
Wholesale Trade	Active Season	+ 1510
Retail Trade	End of Slack Season	+ 6200
Service	End of Active Season	- 2660
Hotels & Restaurants	End of Active Season	- 2400
Laundries & Dry Cleaning	Active Season	——
All Industries		+14,650

NOVEMBER

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Forestry	Active Season	+17730
Mining	Active Season	+ 320
Coal Mining	Beginning of Active Season	+ 380
Oil & Natural Gas	Active Season	+ 20
Non-Metal Mining	End of Active Season	- 340
Food & Beverage		
Meat Products	Active Season	+ 860
Dairy Products	Beginning of Slack Season	- 330
Canned & Cured Fish	Active Season	- 1020
Canned & Preserved Fruits & Vegetables	Active Season	- 8790
Grain Mill Products	Active Season	- 80
Bread & Other Bakery Products	Active Season	- 30
Distilled & Malt Liquors	Active Season	- 10
Other Beverages	Beginning of Slack Season	- 310
Other Foods	Peak	+ 1400
Tobacco & Tobacco Products	Slack Season	- 50
Leather Products		
Boots & Shoes	Trough	- 360
Other Leather Products	Active Season	+ 150
Textile Products	End of Slack Season	+ 640
Cotton Yarn & Broad Woven Goods	Slack Season	+ 130
Woollen Goods	End of Slack Season	+ 90

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER / LOWER - THAN PREVIOUS MONTH
Clothing	Secondary Active Season	/ 960
Men's Clothing	Normal Activity	/ 300
Women's Clothing	Secondary Active Season	/ 90
Knit Goods	Beginning of Active Season	/ 550
Fur Goods	Active Season	/ 70
Hats & Caps	Beginning of Slack Season	- 50
Wood Products		
Saw & Planing Mills	End of Active Season	- 2060
Furniture	End of Slack Season	/ 260
Other Wood Products	Active Season	- 80
Paper Products	End of Active Season	- 1030
Pulp and Paper Mills	End of Active Season	- 1110
Agricultural Implements	Trough	- 230
Heating & Cooking Appliances	Active Season	/ 170
Iron Castings	End of Slack Season	/ 80
Transportation Equipment	End of Active Season	- 710
Motor Vehicles	End of Active Season	- 170
Motor Vehicle Parts	Normal Activity	/ 20
Shipbuilding & Repairing	End of Active Season	- 390
Non-Metallic Mineral Products	Active Season	- 250
Clay Products	Active Season	- 100
Glass & Glass Products	Slack Season	- 20
Products of Petroleum & Coal	Beginning of Slack Season	- 140

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Acids, Alkalis & Salts	Beginning of Slack Season	- 100
Construction	Active Season	- 3830
Buildings & Structures	Active Season	+ 40
Highways, Bridges & Streets	Active Season	- 3590
Transportation	Active Season	- 4480
Steam Railways		
Maintenance of Ways & Structures	End of Active Season	- 1290
Transportation	End of Active Season	- 2230
Telegraphs	End of Active Season	- 100
Truck Transportation	Active Season	- 10
Water Transportation	Active Season	- 1110
Storage		
Grain Elevators	Peak	+ 40
Storage & Warehouse	Peak	+ 120
Communication	End of Active Season	- 410
Public Utility Operation		
Electric Light & Power	End of Active Season	- 470
Other Public Utilities	End of Active Season	- 60
Wholesale Trade	Peak	+ 250
Retail Trade	Beginning of Active Season	+ 4430
Service	Beginning of Slack Season	- 2270
Hotels & Restaurants	Beginning of Slack Season	- 2090
Laundries & Dry Cleaning	End of Active Season	- 130
All Industries		+ 560

DECEMBER

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER / LOWER - THAN PREVIOUS MONTH
Forestry	Peak	/10420
Mining	Active Season	/ 80
Coal Mining	Active Season	/ 430
Oil & Natural Gas	End of Active Season	- 160
Non-Metal Mining	Beginning of Slack Season	- 300
Food & Beverages		
Meat Products	Peak	/ 860
Dairy Products	Slack Season	- 350
Canned & Cured Fish	Beginning of Slack Season	- 990
Canned & Preserved Fruits & Vegetables	Beginning of Slack Season	- 3270
Grain Mill Products	End of Active Season	- 110
Bread & Other Bakery Products	End of Active Season	——
Distilled & Malt Liquors	Active Season	/ 120
Other Beverages	Slack Season	- 190
Other Foods	Active Season	- 520
Tobacco & Tobacco Products	Beginning of Active Season	/ 910
Leather Products		
Boots & Shoes	Slack Season	/ 210
Other Leather Products	Active Season	/ 90
Textile Products	Beginning of Active Season	/ 540
Cotton Yarn & Broad Woven Goods	Slack Season	/ 140
Woollen Goods	Beginning of Active Season	/ 350
Clothing	Secondary Active Season	- 210

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER / LOWER - THAN PREVIOUS MONTH
Men's Clothing	Temporary Increase	/ 90
Women's Clothing	Secondary Slack Season	- 550
Knit Goods	Active Season	/ 370
Fur Goods	Peak	/ 10
Hats & Caps	Slack Season	- 70
Wood Products		
Saw & Planing Mills	Slack Season	- 3240
Furniture	Beginning of Active Season	/ 450
Other Wood Products	End of Active Season	- 250
Paper Products	Beginning of Slack Season	- 1360
Pulp & Paper Mills	Beginning of Slack Season	- 1220
Agricultural Implements	Slack Season	/ 210
Heating & Cooking Appliance	Peak	/ 30
Iron Castings	Temporary Increase	/ 220
Transportation Equipment	End of Active Season	—— ——
Motor Vehicles	Normal Activity	- 320
Motor Vehicle Parts	Beginning of Slack Season	- 330
Shipbuilding & Repairing	Beginning of Slack Season	- 510
Non-Metallic Mineral Products	End of Active Season	- 100
Clay Products	End of Active Season	- 90
Glass & Glass Products	Slack Season	- 50
Products of Petroleum & Coal	Slack Season	- 60

