Monitoring Regional Economies In Canada With New High-Frequency Coincident Indexes

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Abstract

In contrast to many countries, such as the Unites States, it is easier to monitor actual changes in Canadian economic activity because Statistics Canada reports an estimate of the real GDP at factor cost each month. But this measure of the state of economic activity, including its quarterly estimate at market prices, is not available for the provinces and territories. The estimates of real GDP for the jurisdictions are only reported annually by the statistical agency and with a lag of several months after the end of the reference year. Thus, monitoring quarter-to-quarter changes in overall economic activity for most jurisdictions is not possible.

This paper introduces new quarterly composite indexes of coincident indicators of economic activity for each province and two of the three territories in order to assist in monitoring developments in regional economies. The indexes are built using the methodology developed at the U.S. NBER. Our results indicate that the composite indexes are generally more highly correlated with real GDP growth than commonly used high-frequency regional economic indicators. Secondly, the results show that the composite indexes perform well in predicting provincial and territorial real GDP growth over the 1980s and 1990s. On a quarterly basis, the composite indexes for Québec and Ontario explain nearly 60 per cent of the variance in their respective real GDP growth. On an annual basis, the composite indexes for Québec, Ontario, Alberta and British Columbia - four provinces representing 90 per cent of Canadian real GDP – predict about 80 per cent or more of the variance of real GDP growth. Thirdly, the results suggest that the characteristics of the business cycle for some jurisdictions are different from the national business cycle. This is attributable, in part, to the fact that their industrial structure differs from the national structure and the existence of local exogenous shocks. In brief, the composite indexes of coincident indicators will enable an improved monitoring and assessment of the strength and direction of regional economic growth in Canada. Furthermore, the indexes will be timely and available with a lag of only two months after the reference quarter. Lastly, the indexes are intended to provide only an indication of the strength and direction of regional economic activity. The rate of growth of a composite index by itself is meaningless and therefore is not and should never be used as a forecast of growth in real GDP.

Résumé

Contrairement à de nombreux pays, comme les États-Unis, il est plus facile de suivre étroitement l'évolution actuelle de l'activité économique canadienne, parce que Statistique Canada fournit une estimation du PIB réel au coût des facteurs chaque mois. Mais sa mesure de l'état de l'activité économique, y compris son estimation trimestrielle du PIB réel au prix du marché, n'est pas disponible pour les provinces et territoires. Les estimations du PIB de toutes les administrations ne sont publiées qu'annuellement, et elles accusent un retard de plusieurs mois après la fin de l'année de référence. En conséquence, le suivi de l’évolution de l’activité économique agrégée d’un trimestre à l’autre n’est pas possible pour la plupart des administrations provinciales et territoriales.

Ce document propose un nouvel indice composite trimestriel des indicateurs coïncidents de l'activité économique pour chaque province et deux des trois territoires afin de faire un meilleur suivi de la situation conjoncturelle des économies régionales. Les indices composites sont construits avec la méthodologie qui a été développée par le NBER aux États-Unis. Nos résultats montrent que les indices composites sont généralement plus corrélés avec la croissance du PIB réel en comparaison avec les principaux indicateurs économiques régionaux à haute fréquence. Deuxièmement, les résultats indiquent que les indices composites permettent de bien prédire la croissance du PIB réel des provinces et des territoires au cours des années 1980 et 1990. Sur une base trimestrielle, les indices composites du Québec et de l’Ontario expliquent presque 60 pour cent de la variance de leur croissance du PIB réel. Sur une base annuelle, les indices composites pour le Québec, l'Ontario, l'Alberta et la Colombie-Britannique – quatre provinces représentant environ 90 pour cent du PIB canadien – ont prédit environ 80 pour cent et plus de la variance de la croissance de leur PIB réel. Troisièmement, les résultats laissent supposer que les caractéristiques du cycle d’affaire pour quelques administrations sont différentes de celles à l'échelle nationale. Cette situation est en partie attribuable au fait que leur structure industrielle n’est pas la même que dans l'ensemble du pays et qu’elles ont subi des chocs exogènes locaux. En conclusion, les indices composites seront des outils indispensables pour permettre d’évaluer la vigueur courante et la direction de la croissance des économies régionales du pays. En plus, les indices composites seront mis à jour avec seulement un retard très court de deux mois par rapport au trimestre de référence. Finalement, les indices donnent seulement une indication de la force et de la direction des économies régionales. Pris isolément, le taux de croissance de chaque indice ne veut rien dire, et par conséquent, ne doit pas être utilisé comme une prévision de la croissance du PIB réel.

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1. INTRODUCTION

While Statistics Canada reports an estimate of the real GDP at factor cost each month for the national economy, this measure of economic activity, including its quarterly estimate at market prices, is not available for the provinces and territories. The real GDP estimates at market prices for these jurisdictions are only reported annually and with a lag of several months after the end of the reference year.[1]

Lacking official high-frequency estimates of real GDP for the provinces and territories[2], economists generally assess economic developments in Canadian jurisdictions by examining individual series, such as total employment, retail sales, dwelling starts, manufacturing shipments, and international merchandise exports. However, such an approach may not always allow one to draw a clear picture of the strength and direction of provincial or territorial economic growth for the following reasons. First, an individual economic indicator may show an increase while the others show a decline. Second, the information content of total employment for predicting real GDP growth, which is the most commonly used and the broadest coverage of economic activity, is low for many jurisdictions. Third, manufacturing shipments, another widely used measure, is a narrow-base indicator of aggregate production. In 1998, they represented only 20 to 25 per cent of GDP for Québec and Ontario and less than 15 per cent for all other jurisdictions. Finally, monthly data on international merchandise exports, provided on Industry Canada's Web site, are not readily useable to assess short- to longer-term trends.

This difficulty in gauging the state of economic activity across Canada could be overcome by combining several high-frequency coincident indicators into a composite index. Zarnowitz (1992) provides some reasons for building a composite index. A composite index of coincident indicators that has a broad coverage of economic sectors can have greater predictive power than each indicator taken individually. Furthermore, the possibility of making a wrong assessment about where an economy is going can be reduced by evaluating the signals from a number of related economic indicators. Lastly, one can eliminate noise by combining series, which enhances the predictive power of the composite index.

As the U.S. Department of Commerce at the end of the 1960s and more recently some regional U.S. Federal Reserve Banks have done, we combined individual coincident indicators into a composite index in order to produce a reliable monitoring of the state of provincial and territorial economic activity in Canada. The paper describes the methodology we used and discusses the properties of the provincial and territorial composite index of coincident indicators of economic activity.

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1 The estimates for 1999 will only be released near the end of October 2000.

2 The Ministry of Finance of Ontario and l'Institut de la statistique du Québec compute high-frequency estimates of real GDP. The historical times series for both Québec and Ontario are not available on their respective Web site.

The paper is organized as follows. Section 2 explains how the composite indexes are constructed. Section 3 describes the composite index for each province and territory. Section 4 examines their respective performance in monitoring the state of provincial and territorial economies. The last section provides a summary of the key results of the paper.

2. CONSTRUCTION OF THE COMPOSITE INDEXES

There has been an impressive growth in research on cyclical indicators since the pioneering work of Wesley Mitchell and Arthur F. Burns in the 1950s and Geoffrey H. Moore in the 1950s and 1960s. Their work on the development of cyclical indicators, particularly for the U.S. economy, has led many governmental institutions, including Statistics Canada and Finance Canada[3], to construct composite indexes of leading, coincident, and lagging indicators of economic activity.

Among these cyclical indicators, the composite index of leading indicators of national economic activity, notably the U.S. leading index, is certainly the most closely watched by the press, financial market analysts and economists. This leading index is popular because it provides advance information on the momentum in the economy. In contrast, composite indexes of coincident indicators of national economic activity are still largely ignored because statistical agencies of industrialized countries are publishing monthly and/or quarterly estimates of GDP.

Coincident indexes of economic activity have gained some popularity since the middle of the 1980s when they were developed by some U.S. Federal Reserve Banks to provide a timely synthetic measure of regional economic activity.[4] Studies by Phillips (1988), Crone (1994) and Orr, Rich and Rosen (1999) introduced the coincident indexes for the state economies. They found that they are useful to gauge the state of economic activity and are now used regularly by the Federal Reserve Banks to monitor changes in overall activity.

In Canada, however, the assessment of quarter-to-quarter changes in the state of regional economic activity is difficult and challenging for most jurisdictions. We present in this section the new quarterly composite indexes of coincident indicators of economic activity

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[3] At the Department of Finance Canada extensive empirical research has been conducted on the development of leading indexes, indicators and probit models for the Canadian and U.S. economies (Lamy (1992, 1996 and 1998)). At the Department composite indexes of leading indicators of economic activity were built for both the Canadian and U.S. economy and a composite index of leading indicators of Canadian inflation. Along with other variables, the Canadian leading index is used in an indicator model to forecast Canadian real GDP growth one and two quarters in advance. Over the past three years, the leading index was instrumental in providing accurate forecasts of real GDP growth. The leading index is also the best single predictor of recessions in Canada on quarter in advance. Similar results were obtained with the U.S. leading index. Lastly, the Department has built very recently a composite index of leading indicators of employment (Claus 2000)). Among other variables, that index is currently used to forecast near-term change in employment.

[4] High-frequency estimates of real GDP are not available for U.S. states. Annual estimates are reported with a lag of A few years. Only data up to 1997 are currently available.

for each province and territory that will permit to deal with this difficulty.[5] This section of the paper is divided into three parts. Firstly, we outline the methodology used to construct the composite indexes. Secondly, we discuss the construction of the indexes. Thirdly, we present the index for each jurisdiction and assess their cyclical historical profile in relation to the national business cycle.

2.1 *Methodology employed to construct the composite indexes*

We constructed the composite indexes of coincident indicators of regional economic activity using the methodology developed principally by Geoffrey M. Moore at the U.S. National Bureau of Economic Research. The U.S. Department of Commerce and national organizations from other industrialized countries have used this methodology to build leading, coincident, and lagging indexes of economic activity.[6] The methodology consists of statistical operations on the components of the composite index and the index itself and can be summarized in five key steps (Table 1).[7]

Table 1
Key Steps in Constructing a Cyclical Index

Step	Description
One	Choice of the reference series and determination of chronology of cyclical peaks and troughs.
Two	Identification of economic sectors, list of potential variables and selection of individual components.
Three	Standardization of selected individual components to prevent the volatile series to dominate the change in the composite index.
Four	Aggregation of selected standardised individual components into a composite value.
Five	Trend adjustment of the composite value to ensure that its historical behavior is similar to the reference series and index.

