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LA THÈSE A ÉTÉ
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CANADIAN BUSINESS CYCLES
AND
STOCK-MARKET CYCLES

by

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Thesis presented to the School of Graduate Studies of the University of Ottawa as partial fulfillment of the requirements for the degree of Master of Arts (Economics).

Ottawa, Canada, 1981

PREFACE

Few studies have analysed the relationships between short-term business fluctuations and stock market prices. Most business cycle students tend to concentrate on the monetary and real sectors of the economy while other academicians such as Fama, Osborne, Cootner have concentrated their research on the analysis of stock price movement, and on the securities market exclusively (see [14], [17], [18], [illegible]).

Moreover, it is generally agreed, today, that short-term business fluctuations are random processes whereas stock market prices seem to follow a random walk (M. Rau [43], p.12; L. Bachelier [4], p.21). This means that the latter follows stochastic laws while the former is ruled by pure chance as well as by mechanical or deterministic factors.

It is appropriate, therefore, to make an attempt to clarify the relationships between business cycles and stock market cycles.

To begin with, a random walk is a very special case of the random processes. Secondly, the random walk character of the stock market still requires further evidence from empirical studies to reach general acceptance. The study of the inter-connection of the stock market with the rest of the economy may be a means to enlarge such evidence. Thirdly, no single explanation as yet exists of business disturbances and of stock market price movements (see Rau [43], Fama [18]).

PREFACE

It is the purpose of this thesis to explore some of the relationships between business fluctuations and stock market prices in Canada for the Post War II period ranging from January 1947 to December 1975.

ACKNOWLEDGEMENTS

I wish to thank Dr. Apel for his help and direction in the pursuit of this study.

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INTRODUCTION

Although little research work has been pursued on the subject of the relationships between Canadian business cycles and stock market cycles, several studies have been conducted on the analysis of the Canadian business cycles (see A. Waterman [52]; E.J. Chambers [11]; E.J. Chambers [12]; D. White [53], and K. Hay [24]). Other studies such as the one by J.H. Chung on the cycles in Canadian residential construction concentrate on the analysis of cycles in a particular industry. Still other studies on Canadian economic fluctuations are underway[1]. Canadian stock market price cycles have been studied mainly by financial analysts and some academicians concerned with the business of forecasting future stock prices. In Canada, no research seems to have been pursued by academic economists on the testing of the random walk hypothesis, as has been done, for instance, by American academics.

Furthermore, cyclical analyses have been ignored in recent years (see G.H. Moore [38]). Econometric studies, with very complex models, have overwhelmed the less complex time series analyses of business cycles. Nevertheless, cyclical analysis is still useful, for it permits one to establish

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1 The Staff of Statistics Canada is pursuing a study of growth cycles reference turns for Post World War II cycles. A preliminary study has been published in The National Income and Expenditures Accounts. Third Quarter 1975, Statistics Canada, cat. No. 13-801.

the basic framework from which a deeper analysis might be pursued (see I. Mintz [31]). In fact, this type of analysis has prevailed at the National Bureau of Economic Research in the United States over many decades, and the business reference cycles of the NBER are used all over the World.

Since the first publication by Burns and Mitchell in 1938, more and more time series have been collected and analyzed in the industrial countries. Many findings have resulted from those studies (see G.H. Moore [37]). Today, with the help of computers, investigators perform many complex studies and their results give new insight into economic behavioral relationships.

This thesis follows the Mintz's approach of cycle analysis. Ilse Mintz first developed and applied her approach to West Germany (I. Mintz [31]) and subsequently to the United States economy. Her method may be applied to all industrial countries (see NBER [40]). One advantage of her approach is that it permits easy comparison of reference cycles between countries; her methodology is described in CHAPTER II.

In this thesis, the Mintz's approach will be applied to a set of Canadian business series as well as to a set of stock price series. The conclusions of this analysis will appear in CHAPTER III. In CHAPTER IV, historical diffusion indices will be built for both set of series, business and stock market series. It will then be possible to look at some of the existing relationships between stock price

fluctuations and business fluctuations. In particular, the structure of leads-lags will be analysed.

It should be noted, however, that Mintz's approach is not without some detractors and in CHAPTER V some of those criticisms will be reviewed and assessed. In CHAPTER VI, comparisons will be made of the growth references found in this thesis with other Canadian reference cycles, and elements of a synthesis will be proposed.

CHAPTER 1

SCOPE OF THE STUDY

1. Some Definitions

Business cycle is a term used to describe a class of historical events (N. Rau [43] p. 11). It is not a well-defined relationship between economic variables, such as a supply curve. Hence, definitions of business cycles are not very helpful or precise. Two leading American research workers in the field have proposed the following definitions:

> "A cycle consists of expansions occurring at about the same time in many economic activities, followed by similar general recessions, contractions and revivals which merge in the expansion of the next cycle: this sequence of chance is recurrent but not periodic..."
>
> (W.C. Mitchell [33] p. 468).

and

> "cycles are... recurring alterations of expansion and contraction in aggregate economic activity, the alternating movements in each direction being self-reinforcing and pervading widely all parts of the economy".
>
> (R.A. Gordon [21] p. 249).

Although it is difficult to define what is a business cycle, its existence is rarely questioned (see Abramovitz [1]).

2. Cycles and Periodicity

Cycles, as it will be seen in subsequent Chapters, do not repeat themselves. They vary both in amplitude and timing. They also vary from country to country (see A.F. Burns [7]). Nevertheless they are recurrent.

There is also a tendency for expansions to last longer than contractions (A.F. Burns [7]). There are exceptions however (see CHAPTER V). These characteristics apply to the so-called business cycle, but other similar cycles do exist. There are seasonal movements occurring usually within a calendar year. Seasonal unemployment is an example. Ruth Mark has identified sub-business cycles for the interwar years of U.S. (R. Mack [28]). Very long cycles have also been claimed. Schumpeter and some other writers (see Rostow [44], Shuman [45]) have expressed belief in "55-year 'Kondratieff' cycles whose upswings correspond to major innovations, and whose contractions are long periods of relative stagnation" (J.A. Schumpeter [47]). Because of the lack of very long series, less evidence can be advanced for this type of cycle.

More important are the so-called 'Kuznets' cycles such as long swings in building cycles. They last 15 to 20 years and are usually associated with changes in the construction industry (M. Abramovitz [1]).

Similar classification of cycles may be applied to stock prices. The usual practice, promoted by the financial analysts and investment advisors, has been to use the so-called technical analysis. Technical analysis is used to cover a fairly wide range of techniques, all based on the concept that past information on prices and trading volume

of stocks gives the enlightened student a "picture" of what lies ahead (see J. Magee [29]). It would be too long to enumerate and explain all those techniques. It suffices to mention the still widely followed techniques such as the Dow theory proposed by Charles Dow after the turn of the century and extended in a book by Samuel Nelson [41]). There are many versions of this theory but essentially it consists of three types of market movements: the major market trend, which can often last a year or more; a secondary intermediate trend, which can move against the primary trend for one to several months; and minor movements lasting only for some hours to a few days. The determination of the major market trend is the most important decision to the Dow believer. A rising major trend is one where each new peak is higher than the last and each reaction low holds at a price higher than previous low. In a primary downtrend the order is reversed.

Charting, however, is a most widespread form of technical analysis. Price is plotted on the vertical axis and each time period on the horizontal axis. Such charts are plotted on a daily, weekly, or sometimes monthly basis. Several daily newspapers publish those charts in their financial columns.

For the purpose of this thesis the time series will be broken down into the usual seasonal, trend, cyclical and irregular components. Seasonal and irregular components will

be removed and deviations from trends will be considered only. Longer cycles, such as the 'Kondratieff' cycles and the 'Kuznets' cycle will not be considered. The shortness of the period considered should suffice to partially escape the very long term influence.

3. The Framework

In a well known article, Koopmans has pointed out that in every empirical investigation authors should always outline the theory they want to test (T.C. Koopmans [25]). Better understanding of economic behaviours should result from this clarification.

In the first part of this thesis it is hypothesized that since World War II almost systematic alternations of high growth and low growth rates of economic development have prevailed in overall economic activities. Regarding the difference from prewar years with absolute declines in business activity, it is sometimes contended that absolute declines in Canadian business activities are no longer a true picture of post World War II years.

In effect, observations reveal that the annual real G.N.P. (Canada) has increased in 90% of the years for the period 1947 - 1975. The Industrial Production index has shown an annual increase in 93% of those same years, and the positive increases have continued for sixteen years without interruption (1959 to 1974). The same kind of growth rates

have been observed in other industrial countries as well (see I. Mintz [31]).

Accordingly, a new concept has been introduced for this post World War II phenomenon, the so-called "growth cycles".

Mintz defines them as follows:

> "Growth cycles are fluctuations in aggregate economic activity. A growth cycle consists of a period of relativity high growth rate occurring at about the same time in many economic activities, followed by a period of similarly widespread low growth rates which merges into the high growth rates of the next cycle".
>
> (I. Mintz [31]).