INDUSTRY	SEASONAL CONDITIONS	SEASONAL EMPLOYMENT IS HIGHER + LOWER - THAN PREVIOUS MONTH
Acids, Alkalis & Salts	Slack Season	- 20
Construction	End of Active Season	-10070
Building & Structures	End of Active Season	- 4960
Highways, Bridges & Streets	End of Active Season	- 4870
Transportation	End of Active Season	- 600
Steam Railways		
Maintenance of Ways & Structures	Beginning of Slack Season	- 1900
Transportation	Beginning of Slack Season	- 1590
Telegraphs	End of Active Season	- 70
Truck Transportation	End of Active Season	- 50
Water Transportation	End of Active Season	+ 420
Storage		
Grain Elevators	End of Active Season	- 210
Storage & Warehouse	End of Active Season	- 160
Communication	Beginning of Slack Season	- 250
Public Utility Operation		
Electric Light & Power	Beginning of Slack Season	- 310
Other Public Utilities	Normal Activity	- 60
Wholesale Trade	End of Active Season	- 1100
Retail Trade	Active Season	+12270
Service	Slack Season	- 980
Hotels & Restaurants	Slack Season	- 720
Laundries & dry Cleaning	Beginning of Slack Season	- 260
All Industries		+ 2000

CHAPTER V

SEASONAL VARIATIONS IN UNEMPLOYMENT AND SEASONAL UNEMPLOYMENT

A. Typical Seasonal Variations in Unemployment

Seasonal variations in employment will result in seasonal movements in unemployment. These movements will not be the exact reverse of the seasonal variations in employment since the size of the labour force does not necessarily remain constant, it may vary seasonally to a certain extent[1]. They can be measured on the basis of monthly unemployment figures using the methods outlined in Chapter II. The difficulty lies in obtaining suitable monthly unemployment data. The D.B.S. Labour Force Survey has until recently been compiled quarterly, and therefore its measure of unemployment, the number of "persons without jobs and seeking work"[2] cannot be used. The "live" applications for employment on file at local National Employment Service offices, that is the number of unplaced job applicants, reported weekly, can be taken as an indication of the extent of unemployment in the regions covered by these offices. These figures are available for all the post-war period.

There have been some changes in the coverage and compilation of these figures during the period under study. In March 1950 unemployment insurance was extended to cover workers in Eastern Canada logging industries by reducing the number of

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1 - A good example of this is the entry of students into the labour force.

2 - "The Labour Force", Nov. 1945 - March 1952, D.B.S. Reference Paper, Page 3.

days employment required in the past year to qualify for supplementary benefits from 180 to 90. Since that time unemployed loggers would register for work with N.E.S. offices to get their benefits whereas in previous years they might not have registered when out of work. There is also less likelihood of registration falling off during the winter months as workers exhaust their regular benefits and at the same time stop reporting for work, due to the supplementary benefits program. In addition there have been changes in administrative procedure. Since 1950 applications of workers who have not reported for their unemployment insurance for two weeks are removed from the "live" file in fifteen days instead of the previous thirty, and new provisions made it more difficult for women to claim benefits. Thus the live applications data for different years are not strictly comparable, the supplementary benefits program in particular has probably introduced substantial differences. These shortcomings will have to be kept in mind when discussing the seasonal movements in different years.

As indicators of unemployment the unplaced applicants data are subject to two basic limitations. They provide only limited coverage since not all unemployed look for work through the N.E.S.. And they may include at any one time a number of employed persons, as many applicants do not report back when they find jobs in other ways, and may be kept on the employment file for up to a month. These two factors work in opposite directions and it is not clear which predominates, that is

whether the data under-estimate or over-estimate unemployment.[3] The figures are in any case consistently higher than the "persons without jobs and seeking work" reported by the D.B.S. Labour Force Survey. The significance of this is not clear since the latter cannot be considered a more accurate estimate of unemployment.[4]

The typical seasonal variations in unemployment obtained using the unplaced applicants data[5] for the five regions and Canada[6] (the Canada figures are the algebraic sum of the regional figures) are given in Table XXV, along with the measures of amplitude and the results of the additive or multiplicative test. Seasonality in unemployment is clearly multiplicative in all regions. This may at first seem surprising since approximately half of the industries whose seasonal variations were presented in Chapter III were subject to additive seasonality. The result is due to the multiplicative

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3 - It should be noted that the over-estimation of the number employed due to lags in reporting the finding of a job will likely be greater in active seasons with many employment opportunities, than in slack periods, and therefore this defect in the data although it would over-estimate total unemployment, would tend to under-estimate seasonal unemployment.

4 - The relation between the two is discussed in "The Labour Force", op.cit., pp. 4-5.

5 - This data has been obtained from the Economics and Research Branch, Department of Labour. The weekly figures for unplaced applicants have been averaged for each month, and therefore the original data more closely satisfy the requirements stated in Chapter II than the employment data used in Chapter III. The figures are now assumed to be valid for the middle of the month rather than for the beginning of the month.

6 - The Canada and Maritime figures do not include Newfoundland.

nature of seasonality in the largest seasonal industries, and to the fact that one of the main contributors to the fluctuations in unemployment in the post-war period was Forestry whose seasonality is multiplicative.

Table XXV. Typical Seasonal Variations in Unemployment, Canada and the Five Regions on Page 151.

The values for the mean deviations indicate the presence of fairly significant irregular influences and/or changing seasonality. The larger values for British Columbia are probably partly due to the bad weather conditions which hampered logging activities. Measures of short-time changes in seasonality, the r and b coefficients were computed for Canada using relatives, for the six consecutive May to April periods for which data were available. This period was chosen in view of the character of the seasonal movement[7]. The values are presented in Table XXVI.

Table XXVI. Short-time Changes in Seasonality of Unemployment for Canada on Page 152.

The seasonal pattern appears to have been constant during the period, but the amplitude seems to have undergone a fairly substantial change. The seasonal movement as a ratio of the non-seasonal movement seems to have at first increased, levelled out, then increased once more in the last year.

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7 - An alternative choice of period would be from December to November, this would have certain advantages over the period chosen for some of the computations carried out in the next section. See footnote 12.