Note: The description is drawN in part from Zarnowitz and Boschan (1975).

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[5] We did not construct a composite index for Nunavut because time series are short and very limited.

[6] The U.S. Conference Board currently releases the three cyclical indexes. The statistical method of Stock and Watson (1989) was also applied to construct the composite indexes. The preliminary results indicated that the composite indexes were behaving similarly with the ones constructed with the NBER approach. Further work is needed before presenting the results.

[7] This method is well described in the *Handbook of Cyclical Indicators* that was released in 1977 by the U.S. Department of Commerce.

We describe in the Appendix B the algebraic equations that were used to construct the composite indexes.

2.2 *Constructing the composite indexes*

The building process of the composite indexes is discussed relative to the choice of the reference series, the identification of economic sectors and potential variables, and the methodology to select individual components. The last part of this section describes the main characteristics of the composite indexes.

2.2.1 Choice of the reference series

A cyclical index, which is either a leading, coincident or lagging index, is always built around a reference series. The reference series is the economic variable that the researcher intends to monitor. In our case, the reference series is real GDP. However, Statistics Canada publishes only annual estimates of real GDP by province and territory. This means that it is not possible to determine if a potential series is a leading, coincident or lagging indicator with regard to the reference cycle.

A possible solution to this problem would be to use the estimates of provincial real GDP published by the Conference Board of Canada. These time series start in 1961 and are available on a quarterly basis for all provinces. But the data are released with a long lag of five months after the end of the reference quarter. Chart A in Appendix A illustrates each series. Inspection reveals that many series exhibit irregular movements that are unusual for an aggregate series of output. We also noticed that for some provinces, such as Nova Scotia and New Brunswick, the change in real GDP is characterised by successive short periods of increases and declines. This is again an unusual pattern. Furthermore, provincial total employment, real retail sales and real manufacturing shipments, when expressed as a percentage change from the previous quarter, have a very low positive and sometimes negative contemporaneous correlation with real GDP growth (Table A in Appendix A). This is an unexpected result, and as for Canada, these series should be more highly correlated with their respective provincial real GDP growth.[8] Therefore, we concluded that the quarterly levels of the Conference Board data on provincial real GDP are neither reliable nor suitable as reference series to select the components of the composite indexes.

There are two provincial government organisations that provide high-frequency estimates of provincial real GDP. They are the Institut de la statistique du Québec and the Ontario Ministry of Finance.[9] The former releases the value of real GDP at factor cost each month. The series begins in January 1983 and is used as the reference series. The Ontario Ministry

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[8] For Canada, quarterly growth in employment, real retail sales and real manufacturing shipments are much more strongly correlated at lag zero with growth in real GDP (Table A in Appendix A).

[9] For Québec and Ontario, the quarterly GDP data is available with a lag of four and three months after the end of reference quarter respectively. As it will be indicated later, the coincident indexes for these two provinces will be available with a lag of only two months after the end of the reference quarter.

of Finance releases an estimate of real GDP at market prices. This series is available quarterly and starts in 1961. There is no official chronology of the reference cycle for Québec and Ontario. Consequently, we used the rule of two consecutive quarterly declines (increases) in the level of real GDP to designate the start of a recession (expansion). For Ontario, the reference cycles include three cyclical peaks (1979:Q3, 1981:Q2 and 1989:Q4) and three cyclical troughs (1980:Q3, 1982:Q3 and 1991:Q1). For Québec, we have only one cyclical peak (1991:Q1) and one cyclical trough (1992:Q1).

For all other jurisdictions, no high-frequency measures of real GDP are released by either the Ministries of Finance or by any other governmental organisation. We will explain later how the individual components of the composite indexes for these jurisdictions were selected.

2.2.2 Economic sectors and potential variables

The second step in the construction process involves identifying the economic sectors the composite index will cover and listing potential coincident variables for each regional economy.

Identification of economic sectors

The identification of the economic sectors is a crucial stage in the building process of any cyclical indicator. It is even more important for this project because in Canada the industrial structure changes noticeably from eastern to western jurisdictions. In the eastern and western provinces the resource sector represents a more vital part of the economy, while central Canada is much more concentrated in manufacturing activities. Therefore, the efficiency of the regional composite indexes in monitoring actual changes in economic activity will depend in part on our capacity to have a broad and diversified coverage of various economic sectors.

We identified seven economic sectors for each regional economy, broadly covering all aspects of economic activity. They are: (i) labour market, (ii) production, (iii) income, (iv) household demand (consumption and residential investment), (v) business investment, (vi) foreign market, and (vii) the resource market. The information content of the services sector in monitoring regional economies is captured through the labour market and household demand indicators. We did not consider the economic indicators from the financial and monetary markets because they are generally leading indicators of the business cycle. Price variables are also ignored as potential components because they generally lag the business cycle.

Potential variables by economic sector

In contrast to the national economy, where many economic indicators are available, economists have only access to a limited number of regional time series. Tables 3(a) (page 12) and 3(d) (page 15) list the potential variables by economic sector for each jurisdiction

that we have access to. Most time series are available on a monthly basis from about the end of the 1970s or beginning of the 1980s. All the series are potential candidates as coincident indicators because they measure economic performance and do not anticipate movements in economic activity, such as building permits and consumer confidence.[10] The variables from each economic sector are described thereafter.

Labour market

We chose five potential variables. They are total employment, full-and part-time employment, the unemployment rate and the average weekly hours.[11] We did not consider the help-wanted index because it is a leading indicator of the business cycle.[12]

Production

We selected three potential variables. They are the real value of total, non-durable and durable shipments by the manufacturing sector.[13] The ratio of inventory-to-shipments was not used because of its leading relationship with the business cycle.

Income

Potential indicators of income are not numerous neither for Canada as a whole nor for its jurisdictions. Only two indicators are available. They are total real labour income and total real labour income per employee.

Household demand

Much like the income indicators, there are not many potential variables that measure household demand. We selected only two: total real retail sales and the number of housing starts in urban areas. Residential building permits were ignored because they are a leading indicator of residential investment.

Business investment

Except for Alberta, no potential business investment indicators are currently available for the provinces and territories. For Alberta, we used the number of rigs drilled as an indicator

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[10] Moore (1983) has classified most of these variables as coincident indicators for the G-7 countries.

[11] Employment in the goods and service sectors are not considered as potential variables because the newly revised data only start in January 1987. Preliminary analysis indicated that for Saskatchewan the five labour market indicators were weakly correlated with the real GDP growth. But we found growth in total actual hours-worked in Saskatchewan to be strongly correlated with real GDP growth.

[12] The help-wanted index is a component of both the Finance Canada composite index of leading indicators of economic activity and of employment.

[13] Data on durable and non-durable shipments for Newfoundland and Nova Scotia are not available before 1982.

of investment in the business sector. Non-residential building permits are a leading indicator of business investment and were therefore not used.

Foreign market

Five potential variables are considered as foreign market indicators. They are the composite index of coincident indicators of U.S. economic activity published by the U.S. Conference Board, the U.S. National Purchasing Manager total and production indexes, the industrial production index for Japan and the number of non-resident travellers.

Resource market

As mentioned earlier, the reliability of the composite indexes for the eastern and western jurisdictions will be determined by our ability to take into consideration the developments in the resource sector. But before describing potential series from that sector, it is useful to illustrate its importance for provincial and territorial economies in Canada. Table 2 reports the value of real gross domestic product by the resource sector as a per cent of total real GDP. In this study, the resource sector comprises agricultural and related industries, fishing and trapping industries and mining, quarrying and oil well industries.

Table 2
Importance of Production by the Resource Sector in Canada, 1998[1]
(per cent of total real GDP)

	Agricultural and related industries and fishing and trapping industries	Mining, quarrying and oil well industries	Total
Newfoundland	2.1	**8.2**	**10.3**
Prince Edward Island	**6.4**	0.1	**6.5**
Nova Scotia	2.2	1.2	3.4
New Brunswick	1.8	2.2	4.0
Québec	1.5	0.8	2.3
Ontario	1.1	0.8	1.9
Manitoba	**3.5**	2.1	5.6
Saskatchewan	**8.1**	**14.1**	**22.2**
Alberta	**3.2**	**17.6**	**20.8**
British Colombia	1.3	2.8	4.1
Yukon	0.1	**7.5**	**7.6**
Northwest Territories	0.2	**15.4**	**15.6**
Canada	1.9	3.8	5.7

Source: Provincial gross domestic product by industry, Statistics Canada, catalogue 15-203.

The resource sector represents the highest share of real GDP in Saskatchewan, Alberta and the Northwest Territories. Saskatchewan is the jurisdiction where it contributes the most to real GDP. In that province, production by resource industries was equivalent to 22 per cent of GDP in 1998, about four times the national average.[14] The resource sector is also very important for Alberta with a contribution equivalent to one-fifth of total real GDP.[15] For the Northwest Territories, production by resource industries was close to 16 per cent of real GDP in 1998, with zinc and crude petroleum contributing by far the most.

The contribution of the resource sector to economic activity is much less important in Newfoundland, Yukon and Prince Edward Island, but it is still above the national average.[16] In Newfoundland and the Yukon, the contribution to economic activity stems entirely from the mineral sector. In contrast, it is the farm sector that contributes the most

14 The major commodities that are produced in Saskatchewan are crude petroleum (6.7 per cent of nominal GDP) and wheat (6.4 per cent of nominal GDP). Note that production of leading minerals by province, in nominal dollars, was taken from the 1998 Statistical Report published by Natural Resources Canada.

15 Crude petroleum and natural gas are by far the two most important commodities produced in Alberta with a total contribution of 18.5 per cent of nominal GDP in 1998.

16 Iron ore and crude petroleum are the two most important commodities produced in Newfoundland with a contribution equivalent to 12.4 per cent of nominal GDP.

to PEI economy.[17] In the remaining jurisdictions, the contribution of resource industries is equivalent or less than the national average. Québec and Ontario are the two jurisdictions in Canada where the resource sector contributes the least to economic activity, about 2 per cent of real GDP.