This new concept separates every business cycle in two phases: a phase of low growth and a phase of high growth. The high growth phase begins with the upturn of economic activities until the downturn is reached where the low growth phase starts. The endpoints of the phases are termed downturns and upturns, rather than peaks and troughs. The alternations between high-and-low growth rate periods are termed "step cycles".

The growth cycle definition given above differs from the traditional one[1] only in replacing the words "expansion" and "contraction" by "period of relatively high growth rates" and "period of relatively low growth rates". It may be added,

---

1 By the traditional definition of business cycle is meant the Burns-Mitchell definition of business cycles, see [10], p.3.

however, that the relative length of the two phases of the classical cycle differ from those of the growth cycle. In a growing economy, "high-rate phases must always coincide with expansions of classical cycles, while low-rate phases may coincide with either classical cycle phase" (Mintz [31] p.45). Hence, in the thesis it is hypothesized that the growth cycle concept is characteristic of the Post World War II period in Canada, which runs from January 1947 to December 1975.

In this thesis, then, it will be convenient to spell out the growth cycles from two set of business series: a first set that will be called the business series (or indicators) and a second set that will be called the stock market series (or indicators). The latter series will be chosen from the numerous time series published by the Canadian Stock Exchanges, while the former set of series will include indicators published by Statistics Canada. The following chapter explains the choice of the time series and the Mintz's approach to derive the growth cycles.

CHAPTER 11

METHODOLOGY

1. Choice of Series

Numerous indicators might be selected from the long list of series published about the different sectors of the Canadian economy to serve as a basis for establishing Canadian business cycles. On the other hand, only one indicator might be used for that purpose. The GNP series is the one most often used along with the planned investment series. The use of only one indicator involves some danger, however, because some sectors of the economy might be expanding while some other sectors might be entering a depressive phase. These different levels of economic activity might be lost in a total aggregate such as the G.N.P., particularly if the expanding sectors were more prevalent. Thus it is preferable to use a series of indicators instead of just one. It remains to decide how to choose them from the long list of indicators provided by different publications such as the ones included in the Canadian Statistical Review, published by Statistics Canada.

To determine this list of indicators, Mintz experimented with a large number of series (all chosen from the long list of series used by NBER to update the classical business reference cycle). She subjected them to the computerized method of Bry-Boschan, varied the number of

series used as well as their composition so as to come out with a set of series that would reproduce a growth reference cycle very close to the traditional business reference cycle. Following these various experiments, she finally opted for the following priority indicators:

1. Corporate profits after taxes;
2. Number of employees on nonagricultural payrolls, establishment survey;
3. Unemployment rate, total;
4. Index of industrial production;
5. Man-hours in nonagricultural establishments;
6. Nonagricultural job openings unfilled;
7. Personal income;
8. Wage and salary income in mining, manufacturing, and construction;
9. Sales of retail stores;
10. Index of wholesale prices, industrial commodities;
11. Business expenditures for new plant and equipment, total;
12. Index of labor cost per unit of output, total manufacturing;
13. Manufacturing and trade inventories, total book value;
14. Discount rate on new issues of 91 day Treasury bills;
15. Gross national product in current dollars;
16. Gross national product in 1958 dollars;
17. General imports, total (Mintz [31], p.72).

It should be observed that this list comprises both monthly and quarterly data.

Because of the shortage of Canadian data, it has been impossible to conduct similar experiments. Also some American series do not have a Canadian counterpart, as will be seen below. Nevertheless, it may be presumed that a similar list of Canadian indicators would be valuable for establishing a Canadian growth cycle reference. Unfortunately, the exact

counterpart is not available either because of later collection of such data or no collection at all. Nevertheless, an effort has been made to remain as close as possible to the Mintz's list. Moreover, because of the greater dependence of the Canadian economy on export sales, the import series was replaced by an export series.

It remained to choose the Canadian stock market indicators. Given the main purpose of this thesis, the choice was relatively easy. Of the five Canadian Stock Exchanges, only the Toronto and Montreal (and Canadian) ones have been operating for the entire period covered by this study. Those two Stock Exchanges already publish indicators for the stocks traded in their establishments. Hence, the major indicators from the Toronto and Montreal Exchanges include:

1. Montreal industrial indices,
2. Montreal utility indices,
3. Montreal bank indices,
4. Toronto industrial indices,
5. Toronto base metal indices,
6. Toronto western oil indices, and
7. Toronto gold indices.

The construction of those indices is similar to other business indices which give to each stock traded different weights (for details see [34] , [50] , [51]).

The complete list of indicators used in this study is given below. The indicators are listed according to the sector or market they represent. They comprise monthly and

quarterly series, not seasonally adjusted.

A. Financial Sector

1. Three month Treasury yields, monthly series, January 1947 - December 1975;

2. Government bond yields, monthly series, January 1947 - December 1975;

3. Money supply, (M2 series) monthly series, January 1947 - December 1975;

4. Commercial failures, Liabilities monthly series, January 1947 - December 1975.

B. Production Sector

5. Industrial production index, monthly series, January 1947 - December 1975;

6. Gross national product, quarterly series, at 1961 constant price, January 1947 - December 1975;

7. Corporate profit before taxes, quarterly series, 1st quarter 1950 - 4th quarter 1975.

C. Labour Market

8. Labour force employed, monthly series, January 1953 - December 1975;

9. Unemployment rate, monthly series, January 1953 - December 1975;

10. Wages and salaries, manufacturing, monthly series, January 1947 - December 1975;

11. Weekly working hours, monthly series, January 1947 - December 1975.

D. Capital Activity

12. Gross capital formation, quarterly series, at 1961 constant price, 1st quarter 1947 - 4th quarter 1975.

E. Sub-capital Activity

13. Toronto industrial indices, monthly series, January 1947 - December 1975;

14. Toronto base metal indices, monthly series, January 1947 - December 1975;

15. Toronto western oil indices, monthly series, January 1947 - December 1975;

16. Toronto gold indices, monthly series, January 1947 - December 1975;

17. Montreal industrial indices, monthly series, January 1947 - December 1975;

18. Montreal utility indices, monthly series, January 1947 - December 1975;

19. Montreal bank indices, monthly series, January 1947 - December 1975;

F. External Sector

20. Exports, monthly series, January 1947 - December 1975;

G. Construction Sector

21. New dwelling units started, monthly series, January 1948 - December 1975;

H. Manufacturing Sector

22. Sales of new cars, monthly series, January 1947 - December 1975;

I. Income Shares

23. Total labour income, monthly series, January 1947 - December 1975;

J. Consumer Finances

24. Consumer credit, monthly series, January 1956 - December 1975;

K. Financial Failures

25. Commercial bankruptcies, monthly series; January 1947 - December 1975;

L. Prices

26. Consumer price index, monthly series, January 1956 - December 1975;

27. Total GNE implicit price index, quarterly series, 1st quarter 1947-4th quarter 1975[1].

2. Growth Cycles: Statistical Procedures

The first step towards evaluating the growth cycles was to adjust all the original series used for seasonal variations. The X-11 program developed by the Census Bureau of United States was used for this purpose. This program offers different options. The multiplicative option was chosen[2].

Next, a twelve-month moving average was calculated for each monthly series. For the quarterly series, a four-quarter moving average was calculated. It is a convenient

---

1 All the business series are extracted from the different publications of Statistics Canada. The Stock Market Indices are extracted from the different issues of the Toronto Stock Exchange Journal [5] and of the Montreal Stock Exchange.

2 As the purpose of the study is to look at relative changes rather than absolute changes from period to period in the time series used, the multiplicative option was chosen since this process deals with relative changes rather than with absolute changes as does the additive option.

way to eliminate fluctuations of subcyclical duration or very shallow amplitudes. By using a twelve-month moving average, the first average appears only at the twelfth period of the series. As most of the series used covers the period running from January 1947 to December 1975, the first moving average appears on December 1947, and the last moving average appears on December 1975. To correct this situation, the series of moving averages was centred. The centring was done in the following way. The series of moving averages was matched with the month appearing six months before the present ones with which they presently corresponded. An example borrowed from the new car sales series will clarify the procedure employed.

The series of twelve month moving averages over the first two years and the last two years for the period under review give the following numbers.

TABLE 1

Non Centred Twelve-Month Moving Averages of Monthly Series of Sales of New Cars

Month	1947	1948	1974	1975
January		13,408.44	81,708.20	77,253.54
February		13,140.91	81,584.01	77,585.62
March		13,221.38	79,719.09	77,317.85
April		13,169.63	78,976.53	77,156.94
May		13,034.77	79,668.97	76,135.21
June		12,886.28	79,549.40	76,181.67
July		12,547.35	80,516.96	76,093.31
August		12,303.19	81,410.15	75,587.27
September		12,078.54	81,294.59	75,753.93
October		12,080.68	80,859.09	77,181.23
November		12,128.00	79,551.61	79,317.73
December	13,400.80	12,393.09	78,706.81	83,539.75

The centring procedure utilized in this study consisted in moving the series of 12-month moving averages back by six months. In other words, the number corresponding to December 1947 in Table 1 is switched to July 1947 and so on for the rest of the data. The new time series is shown in the following (Table 11).