TABLE XXV

Typical Seasonal Variations in Unemployment
Canada and the five Regions, 1946-1951

(1) Seasonal variations in absolute figures;[8]
(2) Seasonal variations in percentages;

	Canada		Maritimes		Quebec	
Month	(1)	(2)	(1)	(2)	(1)	(2)
January	+51,552	+28.2	+ 3,685	+16.1	+14,223	+25.7
February	+80,843	+44.3	+ 7,246	+31.7	+22,806	+40.9
March	+81,516	+44.6	+ 9,612	+42.0	+28,019	+50.3
April	+64,104	+35.1	+10,607	+46.4	+26,493	+47.6
May	+11,282	+ 6.2	+ 5,096	+22.3	+ 7,621	+13.5
June	-23,974	-13.1	- 1,065	- 4.7	- 7,180	-13.2
July	-42,346	-23.2	- 4,878	-21.3	-15,104	-27.5
August	-59,875	-32.8	- 7,325	-32.0	-19,013	-34.5
September	-66,682	-36.5	- 7,446	-32.6	-20,703	-37.6
October	-61,498	-33.7	- 8,164	-35.7	-20,121	-36.5
November	-37,882	-20.7	- 5,900	-25.8	-14,902	-27.1
December	+ 2,969	+ 1.6	- 1,472	- 6.4	- 739	- 1.6
Ampl. of Variations:		26.7		26.4		29.7
Add. Ratio:		0.320		0.304		0.331
Mult. Ratio:		0.174		0.221		0.147

	Ontario		Prairies		Pacific	
Month	(1)	(2)	(1)	(2)	(1)	(2)
January	+14,002	+28.9	+ 9,835	+33.5	+10,257	+36.7
February	+20,801	+43.0	+14,410	+51.5	+15,707	+56.2
March	+17,688	+36.5	+15,001	+53.6	+11,323	+40.5
April	+10,589	+21.9	+11,919	+42.6	+ 4,623	+16.6
May	- 1,946	- 4.0	+ 2,484	+ 8.9	- 1,846	- 6.6
June	- 6,596	-13.6	- 4,220	-15.1	- 4,786	-17.1
July	- 8,605	-17.8	- 7,260	-25.9	- 6,372	-22.8
August	-13,992	-28.9	-11,281	-40.3	- 8,137	-29.1
September	-15,281	-31.6	-13,558	-48.4	- 9,567	-34.3
October	-12,113	-25.0	-11,943	-42.6	- 9,030	-32.3
November	- 6,387	-13.2	- 5,937	-21.2	- 4,629	-16.6
December	+ 1,844	+ 3.8	+ 1,004	+ 3.6	+ 2,459	+ 8.8
Ampl. of Variations:		22.4		32.3		26.5
Add. Ratio:		0.293		0.233		0.385
Mult. Ratio:		0.198		0.146		0.219

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8 - The presentation of the figures for typical seasonal variations to the nearest unit exaggerates the accuracy of the procedure in isolating the seasonal movement.

TABLE XXVI

Measures of Short-Time Changes in Seasonality of Unemployment in Canada. Periods are from May to April

	1946-1947	1947-1948	1948-1949	1949-1950	1950-1951	1951-1952
r	0.98	0.996	0.99	0.97	0.99	0.99
b	0.62	0.98	1.14	1.14	1.15	1.21

Changes in the seasonal movement expressed in absolute figures depend on the changes undergone by the non-seasonal level. These changes will be considered in the following section dealing with seasonal employment.

B - Seasonal Employment

I CONCEPT AND MEASUREMENT

The seasonal factors redistribute unemployment within twelve month periods through the favouring and inhibiting of economic activity during different months of the year. The creation and suspension of jobs (that is, decrease and increase in unemployment) due to seasonal factors is repeated to the same extent annually when seasonality is constant. The consequent decrease and increase in unemployment can be distinguished from other types of changes in unemployment by this repetitive characteristic. Calling this type of unemployment, "seasonal" unemployment, we define it as recurring unemployment which lasts for at least one, but not more than eleven, months of the year. This definition allows us to measure seasonal unemployment on the basis of typical seasonal variations in unemployment. The method has been presented in its essentials in Chapter IV for seasonal employment, and will not be repeated here. The general rule in this case is: "The amount of seasonal unemployment in any particular month is equal to the difference between that month's seasonal variations in unemployment value, and the trough month's value."

II INTERPRETATION

The figure representing a particular month's seasonal unemployment value indicates the number unemployed in

that month, who can expect to find employment[9] sometime within the next twelve months (then lose their jobs within another twelve months, regain them in another twelve, etc.) as the result of the influence of "normal" seasonal factors, and in the absence of changes in the non-seasonal level of unemployment. This figure, plus the month-to-month changes in seasonal unemployment can be of use in analyzing the level of, and changes in, unemployment.

Taking the live applications for employment on file at local National Employment Service Offices as an indication of the extent of unemployment in the regions covered by these offices, seasonal unemployment can be estimated from the typical seasonal variations in unplaced applicants. To estimate total seasonal unemployment, as well as changes in its level, these offices should be grouped together only if unemployment in the regions covered by them have identical seasonal patterns. The regions for which we have computed seasonal variations are large, and to a certain extent local areas within each region have varying seasonal patterns, and therefore our estimates of total seasonal unemployment are minimum ones. The average seasonal unemployment figures are arranged in calendar form for Canada and the five regions in Table XXVII.

Table XXVII. Calendar of Unemployment on Page 155.

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9 - Or who will withdraw from the labour force.

TABLE XXVII

CALENDAR OF SEASONAL UNEMPLOYMENT

Region	Level of Seasonal Unemployment	Seasonal Conditions	Seasonal Unemployment is Higher + than previous month	Lower - than previous month
		January		
Maritimes	11,849	Beginning of Active Season	+ 5,157	
Quebec	34,926	Beginning of Active Season	+14,962	
Ontario	29,283	Active Season	+12,158	
Prairies	23,393	Active Season	+ 8,831	
Pacific	19,824	Active Season	+ 7,798	
Canada	119,275		+48,906	
		February		
Maritimes	15,410	Active Season	+ 3,561	
Quebec	43,509	Active Season	+ 8,583	
Ontario	36,082	Peak	+ 6,799	
Prairies	27,968	Active Season	+ 4,575	
Pacific	25,968	Peak	+ 5,450	
Canada	148,243		+28,968	
		March		
Maritimes	17,776	Active Season	+ 2,366	
Quebec	48,722	Peak	+ 5,213	
Ontario	32,969	Active Season		- 3,113
Prairies	28,559	Peak	+ 591	
Pacific	20,890	Active Season		- 4,384
Canada	148,916		+ 673	
		April		
Maritimes	18,771	Peak	+ 995	
Quebec	47,196	Active Season		- 1,526
Ontario	25,870	End of Active Season		- 7,099
Prairies	25,477	Active Season		- 3,082
Pacific	14,190	End of Active Season		- 6,700
Canada	131,504			-17,412
		May		
Maritimes	13,260	End of Active Season		- 5,511
Q uebec	28,324	End of Active Season		-18,872
Ontario	13,335	Beginning of Slack Season		-12,535
Prairies	16,042	End of Active Season		- 9,435
Pacific	7,721	Beginning of Slack Season		- 6,469
Canada	78,682			-52,822