Statistics Canada's CANSIM database provides many time series on resource activities. We identified nineteen series that measure income or production from the agricultural and mineral sectors. The variables from the agricultural sector are the real total farm cash receipts, real crop receipts, real livestock receipts, production of wheat (including durum wheat), oats, barley, rye, flaxseed and rapeseed.[18] The variables from the mineral sector include the production of crude petroleum, natural gas, potash, iron ore, aluminum, gold, copper, zinc, nickel and coal.[19]

2.2.3 Methodology to select individual components of the composite indexes

First we present the methodology to select the individual components for the composite indexes. Then, we discuss the evaluation of the variables listed in Tables 3(a) to 3(d).

Methodology to select individual components

[17] The most important agricultural product is, of course, potato. Potato receipts amount to 5.9 per cent of nominal GDP in 1998.

[18] The production data is in metric ton and is available for each of the western provinces from January 1966.

[19] The production data is in thousand of metric tonnes and is available monthly from the 1940s. The data on coal is available by province. For gold and base metals, the data is not available by province.

Table 3(a): Classification and List of Potential Variables by Economic Sectors for the Atlantic Provinces

	Economic Sectors						
	Labour Market	**Production**	**Income**	**Household Demand**	**Business Investment**	**Foreign Market**	**Resource Market**
Newfoundland	Employment (total, full- and part-time) Unemployment rate Average weekly hours	Real manufacturing shipments (total, durable and non-durable)	Real total labour income Real total labour income by employee	Real retail sales Urban housing starts	No high-frequency data available	US composite index of coincident indicators US NAPM indexes Non-resident travellers	Production of crude petroleum Production of iron ore
PEI	Employment (total, full- and part-time) Unemployment rate Average weekly hours	Real manufacturing shipments (total, durable and non-durable)	Real total labour income Real total labour income by employee	Real retail sales Urban housing starts	No high-frequency data available	US composite index of coincident indicators US NAPM indexes Non-resident travellers	Real total cash, crops and livestock receipts
Nova Scotia	Employment (total, full- and part-time) Unemployment rate Average weekly hours	Real manufacturing shipments (total, durable and non-durable)	Real total labour income Real total labour income by employee	Real retail sales Urban housing starts	No high-frequency data available	US composite index of coincident indicators US NAPM indexes Non-resident travellers	Crude oil production for the Atlantic Provinces Real total cash, crops and livestock receipts Production of coal
New Brunswick	Employment (total, full- and part-time) Unemployment rate Average weekly hours	Real manufacturing shipments (total, durable and non-durable)	Real total labour income Real total labour income by employee	Real retail sales Urban housing starts	No high-frequency data available	US composite index of coincident indicators US NAPM indexes Non-resident travellers	Crude oil production for the Atlantic Provinces Real total cash, crops and livestock receipts Production of coal, zinc, gold, copper and nickel

Note: All the series are taken from Statistics Canada's CANSIM database, except for housing starts. That series is released by CMHC.

Table 3(b): Classification and List of Potential Variables by Economic Sectors for Québec, Ontario and Manitoba

	Economic Sectors						
	Labour Market	**Production**	**Income**	**Household Demand**	**Business Investment**	**Foreign Market**	**Resource Market**
Québec	Employment (total, full- and part-time) Unemployment rate Average weekly hours	Real manufacturing shipments (total, durable and non-durable)	Real total labour income Real total labour income by employee	Real retail sales Urban housing starts	No high-frequency data available	US composite index of coincident indicators US NAPM indexes Non-resident travellers	Real total cash, crops and livestock receipts Production of gold, aluminum, copper, and zinc
Ontario	Employment (total, full- and part-time) Unemployment rate Average weekly hours	Real manufacturing shipments (total, durable and non-durable)	Real total labour income Real total labour income by employee	Real retail sales Urban housing starts	No high-frequency data available	US composite index of coincident indicators US NAPM indexes Non-resident travellers	Real total cash, crops and livestock receipts Production of gold, copper, zinc and nickel
Manitoba	Employment (total, full- and part-time) Unemployment rate Average weekly hours	Real manufacturing shipments (total, durable and non-durable)	Real total labour income Real total labour income by employee	Real retail sales Urban housing starts	No high-frequency data available	US composite index of coincident indicators US NAPM indexes Non-resident travellers	Real total cash, crops and livestock receipts Production of wheat and durum wheat, oats, barley, rye, flaxseed and rapeseed. Production of gold, copper, zinc and nickel

Note: All the series are taken from Statistics Canada's CANSIM database, except for housing starts. That series is released by CMHC.

Table 3(c): Classification and List of Potential Variables by Economic Sectors for the Prairie Provinces

	Economic Sectors						
	Labour Market	**Production**	**Income**	**Household Demand**	**Business Investment**	**Foreign Market**	**Resource Market**
Saskatchewan	Employment (total, full- and part-time) Unemployment rate Average weekly hours Total hours worked	Real manufacturing shipments (total, durable and non-durable)	Real total labour income Real total labour income by employee	Real retail sales Urban housing starts	No high-frequency data available	US composite index of coincident indicators US NAPM indexes Non-resident travellers	Production of crude oil and natural gas Real total cash, crops and livestock receipts Production of wheat and durum wheat, oats, barley, rye, flaxseed and rapeseed. Production of gold, copper, zinc, nickel and coal
Alberta	Employment (total, full- and part-time) Unemployment rate Average weekly hours	Real manufacturing shipments (total, durable and non-durable)	Real total labour income Real total labour income by employee	Real retail sales Urban housing starts	Drilling activity for the oil and gas sector	US composite index of coincident indicators US NAPM indexes Non-resident travellers	Production of crude oil and natural gas Real total cash, crops and livestock receipts Production of wheat and durum wheat, oats, barley, rye, flaxseed and rapeseed. Production of gold, copper, zinc, nickel and coal

Note: All the series are taken from Statistics Canada's CANSIM database, except for housing starts. That series is released by CMHC. The data on drilling activity for the oil and gas sector that is from Alberta Treasury.

Table 3(d): Classification and List of Potential Variables by Economic Sectors for British Columbia and the Territories

	Economic Sectors						
	Labour Market	**Production**	**Income**	**Household Demand**	**Business Investment**	**Foreign Market**	**Resource Market**
British Columbia	Employment (total, full- and part-time) Unemployment rate Average weekly hours	Real manufacturing shipments (total, durable and non-durable)	Real total labour income Real total labour income by employee	Real retail sales Urban housing starts	No high-frequency data available	US composite index of coincident indicators US NAPM indexes Housing starts in Japan Non-resident travellers	Production of crude oil and natural gas Real total cash, crops and livestock receipts Production of wheat and durum wheat, oats, barley, rye, flaxseed and rapeseed Production of gold, copper, zinc nickel, aluminum, and coal
Yukon	Employment (total, full- and part-time) Unemployment rate Average weekly hours	Real manufacturing shipments (total, durable and non-durable)	Real total labour income Real total labour income by employee	Real retail sales	No high-frequency data available	US composite index of coincident indicators US NAPM indexes Non-resident travellers	Production of natural gas Production of gold and zinc
Northwest Territories	Employment (total, full- and part-time) Unemployment rate Average weekly hours	Real manufacturing shipments (total, durable and non-durable)	Real total labour income Real total labour income by employee	Real retail sales	No high-frequency data available	US composite index of coincident indicators US NAPM indexes Non-resident travellers	Production of crude oil and natural gas Production of gold and zinc

Note: All the series are taken from Statistics Canada's CANSIM database, except for housing starts. That series is released by CMHC.

Québec and Ontario

The methodology used to evaluate potential variables is based on two criteria. The first is the dynamic correlation with the reference series over the entire sample period.[20] Based on this criterion, a potential variable would be considered as a coincident indicator if the correlation with the reference series at lag zero is higher than at any other lag. The second selection criterion is the relationship between the potential variables and the reference series at the cyclical turning points. A potential variable would be considered as a coincident indicator if the timing of its cyclical peaks and troughs were on average about the same as those of the reference series. Usually, researchers perform an extensive empirical analysis by computing statistics, such as the number of extra or missing cycles in the potential indicators, and the median leads at cyclical turning points, together with the absolute mean deviation from the median. For our project, however, this was not feasible. There are simply not enough cyclical turning points in the reference series.[21]

All other jurisdictions

The individual components of the composite indexes for all other jurisdictions are selected on the basis of the results for Québec and Ontario because there are no high-frequency estimates for the reference series. If a potential variable, such as total employment, retail sales or manufacturing shipments, is a coincident indicator of the reference series for Quebec and Ontario, then it is reasonable to assume that the same relationship would exist with a high-frequency reference series of other jurisdictions. We used correlation analysis, based on annual data, as a guide to assess the importance of the relationship of each potential variable with the reference series.

Evaluation of the potential variables for Ontario and Québec

Ontario

Table 4 reports the coefficients of correlation of each variable with the reference series at lag zero to four. They are all expressed in standardised percentage change from the previous quarter. Variables from each economic sector with high correlation at lag zero are shaded. The table indicates that real total labour income, real wages and salaries, real retail sales, real total, durable and non-durable shipments, the U.S. coincident index and total as well as full-time employment have the highest correlation with the reference series at lag zero. The coincident relationship of urban housing starts with the reference series is much weaker.[22] The size of the correlation coefficients of all other variables, notably the production indicators, is very often small and sometimes negative.

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[20] We have also done a bivariate analysis of the information content of each variable. The results in terms of the selection of coincident indicators remained unchanged.

[21] As previously mentioned, we have only three business cycle peaks and troughs for Ontario and only one cyclical peak and trough for Québec.