TABLE 11

Centred Twelve-Month Moving Averages, Monthly Series of Sales of New Cars

Month	1947	1948	1974	1975
January		12,547.35	80,516.96	76,093.31
February		12,303.19	81,410.15	75,587.27
March		12,078.54	81,294.59	75,753.93
April		12,080.68	80,859.09	77,181.23
May		12,128.00	79,551.61	79,317.73
June	13,400.80	12,393.09	78,706.81	83,539.75
July	13,408.44	12,088.55	77,253.54	
August	13,140.91	12,145.99	77,585.62	
September	13,221.38	12,412.05	77,317.85	
October	13,169.63	13,030.42	77,156.94	
November	13,034.77	13,669.30	76,135.21	
December	12,886.28	79,549.40	76,181.67	

All monthly series are centred in this way. For the quarterly series, the centring procedure consisted in moving the four quarter moving average by two quarters back i.e. so that the first term appears under the second quarter of the first year and the last term of the series under the second quarter of the last year covered. For instance, the centred four

quarter moving averages of G.N.P. at 1961 constant price is shown in the following Table.

TABLE 111

Centred Four Quarter Moving Averages of G.N.P. at 1961 constant price

Year	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1947	-	5,351.91	5,340.24	5,328.40
1948	5,416.98	5,467.71	5,525.36	5,605.57
1949	5,618.98	5,688.21	5,787.47	5,867.23
1950	6,005.50	6,109.34	6,228.92	6,336.91
1951	6,434.25	6,414.19	6,436.41	6,530.70
1952	6,734.73	6,961.95	7,124.57	7,230.98
1953	7,282.45	7,339.30	7,341.72	7,347.86
1954	7,236.36	7,273.14	7,346.80	7,471.05
1955	7,769.16	7,923.75	8,178.97	8,372.80
1956	8,434.42	8,624.80	8,723.77	8,798.52
1957	8,837.66	8,831.25	8,808.50	8,843.78
1958	8,921.16	9,023.77	9,127.06	9,215.14
1959	9,302.65	9,366.21	9,481.76	9,520.77
1960	9,596.83	9,640.78	9,624.80	9,750.85
1961	9,772.45	9,914.46	10,111.80	10,228.80
1962	10,459.38	10,585.75	10,675.27	10,798.16
1963	10,948.71	11,126.49	11,354.75	11,571.30
1964	11,716.26	11,882.43	12,047.22	12,229.26
1965	12,440.36	12,668.94	12,913.88	13,151.32
1966	13,403.26	13,547.64	13,673.70	13,810.62
1967	13,874.77	14,003.28	14,134.68	14,296.70
1968	14,539.25	14,812.80	15,074.80	15,265.21
1969	15,451.43	15,606.95	15,727.41	15,855.47
1970	15,940.04	16,000.82	16,108.03	16,268.11
1971	16,595.03	16,878.86	17,153.73	17,447.41
1972	17,585.45	17,868.84	18,195.69	18,437.27
1973	18,755.72	19,076.83	19,332.41	19,616.77
1974	19,764.89	19,799.16	19,797.83	19,797.23
1975	19,802.27	19,797.83	-	-

3. Turning Points in Indicators

The rule used for selecting a turning point is the following: any month whose value is higher than those of the five preceding months and the five following months is regarded as the date of a tentative peak. Analogously, the month whose value is lower than the five values on either side is regarded as the date of tentative trough. These tentative turns are tested for compliance with a set of constraint rules concerning alteration of phases and duration of phases and cycles: a peak month must be followed by a trough month and vice versa; on the other hand at least five months must separate them, otherwise they are rejected as possible turning points[1].

Following this method, the tentative peaks and troughs for the Toronto Industrial Indices for the period under review are the following:

1 It must be observed that the selection of those turning points follows the computerized method developed by Bry-Boschan of the NBER [6].

TABLE IV

Classical Cycles in Toronto Industrial Indices

1948 - 1961		1965 - 1975	
Trough	Peak	Trough	Peak
April 1947	April 1948	April 1962	March 1965
Sep. 1948	April 1951	June 1966	Jan. 1967
March 1953	July 1956	Aug. 1967	Dec. 1968
Aug. 1957	Jan. 1959	April 1970	Nov. 1971
Dec. 1959	May 1961	June 1974	

As every trough (peak) is followed by a peak (trough) and as at least five months separate each peak-trough or trough-peak, all tentative turns are accepted.

However, if the Toronto gold indices are used the schedule of peaks and troughs are the following:

TABLE V

Turning Points of Toronto Gold Indices

1948 - 1961		1962 - 1975	
Trough	Peak	Trough	Peak
Dec. 1948	Dec. 1949	July 1962	May 1962
Jan. 1951	March 1952	March 1964	July 1963
Jan. 1954	June 1952	April 1967	April 1966
Aug. 1957	July 1954	April 1970	Jan. 1969
Feb. 1960	March 1961	Nov. 1971	Sep. 1970
Oct. 1960	Dec. 1961		June 1974

It is seen that under the "peak" column "March 1952" and "June 1952" follow each other without a trough-month between them. Thus "March 1952", the first of both peaks, is rejected. For the same reason, on the "Trough" side, "February 1960" must be rejected. The "March 1961" and "December 1961" peaks are also rejected for similar reasons. Under the "Trough" column, "July 1962" is also rejected because it appears only 2 months after the preceding peak "May 1962". Thus the tentative cyclical turns are reduced to 16 (out of 22 first retained).

The next step in the process of determinating tentative cyclical turns is the determination of tentative cyclical turns in a Spencer curve of the seasonally adjusted, modified data[1]. This step is chosen as the next one because, on this curve, turning points tend to be closer to those of the unsmoothed data than are those of the twelve-month moving averages (see Bry and Boschan [6]).

In the neighborhood (defined as plus or minus five months) of the turning points established on the twelve-month moving averages, like turning points are found. That is, in the neighborhood of peaks (plus or minus five months) the highest of the eleven points are retained; in the

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1 The Spencer curve is a complex fifteen-month graduation formula, a weighted moving average with the highest weights in the center and negative weights at either end. This ensures that the curve follows the data closely. It has approximately the flexibility of a five-month moving average, but is much smoother.

neighborhood of troughs, the lowest points are retained. Afterwards the turning points are subjected to several tests.

Like turns are rejected when they are less than fifteen months apart and when there is no intervening opposite turn between them. Turns are also rejected when they are less than six months from either end of the series.

The turns retained for the Toronto gold indices, after testing are the following.

TABLE VI

Cycles in Toronto Gold Indices

1948 - 1961				1962 - 1975			
Trough		Peak		Trough		Peak	
Sep.	1948	Oct.	1949	Dec.	1963	June	1966
Oct.	1950	July	1952	Feb.	1967	Feb.	1969
Oct.	1953	Sep.	1954	May	1970	Nov.	1970
Oct.	1957	Jan.	1960	Dec.	1971	Feb.	1974
June	1960	Dec.	1961				

Six turning points were rejected even though each of those points were selected as the highest points within the neighborhood. They were not consistent with the peak-trough or trough-peak pattern.

The accepted turns in the Spencer curve provided the basis for the next step which was the search for turns in the

unsmoothed data. The seasonally adjusted series were smoothed by a four-month moving average. In this way the irregular component was separated from the cyclical component since only the cyclical component will satisfy the rule of the choice of the turning point[1].

Again in the neighborhood (still defined as plus or minus five months) of the peaks established on the Spencer curve, a search was made for the highest of the eleven points, and in the neighborhood of troughs, for the lowest.

To illustrate that procedure the results for the Toronto Gold Index are given in TABLE VII. The turns retained from the Spencer curve are placed parallel to the turns retained from the 4-month moving average series.

TABLE VII

Toronto Gold Index
Turning Points

From Spencer Curve				From Four Month Moving Average			
Trough		Peak		Trough		Peak	
Sep.	1948	Oct.	1949	Aug.	1948	Sep.	1949
Oct.	1950	July	1952	Sep.	1950	May	1952
Oct.	1953	Sep.	1954	Sep.	1953	Sep.	1954
Oct.	1957	Jan.	1960	April	1957	Dec.	1959
June	1960	Dec.	1961	May	1960	May	1962
Dec.	1963	June	1966	Oct.	1963	June	1966
Feb.	1967	Feb.	1969	Jan.	1967	Feb.	1969
May	1970	Nov.	1970	April	1970	Sep.	1970
Dec.	1971	Feb.	1974	Oct.	1971	Dec.	1973

1 The irregular component by definition does not describe a cyclical pattern but rather an erratic or random pattern. Thus it cannot be retained as a turning point.