TABLE XXVII - CALENDAR OF SEASONAL UNEMPLOYMENT (Continued)

Region	Level of Seasonal Unemployment	Seasonal Conditions	Seasonal Unemployment is Higher / Lower - than Previous month
		June	
Maritimes	7,099	Beginning of Slack Season	- 6,161
Quebec	13,523	Beginning of Slack Season	-14,801
Ontario	8,685	Slack Season	- 4,650
Prairies	9,338	Beginning of Slack Season	- 6,704
Pacific	4,781	Slack Season	- 2,940
Canada	43,426		-35,246
		July	
Maritimes	3,286	Slack Season	- 3,813
Quebec	5,599	Slack Season	- 7,924
Ontario	6,676	Slack Season	- 2,009
Prairies	6,298	Slack Season	- 3,040
Pacific	3,195	Slack Season	- 1,586
Canada	25,054		-18,372
		August	
Maritimes	839	Slack Season	- 2,447
Quebec	1,690	Slack Season	- 3,909
Ontario	1,289	Slack Season	- 5,387
Prairies	2,277	Slack Season	- 4,021
Pacific	1,430	Slack Season	- 1,765
Canada	7,525		-17,529
		September	
Maritimes	618	Slack Season	- 121
Quebec	0	Trough	- 1,690
Ontario	0	Trough	- 1,289
Prairies	0	Trough	- 2,277
Pacific	0	Trough	- 1,430
Canada	618		- 6,807
		October	
Maritimes	0	Trough	/ 582
Quebec	582	Slack Season	/ 3,168
Ontario	3,168	Slack Season	/ 1,615
Prairies	1,615	Slack Season	/ 537
Pacific	537	Slack Season	/ 5,284
Canada	5,902		

TABLE XXVII - CALENDAR OF SEASONAL UNEMPLOYMENT (Concluded)

Region	Level of Seasonal Unemployment	Seasonal Conditions	Seasonal Unemployment is Higher + Lower - than previous month
		November	
Maritimes	2,264	Slack Season	+ 2,264
Quebec	5,801	Slack Season	+ 5,219
Ontario	8,894	End of Slack Season	+ 5,726
Prairies	7,621	End of Slack Season	+ 6,006
Pacific	4,938	End of Slack Season	+ 4,401
Canada	29,518		+23,616
		December	
Maritimes	6,692	End of Slack Season	+ 4,428
Quebec	19,964	End of Slack Season	+14,163
Ontario	17,125	Beginning of Active Season	+ 8,231
Prairies	14,562	Beginning of Active Season	+ 6,941
Pacific	12,026	Beginning of Active Season	+ 7,088
Canada	70,369		+40,851

The above measures of seasonal unemployment, since they are derived from typical seasonal variations, are average estimates. Seasonal unemployment can be expected to vary in individual years with variations in seasonality in these years. Making use of the linear regression coefficients (the b values) computed in the previous section, it is possible to estimate the individual seasonal movements in percentage terms for each of the consecutive May to April periods.[10] Combining these values with the unplaced applicants for these periods it is possible to estimate the seasonal movements in absolute figures for these periods[11], and thus seasonal unemployment[12]. The

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10 - See above Chapter II , pages 43-48.

11 - The figures for unplaced applicants are divided by the adjusted seasonal relatives. These deflated values are then subtracted from the actual data, and the results for each consecutive May to April period are adjusted to sum to zero. The results are the seasonal movements for each of these periods.

12 - The amount of seasonal unemployment for each month in a given period is estimated as the difference between its seasonal value and the trough month's value in that period. For the purpose of estimating seasonal unemployment it would perhaps have been better to compute the r and b ratios for the 12-month December to November periods, since it is customary to talk of seasonal unemployment in the sense of unemployment which is expected to disappear due to seasonal causes within the next twelve months. The trough month comes close to the end of this period while the months with heavy seasonal unemployment occur at the beginning of this period, whereas in the period used in this study seasonal unemployment refers to a preceding rather than a following trough month. However this change would probably not greatly alter the values obtained, and would not allow the limited values for 1952 that are available to be used.

estimates[13] derived cannot be treated as exact in view of the rather imprecise methods being used, but they are useful indications of the changes in the seasonal movements in the different years. We will deal with the last five periods. The adjusted seasonal variations are given in Table III, and the derived estimates of seasonal unemployment in Table IV.

Table XXVIII. Adjusted Seasonal Variations in Unemployment on Page 160.

Table XXIX. Seasonal Unemployment for Individual 12-month Periods on Page 161.

There have been substantial increases in the seasonal unemployment figures during the post-war period. The break in 1950-1951 after the high in 1949-1950 seems to have been temporary with even higher values reached in 1951-1952. It is interesting to note that a rough estimate of seasonal unemployment for 1949, of 205,000, obtained by the Economics and Research Branch of the Department of Labour[14] using other methods, falls between our estimate for 1949-50 and the value obtained for seasonal unemployment in February 1949, using the 1949-1950 trough value.

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13 - In view of the slight difference in regional seasonal patterns, estimates of seasonal unemployment obtained from Canada figures underestimate total seasonal unemployment. This discrepancy is however a minor one.

14 - Haythorne, G.V., "Seasonality of Employment in Canada" Labour Gazette, XLIX, 1210-1216.

TABLE XXVIII

Adjusted Seasonal Variations in Unemployment
for Individual 12-month Periods (May to April) for Canada

Month	1947-1948	1948-1949	1949-1950	1950-1951	1951-1952
May	+ 7,915	+ 8,042	+ 8,467	+25,126	+ 7,755
June	-19,399	-22,877	-28,749	-33,365	-30,049
July	-32,707	-41,038	-53,328	-56,759	-57,202
August	-43,328	-55,818	-82,302	-82,068	-87,411
September	-47,003	-61,388	-96,093	-90,109	-103,542
October	-44,317	-59,713	-92,104	-77,478	-97,055
November	-27,432	-59,755	-93,341	-45,482	-62,635
December	+ 1,844	+ 1,865	+ 1,541	+ 8,116	+ 275
January	+37,460	+55,506	+76,595	+70,916	+79,624
February	+60,382	+87,864	+119,693	+103,921	+122,584
March	+60,713	+85,315	+128,535	+100,848	+125,845
April	+45,868	+61,493	+111,174	+76,335	+101,813

TABLE XXIX

Seasonal Unemployment for Individual 12-month Periods (May to April) for Canada.