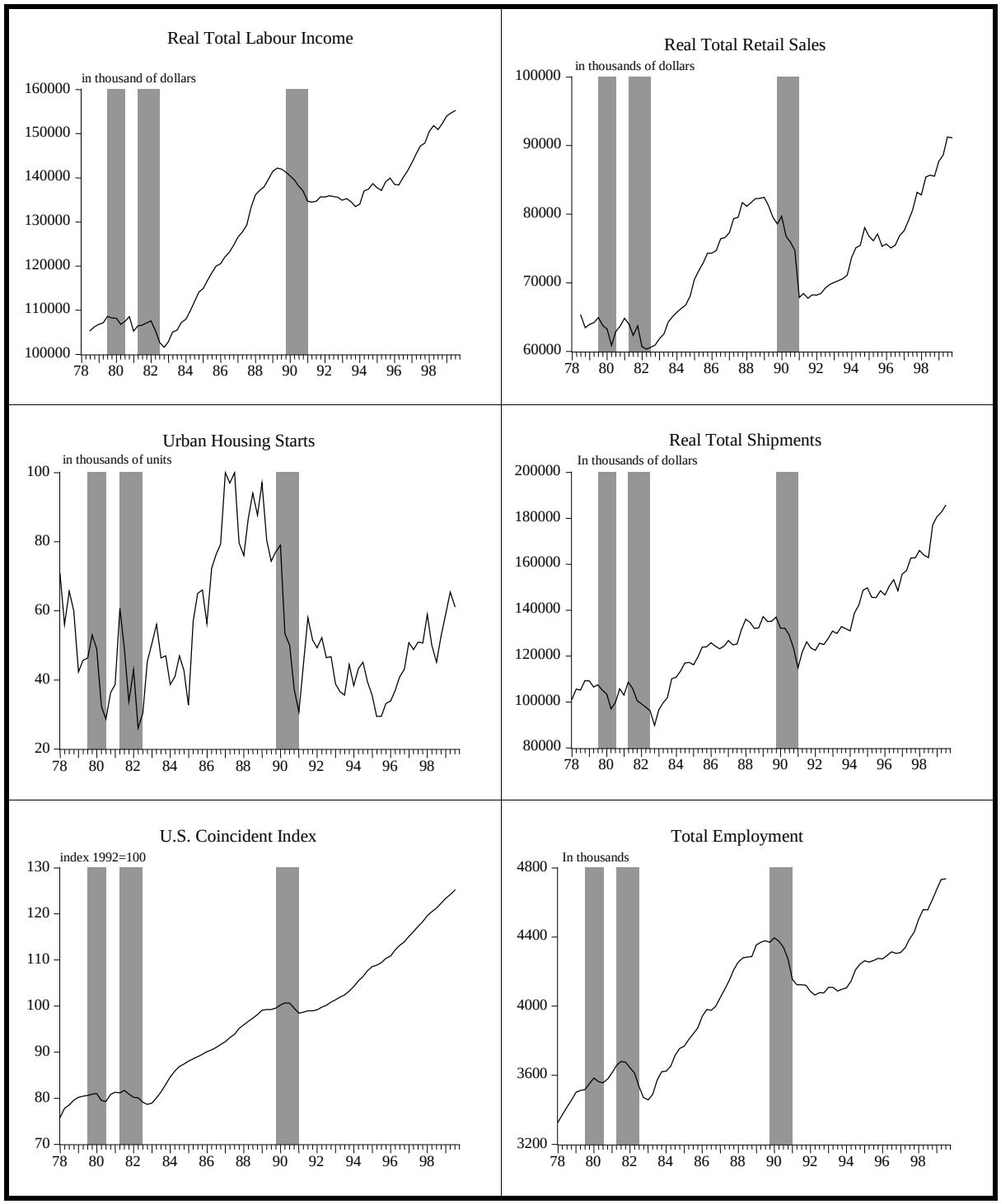
[22] Moore (1983) classified housing starts as a coincident indicator for each of the G-7 countries.

Table 4
Correlation of the Potential Variables with the Reference Series: The Case of Ontario
(1981 Q1 to 1998 Q4)

Potential variables	0 lag	1 lag	2 lag	3 lag	4 lag
Income indicators					
Real total labour income	0.65	0.46	0.29	0.29	0.20
Real wage and salaries	0.64	0.46	0.29	0.29	0.19
Real labour income per employee	0.25	0.19	0.01	0.18	0.23
Household demand indicators					
Real total retail sales	0.47	0.32	0.22	0.43	0.16
Urban housing starts	0.21	0.15	0.17	0.21	0.00
Production indicators					
Real total shipments	0.58	0.26	0.31	0.24	0.09
Real non-durable shipments	0.43	0.13	0.20	0.24	-0.03
Real durable shipments	0.55	0.28	0.31	0.21	0.12
Foreign market indicators					
US NAPM index	0.31	0.20	0.22	0.26	0.09
US NAPM production index	0.28	0.13	0.22	0.22	0.05
US NAPM employment index	0.36	0.27	0.29	0.26	0.09
US coincident index	0.62	0.40	0.29	0.34	0.21
Total non-resident travellers	0.09	0.03	-0.04	0.03	0.16
Labour market indicators					
Total employment	0.64	0.43	0.35	0.22	0.05
Unemployment rate	-0.69	-0.43	-0.39	-0.20	-0.11
Full-time employment	0.66	0.45	0.23	0.21	0.08
Part-time employment	-0.08	-0.09	0.27	0.02	-0.08
Average weekly hours	0.23	0.45	0.28	0.25	0.20
Resource indicators					
Production of crude oil	0.00	0.15	0.12	0.11	-0.08
Production of zinc	0.15	-0.03	0.17	-0.21	-0.06
Production of gold	0.05	0.18	0.14	-0.05	-0.11
Production of copper	0.07	0.01	0.13	-0.02	0.03
Production of nickel	0.21	0.28	0.23	0.13	0.22
Real total farm cash receipts	0.03	0.02	-0.14	-0.05	-0.05
Real crop receipts	0.08	0.07	-0.17	-0.11	-0.07
Real livestock receipts	0.02	-0.07	-0.07	0.13	0.02

Note: The variables exhibiting high correlation with the reference series at lag zero are shaded.

Chart 1
Historical Profile of a Potential Variable from Each Economic Sector With Respect to the Reference Cycle: The Case of Ontario



The shaded areas indicate the periods of recession in Ontario. The reference cycle date are 1979:Q3 to 1980:Q3, 1981:Q2 to 1982: Q3 and 1989:Q4 to 1991: Q1.

The second selection criterion is the relationship of potential variables at cyclical turning points with the reference cycle. Because of the large number of series, we chose to illustrate only the behavior of one potential variable by economic sector.[23] Their historical profile is plotted in Chart 1. Shaded areas indicate periods of recession in Ontario. The charts suggest that the variables have roughly a coincident relationship with the cyclical turning points.[24]

Québec

Table 5 reports the coefficients of correlation of all potential variables with the reference series. All the series are in standardised percentage change from the previous quarter. Variables from each economic sector with the high correlation at lag zero are shaded.

As for Ontario, the results indicate that real total labour income, real wages and salaries, real retail sales, real total, durable and non-durable shipments, the U.S. coincident index and total and full-time employment are also the variables with the highest correlation with the reference series at lag zero. However, the coincident relationship of urban housing starts with the reference series is stronger. Again, the size of the correlation coefficients for all other variables, notably the production indicators, is very often small and sometimes negative.

Chart 2 illustrates the historical profile of one potential variable from each economic sector with respect to the reference cycle.[25] The charts indicate that total employment, real total labour income, real total retail sales, real manufacturing shipments and the U.S. coincident index exhibit a rough coincident relationship with the cyclical turning points in early 1990s, except again for housing starts.

Evaluation of potential variables for all other jurisdictions

The evaluation of the potential variables for all other jurisdictions was not based on the two criteria defined previously because the reference series is only available on an annual basis. However, we can assess the importance of each variable for regional economic activity by examining their respective relationship with the annual reference series. Table 6 (page 23) through Table 10(c) (page 26) reports the annual coefficients of correlation for each potential variable with the reference series. All the variables are expressed as standardised percentage change from the previous period. The variables from each economic sector with high correlation at lag zero are shaded.

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[23] Potential variables from the resource sector were not plotted because they only contribute marginally to provincial economic activity.

[24] For the U.S. and other G-7 countries, Moore (1983) classified labour income, retail sales, employment, and shipments as coincident indicators.

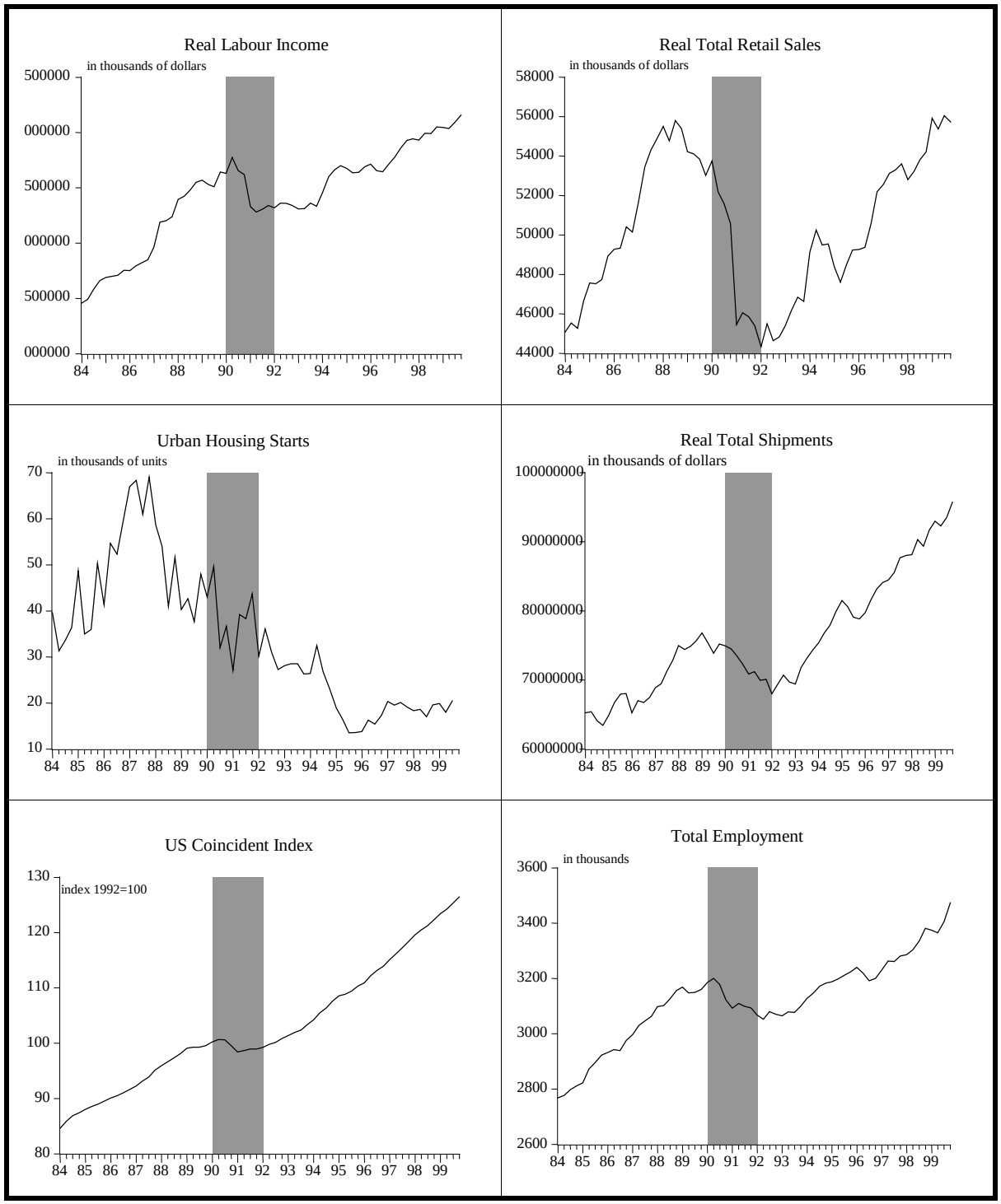
[25] Potential variables from the resource sector were not plotted because the resource sector contributes only marginally to provincial GDP.