The next and last step was to find the peak and trough months in the unsmoothed, seasonally adjusted data which corresponded to the short-term moving average turns previously established. This search was analogous to the previous ones. The highest values in the unsmoothed data within a span of plus or minus five months from the peak in the short-term moving average curve were selected as definite peaks. Correspondingly, the lowest values in the neighborhood of the troughs of the short term moving average curve were retained as troughs of the unsmoothed data. Having again eliminated the turns that did not comply with the rules, the remaining ones were selected as the final turning points of the series. The turning points found for the various series could be amalgamated in a comprehensive index or a diffusion index for obtaining a business reference cycle, similar to a traditional one.

The transformation of the various series, however, must be advanced a step further to obtain the desired growth cycles. To do so, seasonally modified series must be adjusted for trend factors. Here, again, a set of tools are available to adjust indicators for trend. However, they all depend crucially on the selection of the trend curve. The unavoidable arbritariness of this selection is a serious and valid objection to reliance on trend-adjusted data. On the other hand, the different indicators have specific trends,

that are lost when they are deviated from a single trend curve.

To avoid these difficulties, Mintz [31] aplied a new procedure. It consists in computing a 75-month moving average over every and each seasonally adjusted series. Then, the percentage deviation of each series is derived from their respective moving averages. In other words, the 75-month moving averages of each series becomes the trend curve. Use of this procedure helps to iron out the difficulties encountered with the diversity of trends. The moving average is long and flexible enough to iron out cyclical swings that occur during shorter periods of time.

One difficulty, however, remains with this procedure. Thirty-seven months of values are missing at either end of the moving averages. To complete them Mintz [31] made some extrapolations. The missing thirty-seven months at either end of the moving averages were supplied with the help of the average rates of change during the first three years and last three years, for which they were available. The percentage deviation of the original series from the new trend was then computed. Finally, all the steps previously described were performed over the new series obtained i.e. twelve month moving average, choice of tentative turning points, computation of Spencer curves, new set of tentative turning points and so on to the

last step: the determination of tentative turning points in the deviation series.

To show the workings of the procedure just described the Toronto Gold Index is used again. Its 75-month moving averages was calculated, extrapolation made for the missing 74 months and percentage deviations of original seasonally adjusted series were computed. Then, months with values higher than the five preceding months and five following months were retained as first tentative upturns and similarly months with values lower than their five preceding months and five following months were chosen as tentative downturns. The following schedule of tentative turning points was retained.

TABLE VIII

Tentative Turning Points
in the Twelve Month Moving Average Deviation Series

1947 - 1962		1963 - 1975	
Downturns	Upturns	Downturns	Upturns
Nov. 1947	Oct. 1948	March 1963	Nov. 1963
Nov. 1949	Dec. 1950	Dec. 1964	Feb. 1967
Aug. 1952	March 1953	Feb. 1968	Dec. 1971
Jan. 1954	May 1955	March 1974	
Nov. 1955	Dec. 1957		
March 1960	Dec. 1962		

The next step was the calculation of the Spencer curve. Then, in the neighborhood of the turning points found on the 12-month moving average deviation series, a search was made to locate similar turns on the Spencer curve. For the Toronto

gold index the following schedule of turning points was found.

TABLE IX

Toronto Gold Index
Turning Points in the Spencer Curve

1947 - 1962		1963 - 1975	
Downturns	Upturns	Downturns	Upturns
Sep. 1947	Sep. 1948	May 1963	Dec. 1963
Oct. 1949	Sep. 1950	Jan. 1965	Feb. 1967
July 1952	Aug. 1953	June 1968	Jan. 1972
June 1954	June 1955	Feb. 1974	
Oct. 1955	Oct. 1957		
Dec. 1959	Dec. 1962		

Next, the four-month moving averages of the deviation series was calculated and a search was made on the four-month moving averages to locate similar turns in the neighborhood of turns found on the Spencer curve. Those new turns became the turns that served as the guidelines to find the definite turns on the original deviations series. The definite set of growth cycle turning points for the Toronto gold indicator is given in TABLE X.

TABLE X

Turning Points in Toronto Gold Indices
Deviation Series

1947 - 1962				1963 - 1975			
Downturns		Upturns		Downturns		Upturns	
Sep.	1947	Sep.	1948	May	1963	Dec.	1963
Oct.	1949	Sep.	1950	Jan.	1965	Feb.	1967
July	1952	Aug.	1953	June	1968	Jan.	1972
June	1954	June	1955	Feb.	1974		
Oct.	1955	Oct.	1957				
Dec.	1959	Dec.	1962				

Up to this point the procedure described above was for monthly series. However, as quarterly series were also incorporated in the list of indicators, the above procedure must be slightly modified to deal with the quarterly data.

With quarterly series, a four-quarter moving average was utilized where a 15-month moving average was previously utilized. To replace the 75-month moving average a 35-quarter moving average was utilized as a trend curve for every indicator. The missing seventeen quarters at either end of the 35-quarter moving average was also supplied by extrapolation of its average rates of change during the first two years and last two years for which they were available. It was presumed that the series repeated its pattern during the first and last years for the period under review.

The criteria for the choice of the turning points was also similar as for the monthly series. However, as it is not possible to say if the turning points occurred during the first month or during one of the last two months of the quarter, three alternative indexes were constructed in which turns were assumed to occur in the first, second and third month of the quarters respectively. Rules were set up to choose the most appropriate ones. The rules are outlined in the next chapter.

CHAPTER III

APPLICATION TO CANADIAN SERIES

1. Schedules of Step Cycles of Business

TABLE XI shows the growth cycles of twenty business series from January 1947 to December 1975. At the bottom of each column is given the number of cycles retained. In brackets under the number of cycles is given the length of the series. For series covering less than 29 years this mark "---" indicates that for these years it has been impossible to identify the cycle(s). This qualification also applies to TABLE XII as well.

Before concluding this section, it should be observed that a maximum of eight cycles were retained for the following indices:

1. commercial failure liabilities, and
2. government bond yield.

It should also be remarked that some of the shorter series might have eight cycles, but the lack of data does not permit such identification. On the other hand, within the longest series, six series contain seven cycles:

1. total labour income,
2. hours worked weekly,
3. exports,
4. wages & salaries,
5. new car sales,
6. production index.

Three month treasury yields indices have six cycles, while consumer price indices have five cycles. All quarterly series contain three cycles for the period covered.

2. Growth Cycles of Stock Market Indicators

Growth cycles for the seven stock series was given in TABLE XII. Again, at the bottom of this TABLE, the number of cycles observed per series are shown. All seven stock series cover the whole period studied. Within the stock series, three series were found with seven cycles:

1. Toronto industrial,
2. Toronto gold, and
3. Montreal utility.

Three series have six cycles and one has only five growth cycles.

4. Toronto base metal,
5. Montreal industrial,
6. Montreal bank, and
7. Toronto Western Oil [5].

3. Length of Individual Cycles

The growth cycles for both set of series (business and stock series) are recurrent. But they are not periodical, i.e. they do not always depict the same period length. This agrees and reinforces similar finding by other students of business cycles (see for instance G.H. Moore [38]).

TABLE XIII gives the length of individual cycles for both sets of series. The average length in months of cycles are given in the last column of the TABLE. Length of the cycle is defined as the number of months between a downturn and the next downturn inclusive. The cycle number given in the first row of the TABLE corresponds to the successive cycles observed in each individual series. Number one corresponds to the first cycle observed, number two, to the second and so on. Cycle number one for total labour income, for instance, corresponds to the cycle beginning in January 1949 and terminating in March 1953.