Month	1947-1948	1948-1949	1949-1950	1950-1951	1951-1952
May	54,918	69,430	104,560	115,235	111,297
June	27,604	38,511	67,344	56,744	73,493
July	14,296	20,350	42,765	33,350	46,340
A ugust	3,675	5,570	13,791	8,041	16,131
September	0	0	0	0	0
October	2,686	1,675	3,989	12,631	6,487
November	19,571	1,633	2,752	44,627	40,907
December	48,847	63,253	97,634	98,225	103,817
January	84,463	116,894	172,688	161,025	183,166
February	107,385	149,252	215,786	194,030	226,126
March	107,716	146,703	224,628	190,957	229,387
April	92,871	122,881	207,267	166,446	205,355

III ALTERNATIVE APPROACH

The use of "Live Applications" to indicate unemployment, and thus seasonal unemployment may result in estimates that are too low since not everyone who is out of work and looking for work registers with N.E.S. offices. For this reason an alternative method of estimating seasonal unemployment can be of use. With appropriate adjustments typical seasonal variations in employment can be used for this purpose.

The measure of seasonal employment is concerned with the number of present jobs which will disappear at some time during the succeeding eleven months, (appear again in twelve, disappear again in another eleven, etc.) the measure of seasonal unemployment is concerned with the number of "absent" jobs which will reappear sometime in the succeeding eleven months (disappear again in twelve, appear again in another eleven, etc.). The measure of seasonal unemployment is therefore the "opposite" of the measure of seasonal employment, and can be obtained by comparing each month's seasonal variations in employment value with the peak, instead of the trough, month's value. "The amount of seasonal unemployment in any particular month can be obtained by subtracting from the peak month's seasonal variation value, the seasonal variations value for that month."[15] This rule holds good no matter whether non-seasonal employment is changing or constant.

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15 - This is similar to the rule used by Woytinsky, op.cit., 30-33.

The figures for seasonal unemployment thus obtained have to be adjusted to allow for (1) temporary entrants to the labour force, and (2) labour mobility.

(1) Temporary entrants to the labour force are workers who are interested in working only part of the year (e.g. students). They tend to enter the work force during the peak months of employment and they cannot be called unemployed during other periods since they are not looking for, and in fact not interested in, work. Subtracting a month's seasonal value when there are few or no temporary workers from the peak month's value which includes many temporary workers will exaggerate the problem of seasonal unemployment. To overcome this difficulty we can adjust the typical seasonal variation values for temporary workers by subtracting from these values the number of temporary workers. The peak month in this case is the month with the greatest positive variation after adjusting for temporary workers.

(2) A worker who loses his job because of seasonal factors may find work in another seasonal job in a firm with a different seasonal pattern. Computing seasonal variations separately for each of these firms, and then estimating seasonal unemployment will over-estimate the latter since our hypothetical worker will be counted as one of the seasonally unemployed for part of the year in both these firms, when in fact he is employed the year round. The adjustment made in the case of temporary workers can be used here. From each month's seasonal value

will be subtracted those workers who find employment in the off-season. For example, longshoremen who work in the woods in winter should be subtracted from the typical seasonal variations value for Water Transportation during the summer months, and from the typical seasonal variations value for Forestry during the winter months.

The possibility of labour mobility requires the re-examination of the conclusions reached with respect to the principles to be followed in grouping firms. The grouping of firms with different seasonal patterns, when seasonal unemployment is to be estimated, is justified when workers move between the constituent firms in response to seasonal variations in employment opportunities as well as when interest is centered only on changes in the level of seasonal unemployment. This does not however change the industrial and regional grouping already used for the computation of seasonal variations, (a) because of the difficulty of varying the grouping to coincide with labour mobility, and (b) the data on seasonal labour mobility in Canada are mainly estimates of the number of workers who move between certain industries in response to seasonal variations in employment, for which adjustments can be made in the manner described above, rather than in terms of "complementary" firms.

The deficiencies of any estimates of seasonal unemployment obtained from the typical seasonal variations in employment which have been calculated for this study and

listed in Chapter III are, (1) the approximate nature of the allowances made for temporary workers and for seasonal labour mobility, and (2) the incomplete employment data on which they are based.

The employment data used in this study has been obtained from firms in non-agricultural industries employing fifteen or more workers[16]. Estimates of seasonal unemployment based on these figures will only indicate the seasonal unemployment caused by variations in the firms covered and cannot in general be taken as estimates of total seasonal unemployment.

The typical seasonal variations in employment (and thus estimates of seasonal unemployment) valid for the firms covered by the D.B.S. Employment and Payrolls survey can be extended to cover the movements in all the non-agricultural firms in the economy if the following conditions are satisfied.

1) Seasonal movements in employment are the same for reporting and non-reporting firms who fall into the industrial and regional groupings used for the computation of seasonality.

2) Ratios of total employment in the relevant industrial and regional groupings to employment in the survey firms in these groups are available. (The typical seasonal variations in employment in the survey firms would be multiplied by these ratios, and estimates of total seasonal unemployment then

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16 - See above Chapter III, page

obtained from the revised figures.)

Unfortunately, the above procedure cannot be followed in the present study. The relation between seasonal movements in the survey and non-survey firms has not been studied, but since the difference between the firms in the two groups is mainly that of size, which may affect their relative ability to withstand seasonal and non-seasonal pressures, it should not be too surprising if their behaviour is dissimilar. There are no "firm" estimates of the ratio of total employment to survey employment for any significant industrial and regional breakdown. In fact, it is very difficult to obtain total monthly employment figures except for broad industrial groups. Perhaps the most reasonable comparison would be that in which "total" employment figures are the employment figures reported to the Census of Industry, which attempts to cover all firms. The difficulty in this case is the amount of work required to compute these ratios (test to see whether they are constant from year to year, etc.), and that the Census of Industry is mainly interested in production workers so that the same firm may (and in the past has) report different "employment" for the same period, to the different surveys.

All these obstacles make any estimate of seasonal unemployment based on available employment data very dubious, and lead to the conclusion that more reliance should be placed on estimates obtained from live applications data.

APPENDIX

I. At various points in the text of Chapter II statements were made about the tendency of non-seasonal deviations from the moving average to cancel out over a period of years, making the method of moving averages more accurate than it otherwise would be. These deviations were caused by the failure of the moving average to move all the way up to the cyclical peak, or all the way down to the cyclical trough (p. 19); and by the irregular component of the time-series data. In this section we will illustrate the defections of the moving average method when confronted with a cycle, indicate the extent to which these defections cancel out, and compare the results with those obtained when the method of link relatives is used, by means of an example.