Table 5
Correlation of the Potential Variables with the Reference Series: The Case of Québec
(1983 Q1 to 1998 Q4)

Potential variables	0 lag	1 lag	2 lag	3 lag	4 lag
Income indicators					
Real total labour income	0.55	0.21	0.12	0.02	0.20
Real wage and salaries	0.58	0.21	0.15	0.06	0.23
Real labour income per employee	0.32	-0.07	0.00	0.02	0.00
Household demand indicators					
Real total retail sales	0.59	0.25	0.40	0.24	0.30
Urban housing starts	0.33	0.00	0.14	0.06	0.15
Production indicators					
Real total shipments	0.63	0.17	0.09	0.24	0.17
Real non-durable shipments	0.37	-0.11	0.04	0.12	-0.14
Real durable shipments	0.58	0.26	0.09	0.22	0.28
Foreign market indicators					
US NAPM index	0.22	0.24	0.07	0.01	0.14
US NAPM production index	0.20	0.16	0.09	0.00	0.09
US NAPM employment index	0.24	0.31	0.08	0.05	0.15
US coincident index	0.52	0.37	0.22	0.25	0.31
Total non-resident travellers	0.26	0.01	0.00	0.12	0.07
Labour market indicators					
Total employment	0.49	0.43	0.20	0.06	0.21
Unemployment rate	-0.26	-0.46	-0.17	-0.08	-0.18
Full-time employment	0.48	0.34	0.37	0.04	0.19
Part-time employment	-0.02	0.12	-0.29	0.03	0.01
Average weekly hours	0.21	0.05	0.33	-0.06	0.07
Resource indicators					
Production of crude oil	0.06	-0.08	0.24	-0.06	-0.04
Production of zinc	-0.01	0.09	0.07	-0.13	0.03
Production of gold	0.07	0.05	-0.14	0.07	-0.08
Production of copper	0.05	0.27	0.10	0.03	0.08
Production of nickel	-0.12	-0.13	0.12	0.03	0.13
Real total farm cash receipts	0.06	-0.01	-0.03	0.04	-0.01
Real crop receipts	0.29	-0.17	0.05	-0.16	0.15
Real livestock receipts	0.09	-0.10	0.08	-0.07	0.10

Note: Variables with the highest correlation at lag zero with the reference series are shaded.

Chart 2
Historical Profile of a Potential Variable from Each Economic Sector With Respect to the Reference Cycle: The Case of Québec



The shaded areas correspond to the periods of recession in Québec. The reference cycle dates are cyclical peak of 1991:Q1 and cyclical trough of 1992:Q1.

Table 6 shows that total employment is the labour market variable that is the most correlated with real GDP growth for almost all jurisdictions. The size of the correlation coefficient is generally high for all jurisdictions, except for Nova Scotia, New Brunswick, and Yukon. For these three jurisdictions, the correlation with real GDP growth is very low. This strongly suggests the change in employment in these jurisdictions has low coincident information content in predicting quarterly changes in real GDP. Employment in these jurisdictions is likely more of a lagging indicator of change in real GDP.

Real total manufacturing shipments, real total labour income and the two household demand indicators (notably real retail sales) are also highly correlated with the reference series (see Tables 7 and 8).[26] Shipments, labour income and retail sales are again generally the best coincident indicators from their respective sector. As expected, the correlation between foreign activity indicators and real GDP growth is positive and high for most jurisdictions (Table 9). For most jurisdictions, it is the U.S. coincident index that is most highly correlated with the reference series. Again, a foreign activity indicator will likely be part of most composite indexes. The tourism activity indicator is highly positively correlated for the Atlantic Provinces and some other jurisdictions (Table 9 last column).[27]

The last three tables, 10(a) and 10(b) on page 25 and 10(c) on page 26, report the annual coefficient of correlation of each resource indicator with the reference series.[28] We examine first the relationship of agricultural sector indicators with the reference series (the first three columns of Table 10(a) and 10(b)). As expected, the correlations are high for Prince Edward Island, Saskatchewan, Alberta, and, to a lesser extent, Manitoba. (They are the jurisdictions where the agricultural sector is most important, as shown in Table 2 page 10). These results suggest including an indicator from the agricultural sector in the composite index for these four provinces. For the jurisdictions that are large producers of mineral fuels, particularly Saskatchewan and Alberta, the correlation is also high with the reference series (last three columns of Table 10(a)). Again, the results suggest the inclusion of mineral fuels indicators in the composite index.[29] Lastly, the results from Table 10(c) suggest somewhat weaker correlation between metals indicators and the reference series.

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[26] We found that durable shipments for Newfoundland and non-durable shipments for Nova Scotia were more highly correlated with the reference series than total shipments.

[27] That indicator is expected to be included in the composite index for Prince Edward Island, Nova Scotia and New Brunswick. They are, most likely, the provinces where tourism contributes the most to GDP.

[28] The production data on precious and base metals are not available by jurisdiction. We assumed that the change in production for each jurisdiction is equal to the change at the national level.

[29] Currently, the mineral fuels sector in Nova Scotia has a larger contribution to economic activity because of the Sable Offshore Energy Project. That project moved to production phase in late 1999.

Table 6
Labour Market Indicators:
Coefficient of Correlation with the Reference Series
(1982 - 1998)

	Total Employment	Full-time employment	Part-time employment	Unemployment rate	Average weekly hours
Newfoundland	0.67	0.63	0.26	-0.46	-0.05
Prince Edward Island	0.64	0.63	0.02	-0.53	0.50
Nova Scotia	0.32	0.29	0.21	-0.07	0.07
New Brunswick	0.21	0.09	0.38	-0.11	0.15
Manitoba	0.64	0.65	-0.15	-0.56	0.60
Saskatchewan	0.39	0.42	-0.08	-0.54	-0.08 (0.54)[1]
Alberta	0.67	0.60	-0.13	-0.68	0.79
British Columbia	0.80	0.78	-0.05	-0.84	0.26
Yukon	0.27	-	-	-	0.16
Northwest Territories	0.38	-	-	-	0.03

The symbol '-' means no data available. For average weekly hours, correlation is computed from 1984.

1. The number between parentheses corresponds to the correlation of total actual hours worked with the reference series. The data on total actual hours worked starts in January 1976. For all other provinces, we found that the coefficient of correlation between total actual hours worked with real GDP is lower than for total employment with real GDP.

Table 7
Production Indicators:
Coefficient of Correlation with the Reference Series
(1982 - 1998)

	Real total manufacturing shipments[2]	Real non-durable manufacturing shipments[2]	Real durable manufacturing shipments[2]
Newfoundland	0.27	0.12	0.64
Prince Edward Island	0.39	0.24	0.46
Nova Scotia	0.27	0.62	0.15
New Brunswick	0.38	0.32	0.30
Manitoba	0.33	-0.06	0.43
Saskatchewan	0.43	0.45	-0.05
Alberta	0.67	0.38	0.81
British Columbia	0.82	0.53	0.68
Yukon	-	-	-
Northwest Territories	-	-	-

1. Deflated by the industrial producer price index for finished goods.

Table 8
Income and Household Demand Indicators:
Coefficient of Correlation with the Reference Series
(1982 - 1998)

	Real total labour income[1]	Real total labour income per employee	Real total retail sales[1]	Housing starts in urban areas
Newfoundland	0.66	0.06	0.54	0.20
Prince Edward Island	0.26	-0.33	0.44	0.03
Nova Scotia	0.65	0.43	0.60	0.32
New Brunswick	0.17	-0.12	0.43	0.58
Manitoba	0.25	-0.13	0.67	0.28
Saskatchewan	0.19	-0.03	0.22	-0.36
Alberta	0.73	0.60	0.74	0.20
British Columbia	0.76	0.10	0.84	0.72
Yukon	0.75	-	0.27	-
Northwest Territories	0.35	-	0.14	-

1. Deflated by the consumer price index for all goods and services.
2. Correlation of real wage and salaries with real GDP.