TABLE XI

Growth Cycles of Individual Business Series

TOTAL LABOUR INCOME		HOURS WORKED WEEKLY		THREE MONTH TREASURY YIELDS		COMMERCIAL FAILURES[1]	
D	U	D	U	D	U	D	U
1/49	2/50	3/48	12/48	--	12/48	4/50	4/53
3/53	3/55	12/51	5/53	9/53	2/55	2/54	8/55
8/57	10/58	5/54	4/56	7/57	8/58	1/57	5/59
12/59	4/61	12/57	5/59	8/59	9/61	3/60	12/61
3/62	7/64	5/60	1/64	7/62	4/65	12/63	8/64
3/67	3/68	3/67	4/68	4/66	4/67	3/65	7/69
12/69	11/72	2/71	2/72	11/69	8/72	3/71	2/75
3/75	12/75			7/74			
No. of cycles 7 (1947-75)		7 (1947-75)		6 (1947-75)		6 (1947-75)	

TABLE XI

CONSUMER PRICE INDEX		CONSUMER CREDIT		CAR SALES		COMMERCIAL FAILURE LIABILITIES	
D	U	D	U	D	U	D	U
10/48	1/50	...	...	---	7/48	3/50	2/53
12/51	2/56	11/56	9/58	2/51	10/51	2/54	11/54
4/58	10/61	12/60	4/63	3/53	10/54	8/57	8/58
1/63	10/65	10/65	8/67	8/56	5/58	1/60	11/61
2/70	11/72	5/69	8/71	8/59	4/61	10/63	1/65
12/75		11/75		11/63	12/64	7/65	3/67
				3/66	7/67	9/67	8/68
				2/69	1/71	5/72	10/72
				3/73	11/74	11/74	
No. of cycles 5 (1947-75)		4 (1956-75)		7 (1947-75)		8 (1947-75)	

1 This series excludes personal bankruptcies.

TABLE XI

Growth Cycles of Individual Business Series

EXPORT			GOV. BOND YIELD			NEW DWELLING UNITS	
D	U		D	U		D	U
9/48	9/49		10/48	12/49		---	2/49
2/52	10/54		6/53	7/55		2/51	12/51
10/56	1/59		6/57	5/58		1/55	1/57
2/60	12/60		1/60	4/62		12/58	3/60
10/61	6/63		3/64	2/65		12/63	2/66
6/64	1/65		8/66	3/67		2/69	5/70
8/66	7/72		1/70	12/71		4/73	12/74
8/74			3/73	12/73			
(D)			8/75				
No. of cycles 7 (1947-75)			8 (1947-75)			5 (1948-75)	

TABLE XI

PRODUCTION INDEX		UNEMPLOYMENT RATE		MONEY		LABOUR FORCE EMPLOYED	
D	U	D	U	D	U	D	U
---	11/49	---	---	---	---	---	---
4/51	12/51	8/54	10/56	---	3/54	---	3/55
3/53	7/54	6/58	9/59	2/56	9/57	1/57	12/58
11/56	9/58	5/61	5/62	11/58	8/60	7/59	3/63
10/59	3/61	12/62	10/65	11/61	12/65	3/67	3/68
7/62	4/63	6/68	9/69	9/70	8/75	4/69	4/71
12/65	3/67	7/70	2/72			8/74.	
3/69	10/70	12/72	6/74				
2/73	9/75	5/75					
No. of cycles 7 (1947-75)		7 (1953-75)		4 (1953-75)		4 (1953-75)	

TABLE XI

Growth Cycles of Individual Business Series

MANUFACTURE WAGES & SALARIES		PROFITS		GROSS CAPITAL		GNP CST	
D	U	D	U	D	U	D	U
9/48	1/50	QIV/50	QII/52	QI/53	QI/55	QI/47	QIV/49
1/53	11/54	QI/56	QI/61	QI/57	QI/63	QIV/56	QIII/61
1/57	10/58	QI/66	QIV/70	QI/66	QIII/70	QIII/66	QIV/67
1/60	4/61	QI/74		QIV/75		QIV/73	
7/62	7/63						
7/66	3/68						
6/69	11/71						
9/74							
No. of cycles: 7 (1947-75)		3 (1950-75)		3 (1947-75)		3 (1947-75)	

TABLE XI

IMPLICIT PRICE INDEX			
D	U		
QII/52	QIV/55		
QIII/57	QI/64		
QII/67	QIII/71		
QII/75			
No. of cycles: 3 (1947-75)			

TABLE XII

Growth Cycles of Individual Stock Series

TORONTO INDUSTRIAL		TORONTO WESTERN OIL		TORONTO BASE METAL		TORONTO GOLD	
D	U	D	U	D	U	D	U
---	6/49	---	---	---	5/49	11/47	10/48
4/51	1/54	3/52	7/54	9/51	2/54	11/49	12/50
3/56	4/58	7/57	3/58	8/56	2/58	8/52	12/53
7/59	7/60	10/58	7/60	2/59	5/60	11/54	12/57
11/61	6/62	2/62	12/64	7/61	10/62	12/59	12/62
2/65	9/66	5/69	6/70	7/66	2/67	12/64	2/67
7/67	3/68	10/73	12/74	11/69	10/71	2/69	12/71
5/69	6/70			10/73	12/74	1/74	
10/73	9/74						
No. of cycles 7 (1947-75)		5 (1947-75)		6 (1947-75)		7 (1947-75)	

TABLE XII

MONTREAL INDUSTRIAL			MONTREAL UTILITY		MONTREAL BANK	
D	U		D	U	D	U
---	6/49		---	6/49	2/51	10/53
9/51	9/53		2/51	1/54	2/55	12/57
4/56	1/58		7/55	10/57	7/59	4/60
12/61	9/62		3/59	4/60	2/62	12/66
2/65	11/66		2/61	6/62	12/68	12/70
7/67	3/68		1/65	12/66	12/72	12/70
5/69	6/70		7/67	3/68	6/75	11/74
10/73	6/74		5/69	5/70		
			8/72	9/74		
No. of cycles 6 (1947-75)			7 (1947-75)		6 (1947-75)	

TABLE XIII

Length of Cycles in Months: Business Series

(in months, except where it is indicated otherwise)

CYCLE NO.	1	2	3	4	5	6	7	8	AVERAGE
TOTAL LABOUR INCOME	50	53	16	27	60	33	72	-	44.42
HOURS WORKED WEEKLY	45	29	43	29	75	47	49	-	45.29
THREE MONTH TREASURY YIELDS	46	25	35	45	43	56	-	-	41.67
COMMERCIAL FAILURES	46	35	38	45	15	73	-	-	42
CONSUMER PRICE INDEX	50	76	57	85	70	-	-	-	67.6
CONSUMER CREDIT	-	-	49	58	43	78	-	-	57
NEW CAR SALES	25	41	36	51	28	35	49	-	37.86
COMMERCIAL FAILURES LIABILITIES	47	42	29	55	21	26	56	30	38.25
EXPORTS	41	56	40	21	32	26	96	-	38.71
GOV. BOND YIELD	56	48	31	50	29	41	38	29	40.25
NEW DWELLING UNIT	47	47	60	62	50	-	-	-	53.2

TABLE XIII

Length of Cycles in Months: Business Series

(in months, except where it is indicated otherwise)

CYCLE NO.	1	2	3	4	5	6	7	8	AVERAGE
PRODUCTION INDEX	23	44	35	33	41	39	47		37.43
UNEMPLOYMENT RATE	-	46	35	66	25	29	29		38.33
MONEY	-	-	33	36	85	80	-	-	58.5
LABOUR FORCE EMPLOYED	-	-	30	94	25	64			53.25
WAGES & SALARIES MANUFACTURE	52	48	36	30	48	35	63		44.57
PROFITS	21	40	32						(quarters)
GROSS CAPITAL	16	36	39						(quarters)
GNP CST	39	39	29						(quarters)
IMPLICIT PRICE INDEX	21	40	33						(quarters)

TABLE XIII

Length of Cycles in Months: Stock Series

CYCLE NO.	1	2	3	4	5	6	7	8	AVERAGE
TORONTO INDUSTRIAL	59	40	26	39	29	25	53	-	38.71
TORONTO WESTERN OIL	-	64	15	40	87	53	-	-	51.8
TORONTO BASE METAL	59	30	29	60	40	47	-	-	44.16
TORONTO GOLD	24	33	27	61	60	50	59	-	44.86
MONTREAL INDUSTRIAL	55	68	38	29	22	53	-	-	44.16
MONTREAL UTILITY	53	45	23	47	30	22	39	-	37
MONTREAL BANK	48	53	31	82	48	30	-	-	48.67

Hence, it is seen that cycles vary greatly from period to period and from series to series. Cycles in three month treasury yields vary from 25 to 56 months, while cycles of total labour income vary from 16 months to 72 months.

In schedules of stock cycles, however, more uniformity appears. Between the Toronto industrial cycles and Montreal utility cycles lengths are similar, except for the last cycle. Toronto Western oil cycles, however, offer a pattern in large part countercyclical as opposed to the other stock series. Long cycles are observed in the sixties for most series. This period has been a long period of expansion for all industrial countries.

In order to find some relationships between stock market price cycles and business cycles, the leads and lags between both sets of series will now be studied. In other words, the structure of leads-lags between both set of series will be found. This research will involve three steps. First, the leads-lags structure within stock series will be studied. In the second step, the structure of leads-lags within business series will be worked out. Finally, in the last step, the structure of leads-lags between stock market series and business series will be compared.

4. Leads-Lags within Stock Series

The study of the structure of leads-lags within stock series reveals no clear cut leads or lags. Every series leads at one time or another during the period 1947-1975. The Montreal utility series, however, leads more often than other stock series. It leads seven times over the Toronto base metal series and six times over the Toronto industrial series. Similarly some series lag more often than others. The Toronto base metal series, the Toronto oil series and the Toronto industrial series are in this group. Nevertheless, in the stock series, no countercyclical series have been observed even though the gold index seems to follow such a pattern during its first two cycle periods. Also, no great discrepancies are observed between leading series and lagging series. Towards the end of the period covered by this thesis all stock series tend to coincide. A summary of the leads-lags structure for the stock market series is given in Table XIV.