1) Assume a trend-cyclical component given by $\hat{V}_t = 200 + 100\sin(\frac{\pi}{30}(t-1))$ where t = 1st, 2nd, 3rd,....., etc., month. Irregular influences absent. The cycle has a period of 5 years, and let data for six years, more than covering a complete cycle be available. Let seasonality be additive with the values shown in Table XXX. The combined trend-cyclical and seasonal

TABLE XXX

Seasonal Variations in Absolute Numbers

J	F	M	A	M	J	J	A	S	O	N	D
-24	-20	-16	-12	-8	-4	+4	+8	+12	+16	+20	+24

values, that is, the actual data, along with the moving average values are given in Table XXXI. The residuals, the difference between the actual and moving average values, for the five calendar years for which moving average values are available, are shown in Table XXXII together with their averages.

It can be seen that although the residuals differ from the true seasonal values, their average, the typical seasonal variations, are very close to the seasonal values. The defections of the moving average from the trend-cyclical component are of opposite sign over the cycle and roughly equal in magnitude thus tending to cancel, and to confirm the statements on pages 19-21 in the main text.

ii) When the available data do not cover the complete cycle(s) the results will not be so favourable. In this case obtaining a weighted average of the residuals of the type outlined below on pages 48-49 will limit to a certain extent the influence of the deviations. A much better way of dealing with this case is to take a centered twelve-month moving average of the residuals and add the values thus obtained to the first of the moving average values for the corresponding months. Subtracting these combined values from the actual data we obtain a new set of residuals (shown in Table XXXIII) which are less influenced by the cycle since the combined moving average (as indicated by the results) goes almost all the way up to the peak and all the way down to the trough. Their average is a good approximation to the true seasonal values even when a full cycle is not covered.

TABLE XXXI

Time-Series Data $[(TC) + S]$

Yr. \ Mo.	J	F	M	A	M	J	J	A	S	O	N	D
1	176.00	190.45	204.79	218.90	232.67	246.00	262.78	274.91	286.31	296.90	306.60	315.35
2	271.11	277.81	283.45	288.00	291.45	293.81	299.11	299.35	298.60	296.90	294.31	290.91
3	232.78	230.00	224.67	218.90	212.79	206.45	204.00	197.55	191.21	185.10	179.33	174.00
4	117.22	113.09	109.69	107.10	105.40	104.65	108.89	110.19	112.55	116.00	120.55	126.19
5	80.89	88.65	97.40	107.10	117.69	129.09	145.22	158.00	171.33	185.10	199.21	213.55
6	176.00	190.45	204.79	218.90	232.67	246.00	262.78	274.91	286.31	296.90	306.60	315.35

TABLE XXXII

Residuals

Yr. \ Mo.	J	F	M	A	M	J	J	A	S	O	N	D
1	-24.00	-19.32	-14.64	- 9.98	- 5.34	- 0.73	+ 7.85	+12.37	+16.86	+21.29	+25.66	+29.97
2	-17.78	-13.61	- 9.50	- 5.46	- 1.50	+ 2.39	+10.31	+14.14	+17.83	+21.46	+25.02	+28.54
3	-22.00	-16.56	-13.18	- 9.81	- 6.47	- 3.15	+ 4.08	+ 7.32	+10.64	+13.98	+17.34	+20.73
4	-27.85	-24.37	-20.85	-17.29	-13.66	- 9.97	- 2.22	+ 1.61	+ 5.50	+ 9.46	+13.50	+17.61
5	-30.22	-25.97	-21.66	-17.29	-12.85	- 8.37	+ 0.15	+ 4.73	+ 9.34	+13.98	+18.64	+23.32
Average	-24.37	-19.97	-15.97	-11.97	- 7.96	- 3.97	+ 4.03	+ 8.03	+12.03	+16.03	+20.03	+24.03

TABLE XXXIII

Adjusted Residuals

Yr. \ Mo.	J	F	M	A	M	J	J	A	S	O	N	D
2	-23.59	-16.60	-15.60	-11.61	-10.63	- 3.66	+ 4.50	+ 8.63	+12.59	+16.56	+20.51	+24.47
3	-25.58	-19.60	-15.64	-11.66	- 7.68	- 3.72	+ 4.08	+ 7.89	+11.85	+15.83	+19.80	+23.77
4	-24.26	-20.28	-16.31	-12.37	- 8.37	- 4.39	+ 3.59	+ 7.58	+11.58	+15.57	+19.58	+23.58
5	-24.41	-20.39	-16.37	-12.35	- 8.31	- 4.28	+ 3.74	+ 7.78	+11.82	+15.87	+19.91	+23.96
Adjusted Average	-24.41	-19.17	-15.93	-11.95	- 8.70	- 3.96	+ 4.03	+ 8.02	+12.01	+16.01	+20.00	+24.00

iii) The test to determine whether seasonality is additive or multiplicative makes use of the relative constancy of the absolute and relative amplitudes of variations. When the method of moving averages is accurate there is no question of the effectiveness of the test, but when the non-seasonal values are such that the moving average only approximates them, an element other than the nature of seasonality influences the amplitude of variations. This should not however affect the result when seasonality is fairly constant (additive or multiplicative) since the sum of the absolute values of the apparent seasonal displacements for consecutive twelve-month periods are not greatly affected by the inability of the moving average to move all the way up (or all the way down) to the cyclical peak (trough). Around a cyclical peak the absolute values of the positive residuals (i.e. the residuals for the months where the seasonal value is greater than zero) are increased while the absolute value of the negative residuals are decreased. The positions are reversed around a cyclical trough.

The sum of the absolute values (divided by the average, or non-seasonal, activity if seasonality is multiplicative) for a twelve-month period, does not vary greatly from the peak to the trough, therefore our test is valid even if the moving average method only roughly approximates the non-seasonal level.

In the present example the test clearly shows that seasonality is additive.

TABLE XXXIV

Test for Additivity or Multiplicativity. $[(TC) \neq S]$

Year	Absolute Magnitude	Deviation	Average Activity	Relative Magnitude	Deviation
1	188.01	17.77	251.0	74.9	26.0
2	167.54	2.70	290.4	57.7	43.2
3	145.26	24.98	204.7	71.0	29.9
4	163.89	6.35	112.6	145.6	44.7
5	186.52	16.28	141.1	155.4	54.5
Total	851.22	68.08		504.6	198.3
Average	170.24	13.62		100.9	39.7
Relative Deviations		$\frac{13.62}{170.24} = 0.08$			$\frac{39.7}{100.9} = 0.4$

iv) The link-difference method is also very accurate when faced with this type of example. The preliminary averaging eliminates the cyclical influence, and there is no changing trend component. The results are given in Table XXXV, they are, except for one month, equal to the values obtained using the moving average method.