Table 9
Business Investment and Foreign Market Indicators:
Coefficient of Correlation with the Reference Series
(1982 - 1998)

	Drilling activity	US composite index	US NAPM index	US NAPM production index	Japan industrial production	Non-resident travellers
Newfoundland	-	0.36	-0.03	-0.07	-	-0.21
Prince Edward Island	-	0.18	0.62	0.57	-	0.40
Nova Scotia	-	0.35	0.13	0.11	-	0.38
New Brunswick	-	0.10	0.70	0.67	-	0.51
Manitoba	-	0.74	0.01	-0.08	-	0.49
Saskatchewan	-	0.14	0.16	0.16	-	0.33
Alberta	0.71	0.60	-0.31	-0.34	-	0.41
British Columbia	-	0.53	0.23	0.22	0.20	-0.06
Yukon	-	0.05	-0.03	-0.04	-	0.14
Northwest Territories	-	-0.48	-0.30	-0.24	-	-

Table 10(a)
Resource Market Indicators:
Coefficient of Correlation with the Reference Series
(1982 - 1998)

	Real farm cash receipts	Real crop receipts	Real livestock receipts	Crude oil production	Natural gas production	Production of potash
Newfoundland	-0.20	-0.36	0.15	0.30	-	-
Prince Edward Island	0.44	0.02	0.14	-	-	-
Nova Scotia	-0.05	-0.16	0.26	-	-	-
New Brunswick	0.10	-0.06	0.08	-	-	-
Manitoba	-0.13	-0.19	0.24	0.37	-	-
Saskatchewan	0.02	0.34	-0.47	0.19	-0.30	0.08
Alberta	-0.01	-0.18	0.50	0.62	0.31	-
British Columbia	-0.46	-0.15	-0.14	-	0.33	-
Yukon	-	-	-	-	0.30	-
Northwest Territories	-	-	-	-0.32	0.20	-

Table 10(b)
Resource Market Indicators:
Coefficient of Correlation with the Reference Series
(1982 - 1998)

	Total crops production	Wheat production	Oats production	Barley production	Rye production	Flaxseed production	Rapeseed production
Newfoundland	-	-	-	-	-	-	-
P.E.I	-	-	-	-	-	-	-
Nova Scotia	-	-	-	-	-	-	-
New Brunswick	-	-	-	-	-	-	-
Manitoba	-0.20	-0.16	-0.20	-0.09	-0.06	-0.05	-0.30
Saskatchewan	0.32	0.25	0.16	0.61	0.41	-0.21	-0.09
Alberta	-0.51	-0.34	0.01	-0.52	-0.46	-0.37	-0.08
British Columbia	-	-	-	-	-	-	-
Yukon	-	-	-	-	-	-	-
NWT	-	-	-	-	-	-	-

Table 10(c)
Resource Market Indicators:
Coefficient of Correlation with the Reference Series
(1982 - 1998)

	Iron ore production	Aluminum production	Gold production	Copper production	Zinc production	Nickel production	Coal production
Newfoundland	0.27	-	-	0.02	-	-	-
P.E.I	-	-	-	-	-	-	-
Nova Scotia	-	-	-	-	-	-	-0.14
New Brunswick	-	-	0.03	0.23	0.24	-	0.20
Manitoba	-	-	-0.07	0.22	0.10	0.41	-
Saskatchewan	-	-	-0.10	-	-	-	-0.58
Alberta	-	-	-	-	-	-	0.06
British Columbia	-0.13	-0.13	-0.44	0.21	0.11	-	0.10
Yukon	-	-	0.16	-	0.32	-	-
NWT	-	-	0.56	-	0.19	-	-

2.2.4 Description of the composite index of coincident indicators

A cyclical index must be diversified in its coverage of the economic sectors. This will permit us to capture as much as possible the cyclical developments of regional aggregate economic activity, and therefore, enhance the predictive capacity of the composite indexes. This is the objective that we pursued in constructing the composite indexes for the provincial and territorial jurisdictions in Canada.

Description

The individual components of each composite index were selected on the basis of the objective cited above and the statistical results presented in the previous section. The selected components for each index are listed in Table 11 page 28.

The main characteristics of the composite indexes are:

- Each provincial composite index includes a component from the following key economic sectors: (i) the labour market, (ii) production, (iii) income, (iv) household demand and (v) the foreign market. The Japanese index of industrial production is part of the composite index for British Columbia because of the importance of that foreign market for the provincial economy.[30]

[30] We found Japanese housing starts to have lower information content in predicting real GDP growth in British Columbia than total industrial production.

- Resource indicators are included in the composite indexes for 9 of the 12 jurisdictions. With four indicators, British Columbia has the largest number of resource indicators. The indexes for the Atlantic Provinces have at least one resource indicator, except for Nova Scotia that has none.[31] No resource indicators are included in the indexes for Québec and Ontario because the resource sector represents a very small share of GDP.

- Across provinces, the number of components varies from 6 for Québec and Ontario to 11 for British Columbia. Yukon and the Northwest Territories have respectively 6 indicators.

The methodology that we used to construct the composite indexes is fully described in Appendix B. The following gives a brief qualitative description of the methodology. Each composite index is a weighted sum of the selected individual components. No component was lagged. This weighted average was cumulated to create an index in levels. The composite index was constructed so it averages 100 in 1992. For Québec and Ontario, the weight assigned to the components is the regression coefficient obtained from a bivariate regression over the full sample period. The endogenous variable is the standardised percentage change of real GDP and the explanatory variable is the current standardised percentage change of the component.[32] For other jurisdictions, the weight attached to the components is the simple correlation coefficient between the standardised percentage change of the component and real GDP at lag zero. The simple correlation coefficient was computed over the full sample period. Finally, the weights attached to each individual component for each jurisdiction are presented in Appendix C at the end.

Updating process of the composite indexes

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[31] Coal production is not included in New Brunswick's index because the value of production as a share of provincial GDP is very small.

[32] This approach was used to determine the weights of the components of the Department of Finance Canada leading index of economic activity and employment. All regressions revealed autocorrelated errors. We re-estimated the bivariate regressions with an autoregressive component of order one to correct for serial correlation. The relative size of those coefficients used as weights in the composite indexes remained virtually unchanged compared to the coefficients generated without the autocorrelation correction. Therefore, using the adjusted coefficients had virtually no impact on the historical profile of the composite indexes and their capacity in forecasting their corresponding real GDP growth.

Each composite index will be updated only two months after the end of the reference quarter. This means that the values for the first quarter of 2000 will be available near the end of May, just before the release of national economic and financial accounts for the first quarter.[33]

[33] It could also be possible to update the composite indexes on a monthly basis because most of the time series are available monthly. It would only require interpolating the quarterly values on farm cash receipts for the PEI, Manitoba and Alberta composite indexes.

Table 11
Composite Indexes of Coincident Indicators by Province and Territory and Their Respective Components

	Nfld.	P.E.I.	N.S.	N. -B.	Québec	Ontario	Man.	Sask.	Alb.	B.C.	Yukon	NWT
Total employment	✓	✓	✓	✓	✓	✓	✓	✓[4]	✓	✓	✓	✓
Real total shipments	✓[1]	✓	✓[1]	✓	✓	✓	✓	✓	✓	✓		
Real total labour income	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓[6]	✓[6]
Real retail sales	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Urban housing starts	✓		✓	✓	✓	✓	✓		✓	✓		
Drilling activity									✓			
US coincident index	✓		✓		✓	✓	✓	✓	✓	✓		
US NAPM index		✓		✓								
Japan industrial prod.										✓		
Non-resident travellers		✓	✓	✓								
Crude oil production	✓[5]							✓	✓			
Natural gas production									✓	✓	✓	✓
Potash production								✓				
Iron ore production	✓											
Coal production										✓		
Copper production										✓		
Nickel production							✓					
Zinc production				✓						✓	✓	✓
Gold production											✓	✓
Total crops production								✓				
Real farm cash receipts		✓[2]					✓[3]		✓[3]			
Total	**8**	**7**	**7**	**8**	**6**	**6**	**8**	**8**	**10**	**11**	**6**	**6**

1. Durable shipments for Newfoundland and non-durable shipment series for Nova Scotia start in 1982. Total shipments for both provinces start before 1982.
2. Total real farm cash receipts.
3. Real livestock receipts.
4. Total hours worked, goods and services
5. Data are only available from the end of 1997.
6. Wages and salaries.

2.3 *Historical profile of the composite indexes*

This section describes the historical profile of the composite index of coincident indicators of economic activity for each province and the two territories. We identify also a chronology of the business cycle for most jurisdictions and establish the differences with the national cycle. A summary of the key disparities with the national business cycle is presented in Table 24 page 37. It is important to note that the **reference dates are very preliminary and should only be viewed as indicative** for the following two reasons. First, the reference dates are not obtained from an in-depth and broad analysis of the behaviour of the economy. Second, as indicated later, the composite index for some jurisdictions does not perform as well in predicting real GDP growth. As a result, further work is necessary to improve the reliability of these indexes. Consequently, the chronology of the business cycle will most likely change for these jurisdictions.

Charts 3 through 14 plot the composite indexes for the jurisdictions. Shaded areas indicate periods of recession for a province or territory. The composite indexes start in the first quarter of 1979 for all provinces and after 1982 for the two territories. The adjacent Tables provide the reference dates of cyclical peaks and troughs along with the chronology of the national business cycle.[34] The reference dates for Ontario and Québec were derived from actual real GDP and the composite index and from only the composite index for other jurisdictions.[35]

Ontario

The profile of Ontario's Composite Index, illustrated below, is very similarly to actual real GDP. The index is smooth and not more volatile than provincial real GDP, as the standard

Chart 3
Ontario Real GDP and Composite Index

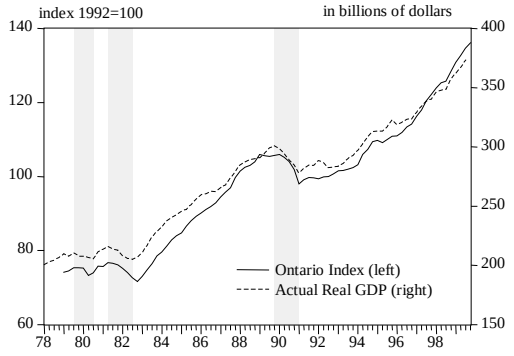


Table 12
Business Cycle Chronology

Reference Cycle	Ontario Index	Canada
Cyclical Peaks		
1979: Q3		1980:Q1 (+2)
1981: Q2	1981: Q2	1981:Q2
1989: Q4	1990: Q1 (+1)	1990:Q1 (+1)
Cyclical Troughs		
1980: Q3		1980:Q3
1982: Q3	1982: Q4 (+1)	1982:Q4 (+1)
1991: Q1	1991: Q1	1991:Q1

Note: Numbers in ( ) refer to difference in timing with the chronology of the reference cycle (first column). The sign "+" means that the turning point occurred after and "-" before the turning point in the reference cycle.

deviation of quarterly growth of both series is about the same. The index clearly identifies

[34] As defined by Cross (1995).

[35] As indicated before, periods of recession (expansion) are defined as two consecutive quarters of decline (increase) in the level of real GDP and/or the index

the last two recessions. But it did not signal the contraction of 1979-1980, a period where provincial real GDP fell a cumulative 2.4 per cent over four quarters.[36] Overall, the index has a good record in terms of timing around reference dates with specific cyclical turning points within one quarter. Table 12 indicates the extent to which the chronology of business cycle in Ontario is different from the national business cycle. The timing of the last two cyclical downturns and upturns in the composite index is not different from that of the cyclical turning points in Canada. Based on actual real GDP, however, there are some minor differences in the onset and duration of downturns in Ontario compared with Canada.