TABLE XIV

Leads-Lags within Stock Series

LAG \ LEAD	TORONTO INDUSTRIAL	TORONTO OIL	TORONTO BASE METAL	TORONTO GOLD
TORONTO INDUSTRIAL	0 / 0	1 / 2	2 / 2	5 / 4
TORONTO OIL	2 / 1	0 / 0	0 / 0	3 / 2
TORONTO BASE	1 / 2	1 / 1	0 / 0	4 / 3
TORONTO GOLD	0 / 1	1 / 1	0 / 0	0 / 0
MONTREAL INDUSTRIAL	1 / 2	0 / 1	2 / 2	5 / 4
MONTREAL UTILITY	0 / 0	1 / 1	2 / 2	5 / 4
MONTREAL BANK	2 / 2	1 / 1	1 / 1	2 / 2

TABLE XIV

Leads-Lags within Stock Series

LEAD / LAG	MONTREAL INDUSTRIAL		MONTREAL UTILITY	MONTREAL BANK
TORONTO INDUSTRIAL	1 / 2		6 / 5	2 / 2
TORONTO OIL	3 / 3		5 / 6	2 / 2
TORONTO BASE	2 / 3		7 / 7	2 / 2
TORONTO GOLD	1 / 2		4 / 5	1 / 1
MONTREAL INDUSTRIAL	0 / 0		5 / 5	1 / 1
MONTREAL UTILITY	1 / 2		0 / 0	0 / 0
MONTREAL BANK	2 / 3		4 / 4	0 / 0

5. Leads-Lags Structure within Business Series

The leads-lags structure within business series is more complex than the previous one observed in the stock series. As will be seen, some series move in the opposite direction to other business series and the lengths of cycles for some series differ greatly from other series. The consumer price index, for instance, depicts longer cycles than other series. The car sales cycles, on the other hand, present shorter cycles. Thus, given those characteristics of the cycles of the different business series, it is difficult to locate a unique series for the entire period. The leading series varies from cycle to cycle.

At some particular period of times, however, all the business series cycles tend to coincide. The last quarter of 1959 and 1969 is such a common period at downturns while in 1969 the unemployment rate series leads other indicators. For other cycle periods, the situation is more obscure. Nevertheless, other coincident periods (at downswings or at upswings) occur within some of the cycles. The total labour income series, the three month treasury yields series, the consumer credit series, the new car sales series, the government bond yield series, the production index series, the labour force employed series, the wages and salaries series have cycles coincident at upturns in 1958. On the other hand, the consumer price index series,

the new dwelling units series, the unemployment rate series and the money series have almost coincident upswings for the same period. The total labour force employed series and the wages and salaries series have the same upturns in March 1968. The Government bond yields and the production index series coincide exactly at upturns in March 1967. Also the car sales series and the new dwelling units series have the same coincidental downturns in February 1969.

In summary the overall picture is mixed. The reproduction in TABLE XV of the cycles for 12 business series gives a better idea of that mosaic. The last four series in the TABLE, the consumer price series, the new dwelling unit series, the unemployment rate series, and the money supply series are the series which depict longer cycles relative to other series.

It remains, now, to find a way to reduce the individual growth cycles to a common denominator in order to find some relationships between market and business series. This will be done in the next chapter through the introduction of another index, namely, the diffusion index.

TABLE XV

Growth Cycles in Business Series

SERIES	YEAR									
	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
TOTAL LABOUR INCOME	U 10	D 12		U 4	D 3		U 7			D 3
THREE MONTH TREASURY YIELDS	U 8	D 8		U 9	D 7			U 4	D 4	D 4
CONSUMER CREDIT	U 9		D 12			U 4		D 10		U 8
CAR SALES	U 5	D 8		U 4		D 11	U 12		D 3	U 7
GOVERNMENT BOND YIELD	U 5		D 1		U 4		D 3	U 2	D 8	U 3
INDEX INDUSTRIAL PRODUCTION	U 9	D 10		U 3	D 7	U 4		D 12		U 3
LABOUR FORCE EMPLOYED	U 12	D 7				U 3				D 3

TABLE XV

Growth Cycles in Business Series

SERIES	YEAR 1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
WAGES & SALARIES	U 10		D 1	U 4	D 7	U 7			D 7	
CONSUMER PRICE INDEX	D 4			U 10		D 1		U 10		
NEW DWELLING UNITS	D 12		U 3			D 12			U 2	
UNEMPLOYMENT RATE	D 6	U 9		D 5	U D 5 12			U 10		
MONEY SUPPLY	D 11		U 8	D 11				U 12		

TABLE XV

Growth Cycles in Business Series

SERIES	YEAR								
	1968	1969	1970	1971	1972	1973	1974	1975	
TOTAL LABOUR INCOME	U 3	D 12			U 11			U 12	
THREE MONTH TREASURY YIELDS		D 11			U 8		D 7		
CONSUMER CREDIT		D 5		U 8				D 11	
CAR SALES		D 2		U 1			D 3	U 11	
GOVERNMENT BOND YIELD			D 1	U 12		D 3	U 12	D 8	
INDEX INDUSTRIAL PRODUCTION		D 3	U 10			D 2		U 9	
LABOUR FORCE, EMPLOYED	U 3	D 4		U 4			D 8		

TABLE XV

Growth Cycles in Business Series

SERIES	YEAR 1968	1969	1970	1971	1972	1973	1974	1975
WAGES & SALARIES	U 3	D 6		U 11			D 9	
CONSUMER PRICE INDEX			D 2		U 11			D 12
NEW DWELLING UNITS		D 2	U 5			D 4	U 12	
UNEMPLOYMENT RATE	D 6	U 9	D 7		U D 2 12		U 6	D 5
MONEY SUPPLY	D 12		U 9					D 8

CHAPTER IV

DIFFUSION INDICES

1. How to Build a Historical Diffusion Index

Given the need to have an indicator that will measure the pulse of the overall level of economic activity and not just of one sector, a formula must be found to serve this purpose. Two are available: the comprehensive index (see Mintz [31] , p. 55-57) and an historical diffusion index. The latter was chosen for reasons to be explained below.

To build a diffusion index, all cycle schedules have to be expressed in terms of plus "+" or minus "-". A plus "+" sign is given to every month in the expanding phase of a series i.e. every month coming after an upturn month until the next downturn month inclusive. Similarly a minus "-" sign is given to every month of a series in the regressive phase i.e. every month after a downturn until the next upturn month of the series inclusive. All series, then, are expressed in terms of the signs plus "+" or minus "-" for each month of the period covered by the study. With this transformation, it becomes possible to reduce individual growth cycles to a single index. It is done in the following way. For every month covered by this study, the number of series in an expanding phase i.e. those with the sign plus "+" and the number of series with a minus "-" sign are

counted, and the two numbers obtained are subtracted from each other. For instance, if, for the specific month, the number of plus "+" sign is equal to six (6) and the number of minus "-" sign is equal to fifteen (15), then the grand total is minus "-" nine (9). Thus this month is in the low phase of the period.

The above procedure is applied to the twenty business series and to the seven (7) stock series. A separate total is calculated for each set of the series in order to establish two diffusion indices, one for the business series and one for the stock series.

After having summed up the number of plus "+" signs and minus "-" signs for every month of the period covered by each series and after having subtracted the two totals for every month from each other, the grand total for every month is expressed in percentage terms in the following way. The number of series covered is expressed as 100 per cent and the grand total for every month is converted in terms of the percentage of the total series. In June 1970, for instance, of the total twenty business series fourteen series are in their decreasing phase while six series are still in their expanding phase. The grand total gives minus eight (-8) and in percentage of the total number of series it gives 40.0 per cent. Hence, it is 40.0 per cent for the low phase, as it is explained below.

The percentages obtained in this manner are termed the "historical diffusion index". A downturn in that index- the reference cycle downturn- is located in the month in which the number of indicators in the high phase (+) exceeds the number in the low phase (-) and which precedes a month in which indicators in the low phase outnumber those in the high phase. The index thus crosses the zero line between the downturn and the following month. The upturn is determined in a corresponding fashion (Mintz [31] p. 56-57).

TABLE XVI gives the dates of the reference cycles for the business series and stock series[1].

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1 It must be observed that because of the shortness of some business series the period before 1957 does not include all 20 business series. It is complete, however, for stock series.

TABLE XVI

Growth Cycles Reference Turns

Business Series				Stock Series			
Upturns		Downturns		Upturns		Downturns	
Oct.	1949	Apr.	1953	July	1949	Oct.	1951
Apr.	1955	Mar.	1957	Feb.	1954	Apr.	1956
Nov.	1958	Nov.	1959	Feb.	1958	Aug.	1959
Dec.	1961	Aug.	1962	June	1960	Dec.	1961
May	1963	Sep.	1966	Nov.	1962	Mar.	1965
Jan.	1968	May	1969	Jan.	1967	June	1969
Oct.	1971	Sep.	1975	July	1970	Nov.	1973
				Dec.	1974		
Total	7	Total	7	Total	8	Total	7

As shown, the number of reference turns for both sets of series is almost the same. It can also be seen that stock reference upturns always lead business reference upturns.