II. The use of link-relatives when seasonality is additive leads to incorrect values for the typical seasonal variations. A simple example has been constructed to illustrate the extent of the possible errors. The non-seasonal movement consists of a straight line trend with values given by the equation $10+2t$, where $t=1$ is January of the first year. The seasonal and actual values, along with the various steps needed to obtain typical seasonal variations using the link-relative method, are shown in Table XXXVI.

TABLE XXXV

Using Link-Difference Method for Example [(TC) ∔ S]

J	F	M	A	M	J	J	A	S	O	N	D
Average Link-Difference											
-48.40	∔ 4.40	∔ 4.00	∔ 4.00	∔ 4.00	∔ 4.00	∔ 8.00	∔ 4.00	∔ 4.00	∔ 4.00	∔ 4.00	∔ 4.00
Chain Differences: Base = December											
-48.40	-44.00	-40.00	-36.00	-32.00	-28.00	-20.00	-16.00	-12.00	- 8.00	- 4.00	0

Trend Component = 0; Average of Adjusted Chain Differences = -24.03

Typical Seasonal Variations

-24.37	-19.97	-15.97	-11.97	- 7.97	- 3.97	∔ 4.03	∔ 8.03	∔12.03	∔16.03	∔20.03	∔24.03

TABLE XXXVI

Using Link Relatives When Seasonality is Additive

		J	F	M	A	M	J	J	A	S	O	N	D
Seasonal Values		-6	-5	-4	-3	-2	-1	+1	+2	+3	+4	+5	+6
Actual Values	Yr.1	6	9	12	15	18	21	25	28	31	34	37	40
	2	30	33	36	39	42	45	49	52	55	58	61	64
	3	54	57	60	63	66	69	73	76	79	82	85	88
Link Relatives	Yr.1	37.5	150.0	133.3	125.0	120.0	116.7	119.0	112.0	110.7	109.7	108.8	108.1
	2	75.0	110.0	109.1	108.3	107.7	107.1	108.9	106.1	105.8	105.5	105.2	104.9
	3	84.4	105.6	105.3	105.0	104.8	104.5	105.8	104.1	103.9	103.8	103.7	103.5
Average Link Relatives		65.6	121.9	115.9	112.8	110.8	109.4	111.2	107.4	106.8	106.3	105.9	105.5
Chain Relatives		65.6	80.0	92.7	104.6	115.9	126.8	141.0	151.4	161.7	171.9	182.0	192.0
Adjusted Chain Relatives		57.9	64.6	69.6	73.8	77.4	80.6	87.1	89.8	91.4	94.9	97.3	100.0
Seasonal Index		70.6	78.8	84.8	90.0	94.4	98.3	106.2	109.5	111.5	115.7	118.7	122.0
Typical Seasonal Variations		-13.1	- 9.5	- 7.1	- 4.1	- 3.1	- 1.4	+ 2.3	+ 3.9	+ 5.1	+ 7.3	+ 9.0	+10.9

Before using either the link-difference or link-relative method, it is necessary to reach a decision as to the nature of seasonality. This decision may be based on qualitative knowledge of the relation of the seasonal to the non-seasonal movements in particular industries, or on some quantitative test. Difficulty has been experienced in trying to construct an additive or multiplicative test for the link method.

The problem facing us is, how to obtain an estimate of the seasonal movement in each of the years as a by-product of the link method. A possible, though cumbersome, test is to first take link-differences, and treat the set of links for each year in the same manner as the average link-differences. That is, chain them, adjust for trend,and obtain estimates for the seasonal values. The sum of the absolute values for each set of seasonals can be used to estimate the amplitude of variations, and these amplitudes are compared with the average activity in the corresponding year to indicate the nature of seasonality. Depending upon the result of this test the link-difference method is completed or link-relatives are computed.

When seasonality is additive this test will probably be effective since the non-seasonal elements remaining in the apparent seasonal values will usually not be too large, nor will they necessarily vary directly with the non-seasonal movement. However, when seasonality is multiplicative it is not clear that the test will give the correct result, since the larger defections contained in the estimated seasonal

values (due to an incorrect method being used) will not necessarily vary with the non-seasonal level, and they might be sufficiently large to obscure the nature of seasonality.

The above test has been applied to our fictitious example in I, and as can be see from Table XXXVII the results are satisfactory.

III. The averaged residuals have been adjusted to total zero, in this study, in the following way.

Let a_j = unadjusted average residual value for j^{th} month a'_j = adjusted average residual value for j^{th} month then $a'_j = a_j - \frac{1}{12}\sum_{i=1}^{12} a_i$.

It is clear that $\sum_{j=1}^{12} a'_j = 0$.

Wald uses the following method.

$$a'_j = a_j - \frac{|a_j|\left(\sum_{i=1}^{12} a_i\right)}{\sum_{i=1}^{12}|a_i|}$$

Once again it is clear that

$$\sum_{j=1}^{12} a'_j = 0.$$

The choice between these two methods should depend on the assumptions as to the nature of the "error" in the uncorrected residuals. If it is assumed that this error varies directly with the absolute value of the residual Wald's method is superior, if this is not the case, the simpler method used in this study should be preferred.

The average of the unadjusted average residuals may not equal zero because they are affected by the trend-

TABLE XXXVII

Applying Additive or Multiplicative Test to Link Method

Estimated Seasonal Values		J	F	M	A	M	J	J	A	S	O	N	D
Year	1	-28.42	-22.45	-16.59	-10.96	- 4.67	- 0.82	+ 7.48	+11.13	+14.05	+16.16	+17.48	+17.61
	2	-30.53	-21.79	-14.11	- 7.48	- 1.99	+ 2.41	+ 9.75	+12.03	+13.32	+13.66	+13.11	+11.67
	3	-25.71	-18.41	-13.66	- 9.45	- 5.38	- 1.64	+ 5.99	+ 5.62	+ 9.36	+13.33	+17.64	+22.34
	4	-17.21	-17.38	-16.82	-15.45	-13.19	- 9.98	- 1.78	+ 3.48	+ 9.80	+17.21	+25.72	+35.61
	5	-20.17	-19.69	-18.22	-15.80	-12.49	- 8.37	- 0.48	+ 5.98	+12.03	+18.52	+25.35	+32.41

Year	Absolute Magnitude	Deviation	Average Activity	Relative Magnitude	Deviation Deviation
1	167.86	0.40	251.0	66.9	30.9
2	151.85	16.41	290.4	52.3	45.5
3	148.53	19.73	204.7	72.6	25.2
4	183.65	15.39	112.6	163.1	65.3
5	189.44	21.18	141.1	134.3	36.5
Average	168.26	14.60		97.8	40.6
Ratio	$\frac{14.60}{168.26}$ = 0.09				$\frac{40.6}{97.8}$ = 0.4

cyclical-irregular component due to the defections of the moving average method. There is no reason to expect these defections to be greater for the larger residuals, the size of the latter may be due to large seasonal values. An examination of the residuals in Table III does not indicate any significant correspondence between the size of the residual and the size of the defection. This is the reason for making use of the simpler method in this study.