In brief, the results from the table suggest that the two business cycles are very similar. This is not surprising since the industrial structure of both economies shares strong similarities and the provincial economy represents a very large part of national real GDP.

Québec

As for Ontario, the historical profile of Québec's Composite Index is very similar to provincial real GDP in terms of smoothness. The business cycle profiles of these two series

Chart 4
Québec Real GDP and Composite Index

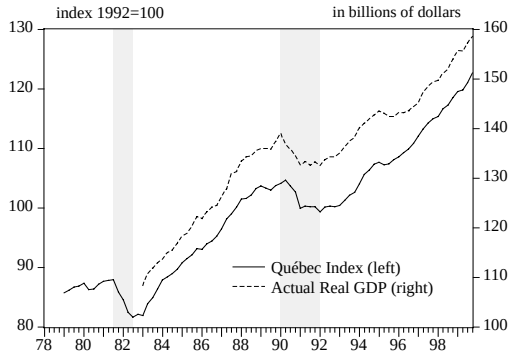


Table 13
Business Cycle Chronology

Reference Cycle	Québec Index	Canada
Cyclical Peaks		
		1980:Q1
	1981: Q3	1981:Q2
1990: Q1	1990: Q2 (+1)	1990:Q1
Cyclical Troughs		
		1980:Q3
	1982: Q3	1982:Q4
1992: Q1	1992: Q1	1991:Q1 (-4)

Note: Numbers in ( ) refer to difference in timing with the chronology of the reference cycle (first column). The sign "+" means that the turning point occurred after and "-" before the turning point of the reference cycle.

are also similar. Compared to the chronology of the reference cycle, the index reaches a peak one quarter later and also turns up in the second quarter of 1992. Furthermore, there are no marked disparities between the provincial and national business cycles in terms of the timing and duration of contraction, except for the last cyclical upturn. Again, the similarity of the two business cycles reflects in large part the strong similarities in industrial structure. However, the index suggests that output loss during the 1981-1982 recession was greater for Québec than for Canada, and both actual real GDP and the index show that the provincial recession in the early 1990s was also more severe.

[36] The index was at least suggesting strongly that the growth in the economy was slowing dramatically.

Newfoundland

Chart 5 plots the profile of Newfoundland's Composite Index along with Canada's real GDP. Again, the index has a smooth profile. Table 14 suggests that the business cycle in Newfoundland is different from the national cycle in terms of the number of contractions.

Chart 5
Newfoundland Composite Index and Canada Real GDP

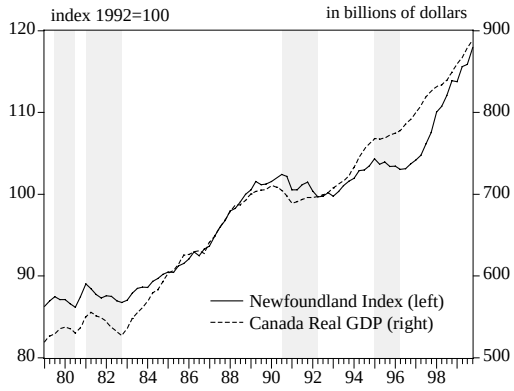


Table 14
Business Cycle Chronology

	Newfoundland Index	Canada
Cyclical Peaks		
	1979: Q3 (-2)	1980:Q1
	1981: Q1 (-1)	1981:Q2
	1990: Q3 (+2)	1990:Q1
	1995: Q1	
Cyclical Troughs		
	1980: Q3	1980:Q3
	1982: Q4	1982:Q4
	1992: Q2 (+5)	1991:Q1
	1996: Q2	

Note: Numbers in ( ) refer to difference in timing with the national chronology. The sign "+" indicates that the turning point occurred after and "-" before the national turning point.

As shown in Chart 5, the key disparity between the two business cycles is the additional downturn that Newfoundland experienced in the 1990s. The index suggests that a downturn started in the second quarter of 1995 and lasted through the second quarter of 1996.[37] This was due to the adverse impact on the labour market and other economic activities of the end of the development stage of Hibernia.

Prince Edward Island

The historical profile of PEI's Composite Index is illustrated below along with national real GDP. Unlike the previous indexes, the quarterly movement of the PEI index is more

Chart 6: Prince Edward Island Composite Index and Canada Real GDP

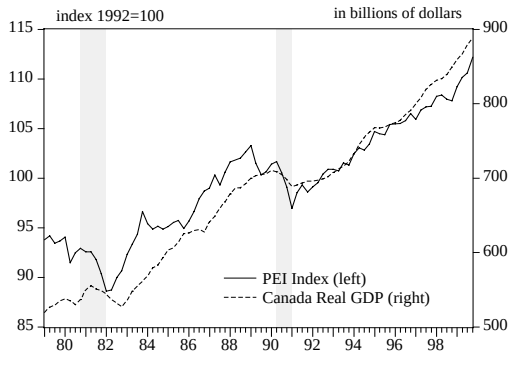


Table 15
Business Cycle Chronology

	PEI Index	Canada
Cyclical Peaks		
		1980:Q1
	1981: Q3 (+1)	1981:Q2
	1990: Q3 (+2)	1990:Q1
Cyclical Troughs		
		1980:Q3
	1982: Q2 (-2)	1982:Q4
	1991: Q1	1991:Q1

Note: Numbers in ( ) refer to difference in timing with the national chronology. The sign "+" indicates that the turning point occurred after and "-" before the national turning point.

[37] Data from Statistics Canada's provincial accounts show that real GDP growth in Newfoundland slowed substantially in 1995 and the level of real GDP dropped 3.3 per cent the following year.

erratic, which makes it difficult to identify cyclical turning points. Based on the index, the PEI economy experienced two recessions over the last 20 years and both occurred at about the same time as the national contractions.

Nova Scotia

The Nova Scotia Composite Index is smooth and behaves similarly to Canadian real GDP. The historical profile of the index suggests that Nova Scotia has experienced business cycles that are close to the national business cycles in terms of the number of contractions.

Chart 7
Nova Scotia Composite Index and Canada Real GDP

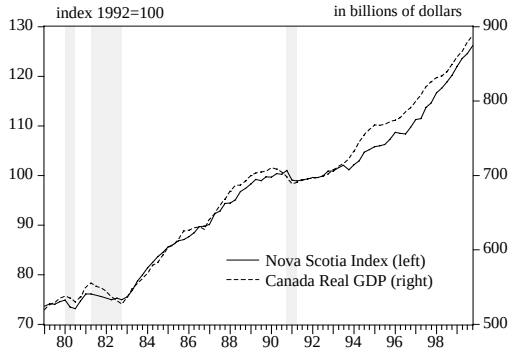


Table 16
Business Cycle Chronology

	Nova Scotia Index	Canada
Cyclical Peaks		
	1980:Q1	1980:Q1
	1981:Q2	1981:Q2
	1990: Q4 (+3)	1990:Q1
Cyclical Troughs		
	1980:Q3	1980:Q3
	1982:Q4	1982:Q4
	1991:Q2 (+1)	1991:Q1

Note: Numbers in ( ) refer to difference in timing with the national chronology. The sign "+" indicates that the turning point occurred after and "-" before the national turning point.

One difference is the last recession, which was shorter in duration in Nova Scotia. Actual data show that real GDP dropped marginally (0.4 per cent) in 1990 and increased slightly (0.1 per cent) in 1991.

New Brunswick

The historical profile of New Brunswick's Composite Index is plotted below along with

Chart 8: New Brunswick Composite Index and Canada Real GDP

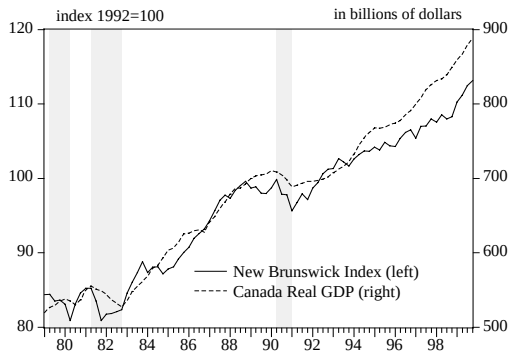


Table 17
Business Cycle Chronology

	New Brunswick Index	Canada
Cyclical Peaks		
	1979: Q2 (-3)	1980:Q1
	1981: Q2	1981:Q2
	1990: Q2 (+1)	1990:Q1
Cyclical Troughs		
	1980: Q2 (-1)	1980:Q3
	1981: Q4 (-4)	1982:Q4
	1991: Q1	1991:Q1

Note: Numbers in ( ) refer to difference in timing with the national chronology. The sign "+" indicates that the turning point occurred after and "-" before the national turning point.

Canada's real GDP. The index identifies three recessions. Table 17 indicates that the 1980 recession started earlier and lasted longer in New Brunswick. However, the provincial recession in 1981 was shorter than Canada's.

Manitoba

The historical profile of Manitoba's Composite Index, along with Canada's real GDP, is shown below. Both profiles are smooth with about the same degree of volatility. The index clearly identifies three recessions in the last twenty years, the same as for Canada. There

Chart 9: Manitoba Composite Index and Canada Real GDP

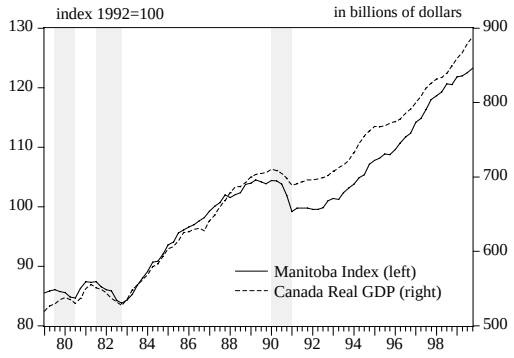


Table 18
Business Cycle Chronology

	Manitoba Index	Canada
Cyclical Peaks		
	1979: Q3 (-2)	1980:Q1
	1981: Q3 (+1)	1981:Q2
	1990: Q1	1990:Q1
Cyclical Troughs		
	1980: Q3	1980:Q3
	1982: Q4	1982:Q4
	1991: Q1	1991:Q1

Note: Numbers between ( ) refer to difference in timing with the national chronology. The sign "+" indicates that the turning point occurred after and "-" before the national turning point.

are no significant disparities with the two business cycles in terms of the onset and duration of contractions. However, the index suggests that the last recession was more severe in Manitoba, which is corroborated by actual data on real GDP.[38]

Saskatchewan

The Chart above plots the historical profile of Saskatchewan's Composite Index along with Canada's real GDP. As the next section will demonstrate, the Saskatchewan Index does not perform as well as the others in forecasting real GDP growth. Clearly, further work is

Chart 10: Saskatchewan Composite Index and Canada Real GDP

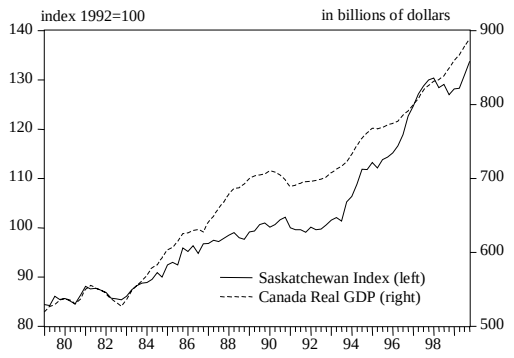


Table 19
Business Cycle Chronology

	Saskatchewan Index	Canada
Cyclical Peaks		
		1980:Q1
		1981:Q2
		1990:Q1
Cyclical Troughs		
		1980:Q3
		1982:Q4
		1991:Q1

Note: Numbers between ( ) refer to difference in timing with the national chronology. The sign "+" indicates that the turning point occurred after and "-" before the national turning point.

needed to improve its reliability. Therefore, we chose not to discuss the business cycle characteristics of this provincial index until we find a more reliable index.