Similarly, stock reference downturns often occur before the high phase of business series is completed. Thus, Canadian Stock Markets have a tendency to react to the expectation of a business expansion or contraction. Does this mean that investors are better informed of the future of the economy? Do they have better knowledge? It is an hypothesis that has received some thought, but no consensus has emerged so far (see H.M. Finlay [19]).

CHAPTER V

CRITICS & COMMENTS

1. The Critics

The growth cycle references for the Canadian business series and stock market prices have been established by the method used by Mintz. However, the concept of the growth cycle and its application to Post World War II industrial economies has not received the unanimous support of business cycle researchers. For example, Joseph A. Licari and Mark Gilbert contend that:

> "The concept of growth cycle characterized by quasi-regularity of growth rates has become one of the more popular stylized facts in interpretations of postwar dynamics in Western economies. This view fails, however, to be supported by statistical examination of movements in aggregate annual time series for most economies in Western Europe and North America during the 1950-1969 period. While annual growth rates are by no means stable, their fluctuations are in most cases not statistically distinguisable from those generated by a random process. It appears that exogenous influences, in particular of a policy nature, may be dominant after the Second World War, thus producing a historical record generally lacking in even a crude regularity. The general validity of our findings must await similar tests based upon alternative growth cycle definitions and more granular (quarterly or monthly) data. Nonetheless the growth cycle emerges in this study as more an interpretative myth than an empirical reality" (J.A. Licari and M.G. Gilbert [26]).

The statistical sample used by Licari and Gilbert are annual data of OECD countries. The annual series utilized for Canada are G.N.P. based on constant 1963 prices, exports, imports, an agriculture indicator, a manufacturing indicator and a construction indicator.

By using the nonparametric test developed by Moore and Wallis [39], Licari and Gilbert simply try to answer the question: does the pattern of first differences, i.e. (growth rates of individual series) display characteristics which deviate significantly from those expected on purely probabilistic grounds or not?

If the first differences deviate significantly, it can be inferred that the series exhibit some tendency towards systematic fluctuations. If they do not fluctuate significantly, then they simply correspond to random series and growth cycles that imply successive alternatives of high and low rates must be rejected.

Along these general ideas, Moore and Wallis [39] have developed a nonparametric test based simply on combinational considerations. "In essence, it tests the randomness of the distribution of sequences (of like sign in the differences between successive observations by length)".

To understand better this test, the following example is given. Suppose that the series is the following:

1, 5, 3, -2, 0, 4, -7, 5, 6, 1.

The signs of the first differences are +- - - + - + + -. Ignoring the incomplete phase preceding the first turning points, 1, 5, with the plus sign and the incomplete phase following the last turning point 6, 1 with a minus sign, a number of phases of different length is obtained. A phase is made up of the successive similar signs, and the number of similar signs gives the length of the phase. For instance, the series ++ - - includes two phases of length two (2) each.

Returning to the original series of the example, it has two phases of length one, one phase of length two, and one phase of length three. The size of the sample is $N = 10$. The formula to obtain the expected number of phases is the following:

$$P_n = \frac{2(n^2 + 3n + 1)(N - n - 2)}{(n + 3)!}$$

Where N = sample size, n = phases of length n, and P_n is the expected number of phases of length n. Thus, the expected number of phases of length 1 is:

$$P_1 = \frac{5(N - 3)}{12},$$

of length 2 is:

$$P_2 = \frac{11(N - 4)}{60}, \text{ and}$$

of length greater than 2 is:

$$P = \frac{4N - 21}{60}.$$

Applying the formula to the previous numerical example the following results are obtained:

Actual	Expected
$P^*_1 = 2$	$P^*_1 = 2.92$
$P^*_2 = 1$	$P^*_2 = 1.10$
$P^*_3 = 1$	$P^*_3 = 0.32$

From this is calculated the coefficient of significance X^2_p in the following way:

$$\chi^2_p = \frac{(2 - 2.92)^2}{2.92} - \frac{(1-1.10)^2}{1.10} - \frac{(1 - 0.32)^2}{0.32}$$

$$\chi^2_p = 1.82$$

This value of χ^2_p is not significant, even at the 0.10 level[1].

For the Canadian series tested, Licari and Gilbert obtain results as shown in TABLE XVIII.

TABLE XVIII

χ^2_p Coefficients for Some Canadian Annual Series

GNP	EXPORT	IMPORT	AGRICULTURE	MANUFACTURE	CONSTRUCTION
7.13*	0.64	0.24	1.74	2.60	6.0

*Significant at 0.05 level.

1 The interpretation is similar to the χ^2 with large sample.

2. Comments and Findings of this Thesis

The above result would tend to show that the concept of the growth cycle with its periodic alterations of high phase and low phase of economic activities does not give an adequate description of the economic development that has occurred in Canada since World War II. The above evidence also renders dubious the schedules of growth cycles that were worked out earlier in this thesis. In order to assess the evidence provided by Licari and Gilbert, all the deviation series[1], that were derived in CHAPTER IV, were tested for randomness using the Moore-Wallis test.

Only five business series score with a non-significance coefficient. They are:

1. hours weekly series,
2. bankruptcy series,
3. implicit price index series,
4. commercial failure liabilities, and
5. exports.

All the other series have very significant coefficients. The significance coefficients are shown in TABLE XIX.

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1 It is recalled that the deviation series were those obtained after adjustment for trend using a 75-month moving average as trend.

TABLE XIX

Significance Coefficient, Monthly Series

SERIES	χ^2_p	SERIES	χ^2_p	SERIES	χ^2_p
LABOUR INCOME	65.31	GNP	10.82	WAGES & SALARIES	55.05
PRODUCTION INDEX	28.10	GROSS CAPITAL	24.08	DWELLING UNITS	24.31
MONEY	34.20	THREE MONTH YIELDS	135.08	GOVERNMENT BOND YIELD	75.89
HOURS WEEKLY	2.71*	UNEMPLOYMENT RATE	33.57	EMPLOYMENT	18.29
BANKRUPTCY	3.72*	IMPLICIT PRICE INDEX	4.91*	CONSUMER CREDIT	60.97
PROFITS	26.0	CAR SALE	34.62	CPI	74.02
EXPORT	1.86*	COMMERCIAL FAILURE LIABILITIES	1.0*	MONTREAL BANK INDEX	79.12
TORONTO INDUSTRIAL	51.30	GOLD INDEX	46.54	---	---
TORONTO WESTERN	85.78	TORONTO BASE METAL	74.28	---	---

* This Series has a non-significant coefficient.

Thus, only five series seem to follow a random pattern. All other series studied depict a more determinate pattern following the Moore-Wallis test.

This last result is reinforcing rather than weakening the growth cycle concept hypothesized in this study for the period covered of the Canadian economy. Thus the contention by Licari and Gilbert that this concept is not valid for Canada for the post World War II period must be rejected. Nevertheless, the random series found by the test and used in this study could possibly affect the dating of the actual basic growth cycles researched. In order to see the impact of those five random series detected by the Moore-Wallis test, the growth cycle reference for the business series was recalculated without those random series. The new schedule is shown in TABLE XX.

The comparison of the modified growth cycle reference with the previous one shows that the schedule remains similar to the original one. Only one upturn is different by two months only.

TABLE XX

Modified Business Cycle Reference

1947 - 1960				1961 - 1975			
Upturns		Downturns		Upturns		Downturns	
Dec.	1949	Apr.	1953	Dec.	1961	Aug.	1962
Apr.	1955	Mar.	1957	May	1963	Sep.	1966
Nov.	1958	Nov.	1959	Jan.	1968	May	1969
				Oct.	1971	Sep.	1975

TABLE XXI

Previous and New Growth Cycles Reference Turns

Previous Reference Turns				Modified Reference			
Upturns		Downturns		Upturns		Downturns	
Oct.	1949	Apr.	1953	Dec.	1949	Apr.	1953
Apr.	1955	Mar.	1957	Apr.	1955	Mar.	1957
Nov.	1958	Nov.	1959	Nov.	1958	Nov.	1959
Dec.	1961	Aug.	1962	Dec.	1961	Aug.	1962
May	1963	Sep.	1966	May	1963	Sep.	1966
Jan.	1968	May	1969	Jan.	1968	May	1969
Oct.	1971	Sep.	1975	Oct.	1971	Sep.	1975

The foregoing corrections modify slightly the structure of leads-lags. But still a clear lead of stock growth cycles at upturns over business cycles persist. The lead varies from 5 months to 18 months. At downturns, stock reference turns also lead the business reference turns except for one downturn, in May 1969 where business series lead stock series (see TABLE XXII).