The results of using both methods for adjusting the average of the residuals for the first four years in the first example are given in Table XXXVIII. The adjustment is required because a complete cycle has not been covered, and the defections do not all cancel out. They are mainly positive since the upper part of the cycle has been covered. It should be noted that Wald's method of adjusting will never change the sign of the unadjusted average residual values. In cases where the "incomplete" cyclical influences are strong it is possible for the defections to change the sign of some of the apparent seasonal values. The necessary corrections may be made with the method used in this study.

IV. The dangers of neglecting to test for the multiplicativity or additivity of seasonality can best be illustrated by reference to an example in the literature.

J. Wisniewski, in an article titled "Interdependence of Cyclical and Seasonal Variation",[1] attempted to relate the

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1 - Econometrica, 1934 pp. 176-181.

TABLE XXXVIII

Adjusting the Average Residuals for First Four Years in Table II

(1) Adjustment Obtained With Method Used in this Study.
(2) Adjustment Obtained With Wald's Method.

Month	Sum of Residuals	Average	(1) Adjustment	(1) Adjusted Average	(2) Adjustment	(2) Adjusted Average
J	-91.63	-22.91	-0.96	-23.87	-1.61	-24.52
F	-73.88	-18.47	-0.96	-19.43	-1.30	-19.77
M	-58.17	-14.54	-0.96	-15.50	-1.02	-15.56
A	-42.52	-10.63	-0.96	-11.59	-0.75	-11.38
M	-26.97	- 6.74	-0.96	- 7.70	-0.48	- 7.22
J	-11.46	- 2.87	-0.96	- 3.83	-0.20	- 3.07
J	+20.02	+ 5.01	-0.96	+ 4.05	-0.35	+ 4.66
A	+35.44	+ 8.86	-0.96	+ 7.90	-0.62	+ 8.24
S	+50.83	+12.71	-0.96	+11.75	-0.90	+11.81
O	+66.19	+16.54	-0.96	+15.58	-1.17	+15.37
N	+81.52	+20.38	-0.96	+19.42	-1.44	+18.94
D	+96.85	+24.21	-0.96	+23.25	-1.71	+22.50
Average		+ 0.96	-0.96	0		0

$$\frac{\sum_{i=1}^{12} |a_i|}{12} = 13.66 \qquad \frac{0.96}{13.66} = 0.07$$

seasonal movement to the non-seasonal movement. The method he used was the following.

He adopted Kuznets method for measuring seasonal variations, (averaging seasonal relatives) therefore implicitly assuming that seasonality was multiplicative, that is, the amplitude of seasonal variations varies directly with the non-seasonal level. He then obtained the coefficient of regression (b) of gross seasonal indices (minus 100) on average seasonal indices (minus 100), to measure variations in seasonal movement from year to year. He compared variations in b with variations in the non-seasonal (cyclical) level of employment. His conclusion was that the b's approximate a decreasing function of the level of employment in the given series. That is, the amplitude of seasonal variations (as measured by b) is a decreasing function of the non-seasonal level. This result is paradoxical, since, in order to use Kuznets methods, he must make the assumption that the amplitude of seasonal variations is an increasing function of the non-seasonal level of employment.

Wisniewski's results can be explained if seasonality was additive in the industries he examined. If the seasonal displacement in absolute figures (i.e. the deviations from the non-seasonal level in the units used in the time series) is constant even though changes occur in the non-seasonal level, measuring seasonality with the implicit assumption that seasonality is multiplicative over-estimates (under-estimate) the seasonal relatives, in relation to the seasonal index which

is an average of these values, when the non-seasonal level is low (high).

This argument can be illustrated using the fictitious data for the trend-cyclical and seasonal example developed in this appendix. The seasonal index has been computed using relatives, and b's have been computed for the gross seasonal relatives for each year[2]. The results are contained in Table XXXIX. It can be seen that the b's are approximately a decreasing function of the non-seasonal level. To conclude from this that the amplitude of seasonal variations is a decreasing function of the non-seasonal level is however erroneous since, as we know, the amplitude is the same in each of the years. The additive or multiplicative test should always be used before other attempts are made to determine the relation between the seasonal and non-seasonal movement.

TABLE XXXIX

Year	b	Average Value
1	0.73	251.0
2	0.62	290.0
3	0.77	204.7
4	1.33	112.6
5	1.44	141.1

The seasonal movements in Meat Products satisfy one of the assumptions on which Wald's method[3] is based, that

2 - See above, Chapter II, pages 45-46.

3 - See above, Chapter II, pages 41-43.

is, monotonic changing amplitude. Neither the seasonal pattern nor the nature of seasonality strictly satisfy the other requirements, but this is not sufficient to obscure the general movement, nor to deprive the results of all significance. The adjusted seasonal values for 1948-1950, expressed as percentages of the average employment for the period 1947-1951 are given in Table XL.

TABLE XL

Adjusted Seasonal Values for Meat Products, Obtained Using Wald's Method. Expressed as Percentages of Average Employment in Meat Products, 1947-1951

Month	1948	1949	1950
January	∕ 4.8	∕3.0	∕2.7
February	- 4.1	-2.5	-2.3
March	-11.3	-7.0	-6.1
April	-13.1	-8.0	-6.7
May	-11.2	-6.9	-5.5
June	- 3.8	-2.8	-2.1
July	∕ 0.8	∕0.8	∕0.5
August	∕ 3.0	∕3.0	∕1.8
September	∕ 2.4	∕2.3	∕1.4
October	∕ 2.6	∕2.2	∕1.4
November	∕ 6.1	∕5.3	∕3.4
December	∕10.0	∕8.9	∕5.9
Ampl. of Variations	6.1	4.4	3.3

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