TABLE XXII

Modified Growth Cycles Reference Turns

Business Series		Stock Series		Lead	Lag
Upturns	Downturns	Upturns	Downturns	(-)	(+)
Dec. 1949		Jul. 1949		- 5	
	Apr. 1953		Oct. 1951		-18
Apr. 1955		Feb. 1954		-14	
	Mar. 1957		Apr. 1956		-11
Nov. 1958		Feb. 1958		- 9	
	Nov. 1959		Aug. 1959		- 3
Dec. 1961		June 1960		-18	
	Aug. 1962		Dec. 1961		- 8
May 1963		Nov. 1962		- 6	
	Sep. 1966		Mar. 1965		-18
Jan. 1968		Jan. 1967		-12	
	May 1969		June 1969		+ 1
Oct. 1971		July 1970		-15	
	Sep. 1975		Nov. 1973		-22
		Dec. 1974			

Thus most of the monthly series analysed tend to show non-randomness; annual series, however, often present randomness. This is the present difficulty.

In order to further investigate this issue, some additional annual series were tested: dwelling starts, Canadian total unemployment rate, Canadian personal expenditures on consumer goods, implicit price index and the annual consumer price indices. The annual figures of dwelling starts for centres of 5,000 people and over for the period 1947-75 scored a $\chi_p^2 = 3.49$. This was not significant. Annual figures for Canadian unemployment rates (period 1954-75) did not score high on the test $\chi_p^2 = 0.45$. This too was not significant. Testing of personal expenditures on consumer goods and services gave a significant χ_p^2. It was equal to 6.71.

The same conclusion applied to the implicit price index with $\chi_p^2 = 5.64$. It was seen earlier that this indicator has a random character with monthly variations. Furthermore, annual consumer price indices indicated a $\chi_p^2 = 1.58$ (i.e. non-significant).

One possible solution to the random - non-random paradox was given in the conclusion of the paper of Moore-Wallis, originator of this significance test.

> "An additional point obvious, buy worthy of mention, is that the time unit used may affect conclusions, derived from the χ_p^2 test; for example year to year movements may appear random and month to month movements non-random, or vice versa"[39].

This is the case at hand. This thesis used monthly and quarterly series, whereas Licari and Gilbert dealt with annual data. Following Moore-Wallis themselves, it is possible that "year to year movements appear random even if they have significant χ^2_p for monthly movements. Thus to reject Mintz's growth cycle, Licari-Gilbert should have utilized monthly and quarterly series as was done in this study. They seem right, however, in saying that the concept of growth cycles does not show up in annual movements. The Mintz' concept must be tested with monthly or quarterly series (see Mintz [31]).

CHAPTER VI

THE GROWTH REFERENCE CYCLES OF THIS THESIS & OTHER CANADIAN REFERENCE CYCLES

Some students of Canadian business cycles (see [5], [11] , [12] , [15] , [24] , [53]) have published Canadian business reference turns that mainly vary from each other by the method used for their calculation. Some authors are mainly concerned with the classical business cycles (see [5] , [11] , [24]); other writers by the rate of growth for GNP (see [48]). Some students use series adjusted for price movement. Some other studies are original data.

The diversity of chronologies of business cycles offered might tend to confuse rather than clarify, the exact timing of business fluctuations. Unhappily, unanimous consensus rarely exists in this area (see [21]) for many factors cause or at least contribute to business fluctuations and they are usually combined in different ways from one cycle to another, (see R.A. Gordon [21] particularly part II). Nonetheless comparisons can be made of the different schedules of business cycle offered, to see at least, their divergences or their similarities.

In its 55th annual report, the NBER proposed growth cycle chronologies for five countries of which Canada was one. The most interesting point is that they used the methodology that was explained and applied earlier - Mint's

approach - with slightly different series. They covered the period 1949 - 1970. Comparison with the business growth chronologies found in this thesis reveals the following.

TABLE XXIII

Growth Cycle Chronologies

NBER		THIS STUDY	
U	D	U	D
1/50	11/52	12/49	4/53
10/54	11/56	4/55	3/57
6/58	10/59	11/58	11/59
5/61	3/62	12/61	8/62
2/63	3/66	5/63	9/66
2/68	3/69	1/68	5/69
12/70		10/71	9/75

Only at upturns in December 1961 and in October 1971, as it is seen in TABLE XXII, was there a large divergence between the cycle chronologies. All other turns were coincident.

Another interesting comparison is with the chronologies offered by Derek A. White [53] (see p. 237) prepared for the Economic Council of Canada. As he does not cover the early seventies, his chronology was compared with the one developed by J.H. Chung [13]. The interesting feature here is that White used the traditional approach for finding cycles.

TABLE XXIV

Comparison of Canadian Cycles Chronologies with the Growth Chronologies of this Study

ECC			THIS STUDY		
Peak	Trough		D	U	
10/48	9/49		---	12/49	
5/53	6/54		4/53	4/55	
4/57	4/58		3/57	11/58	
1/60	3/61		11/59	12/61	
QII/62	Q1/63	(QIII)	8/62	5/63	(QII)
Q1/66	QIV/67	(QIII)	9/66	1/68	(QI)
QI/69	QIV/70	(QII)	5/69	10/71	(QIV)
			9/75		

The Canadian Department of Industry, Trade and Commerce has also issued a reference cycle recently (1975) [49]. It is in substance similar to White's reference cycles but it has been worked out with quarterly time series. Emphasis is also given to the growth rate in real gross national expenditure.

TABLE XXV

Other Comparisons

ITC		ECC		THIS STUDY	
P	T	P	T	D	U
QI/48	QI/49	10/48	9/49	---	12/49
QI/51	QIV/51	5/53	6/54	4/53	4/55
QII/53	QIII/54	4/57	4/58	3/57	11/58
QIV/56	QI/58	1/60	3/61	11/59	12/61
QI/60	QI/61	QII/62	QI/63	8/62	5/63
QIV/69	QIV/70	QI/66	QIV/67	9/66	1/68
QI/74	QII/75	QI/69	QIV/70	5/69	10/71
				9/75	

All the high-phases determined in this study coincide with or lag the expansion phases of White's reference cycles. Also all the high-phases correspond with ITC's reference cycles. However ITC's references do not have cycles in the middle of the sixties, while it has one in the early fifties that was not found in this thesis.

Recapitulating, comparisons of the growth cycle chronology of this thesis with other Canadian chronologies do not show great differences. It is in substantial agreement with them.

CANADIAN REFERENCE CYCLES

Canadian stock cycles have been largely neglected by students of Canadian business cycles. Even today it is still largely the domain of the financial analysts, who are still largely absorbed in advising on portfolio management and financial investment. They are not concerned with stock cycle phenomena for its own sake, but rather as another way to better advise investors. As a result, there does not exist in Canada a formal study on Canadian stock cycles.

To test the findings of this study on Canadian stock cycles, chronology offered by the Dow theory for U.S. stock markets has been chosen.

This comparison (TABLE XXIV) would tend to show that American stock markets tend to lead at troughs and lag at peak over stock markets. It remain to confirm, by lengthier studies, the relationship between U.S. and Canadian stock markets found in this study.

THE GROWTH REFERENCE CYCLES OF THIS THESIS & OTHER CANADIAN REFERENCE CYCLES

TABLE XXVI

Comparison of Stock Cycles

DOW (U.S.A.)		CANADA		LEADS (-) LAGS (+)
Peak	Trough	D	U	(CANADA)
	6/49		7/49	+ 1
1/53		10/51		-15
	9/53		2/54	+ 5
4/56		4/56		0
	10/57		2/58	+ 4
		8/59		
			6/60	0
12/61		12/61		+ 5
	6/62		11/62	
		3/65		-11
2/66			1/67	+ 3
	10/66			
		6/69		
			7/70	-
		11/73		
			12/74	-

SYNTHESIS AND CONCLUSION

This study has been concerned with the investigation of some relationships between Canadian business cycles and stock market price cycles. Two growth cycle references were constructed and compared using the Mintz' approach; and comparisons were made between them. They were also compared with other cycle references.

Findings of this study indicate a systematic lead at upswings of the Canadian stock market indicators over the business cycles. This finding is not surprising, since it has been generally recognized by financial analysts (see for example [16])for a long time. Dow Theory proponents have also observed this phenomenon a long time. ago. This explains why they suggest the use of the stock market composite indices as predictors of the future trend of business activities. On average, the length of the lead (at upturns) was about eleven months long with a standard deviation of 4.8 months.

This study, however, did not reveal such a systematic lead of stock prices at downswings. At least one high-phase in the stock market stayed longer than the corresponding business high-phase.

The concept of growth cycle was also criticized in this thesis. The experiment conducted in this study did not reveal systematic randomness of deviation cycles

in monthly series, but it was seen that the result is highly dependent on the series used either monthly or annually.

This study also has highlighted the lack of research done in the field of stock market cycles to date.

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