---

[38] In 1991, real GDP in Manitoba fell by 4.7 per cent compared to 1.9 per cent for Canada.

Alberta

Chart 11 illustrates the historical profile of Alberta's Composite Index along with Canada's real GDP. The index identifies three recessions over the last two decades. However, their timing is different. The index suggests that Alberta did not experience a recession in 1980, but did experience a downturn in 1981-1983 and 1985-1986 where a substantial drop in crude oil prices adversely affected the provincial economy. Another difference is the onset

Chart 12: British Columbia Composite Index and Canada Real GDP

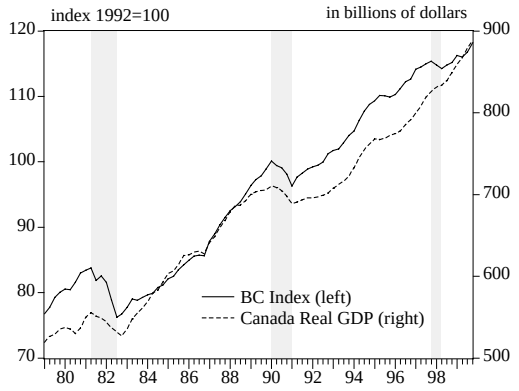


Table 20
Business Cycle Chronology

	Alberta Index	Canada
Cyclical Peaks		
		1980:Q1
	1981: Q3 (+1)	1981:Q2
	1985: Q4	
	1990: Q4 (+3)	1990:Q1
Cyclical Troughs		
		1980:Q3
	1983: Q2 (+2)	1982:Q4
	1986: Q2	
	1991: Q2 (+1)	1991:Q1

Note: Numbers between ( ) refer to difference in timing with the national chronology. The sign "+" indicates that the turning point occurred after and "-" before the national turning point.

and duration of the contractions in the 1981-1982 and in early 1990s. The first recession was more prolonged in Alberta, while the second recession began later and was shorter in duration. Lastly, based on the index, the fall in commodity prices in 1997 and 1998 did not push the provincial economy into a recession. But the index suggests that the adverse price shock caused a sharp slowdown in growth.

British Columbia

Chart 12 illustrates British Columbia's Composite Index with the historical profile of Canada's real GDP. The index identifies three recessions, as for Canada, but their timing is different. The first two contractions in B.C. occurred in 1981-1982 and 1990-1991. The

Chart 11: Alberta Composite Index and Canada Real GDP

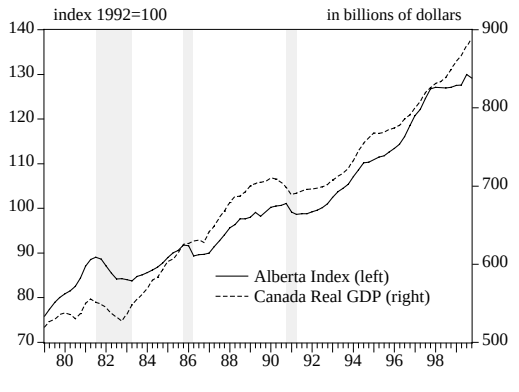


Table 21
Business Cycle Chronology

	British Columbia Index	Canada
Cyclical Peaks		
		1980:Q1
	1981: Q2	1981:Q2
	1990: Q1	1990:Q1
	1997: Q4	
Cyclical Troughs		
		1980:Q3
	1982: Q3 (-1)	1982:Q4
	1991: Q1	1991:Q1
	1998: Q2	

Numbers between ( ) refer to difference in timing with the national chronology. The sign "+" indicates that the turning point occurred after and "-" before the national turning point.

timing of these two downturns was coincident with that of the national downturns. The index suggests, however, that the first two recessions were more severe in British Columbia in terms of the cumulative drop in activity (particularly in 1981-1982). Lastly, the index suggests that the Asian crisis and the accompanied drop in commodity prices caused a mild recession in British Columbia in late 1997 and early 1998. Based on the index, the contraction was modest in terms of output loss and was short-lived.[39] Since then, the recovery in the index has been solid, rising 0.6 per cent per quarter on average. The recovery in the index was stronger in 1999, particularly in the second half of the year.

Yukon

The historical profile of the Yukon's Composite Index is plotted in the Chart below. The index is clearly very volatile, a characteristic that corresponds to the nature of the Yukon's

Chart 13: Yukon Composite Index and Canada Real GDP

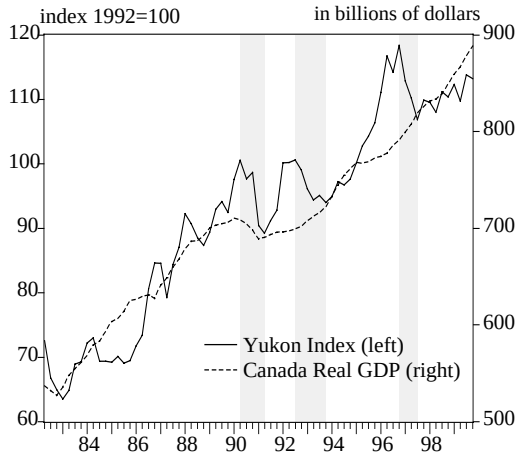


Table 22
Business Cycle Chronology

	Yukon Index	Canada
Cyclical Peaks		
		1980:Q1
		1981:Q2
	1990: Q2 (+1)	1990:Q1
	1992: Q2	
	1996: Q4	
Cyclical Troughs		
		1980:Q3
		1982:Q4
	1991: Q2 (+1)	1991:Q1
	1993: Q4	
	1997: Q3	

Numbers between parentheses refer to difference in timing with the national chronology. The sign "+" indicates that the turning point occurred after and "-" before the national turning point.

economy. The index suggests that the Yukon experienced four contractions over the last two decades, two more that for Canada.

[39] For 1998 as a whole, real GDP in British Columbia rose 0.2 per cent. The composite index of coincident indicators predicted very weak growth for 1998. Growth in the index fell sharply to 0.4 per cent in 1998.

Northwest Territories

The historical profile of the Northwest Territories' Composite Index is plotted in the Chart below, along with Canada's real GDP. As for Yukon, the index is much more volatile than national growth. Furthermore, the index suggests a difference with the national business

Chart 14: Northwest Territories Composite Index and Canada Real GDP

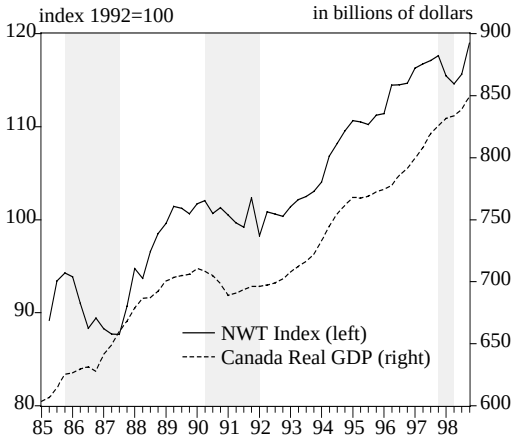


Table 23
Business Cycle Chronology

	Northwest Territories Index	Canada
Cyclical Peaks		
		1980:Q1
		1981:Q2
	1985: Q4	
	1990: Q2 (+1)	1990:Q1
	1997: Q4	
Cyclical Troughs		
		1980:Q3
		1982:Q4
	1986: Q3	
	1992: Q1 (+4)	1991:Q1
	1998: Q2	

Numbers between parentheses refer to difference in timing with the national chronology. The sign "+" indicates that the turning point occurred after and "-" before the national turning point.

cycle. Based on the index, the territorial economy had one more recession during the 1990s, namely in 1997-1998. The additional contraction corresponds to an adverse commodity price shock.

Table 24
Regional Business Cycles: Are There Differences with the National Business Cycle?

	Differences		What is it?	Comments
	No	**Yes**		
Newfoundland		✓	One more contraction in 1996	End of development phase of Hibernia
Prince Edward Island	✓			
Nova Scotia		✓	Shorter recession in 1991	
New Brunswick		✓	Shorter recession in 1981	
Québec	✓			
Ontario	✓			
Manitoba	✓			
Saskatchewan				Composite index not reliable enough to identify reference dates
Alberta		✓	Only one downturn in early 1980s. Alberta experienced a downturn around mid-1980s.	The downturn in mid-1980 was related to the drop in crude oil prices
British Columbia		✓	Only one downturn in B.C. in early 1980s. B.C. experienced a mild downturn in 1997-1998.	Downturn in 1997-1998 was related to the Asian crisis and drop in commodity prices
Yukon and Northwest Territories				Composite indexes not reliable enough to identify reference dates

3. PERFORMANCE OF THE COMPOSITE INDEXES IN MONITORING THE STATE OF REGIONAL ECONOMIES

The most important question is how useful are the indexes in monitoring or tracking the state of regional economies in Canada? To answer this, we will examine the reliability of each composite index to predict real GDP growth over the 1980s and 1990s. The reliability of each composite index is assessed with simple correlation analysis and with a coincident indicator model.

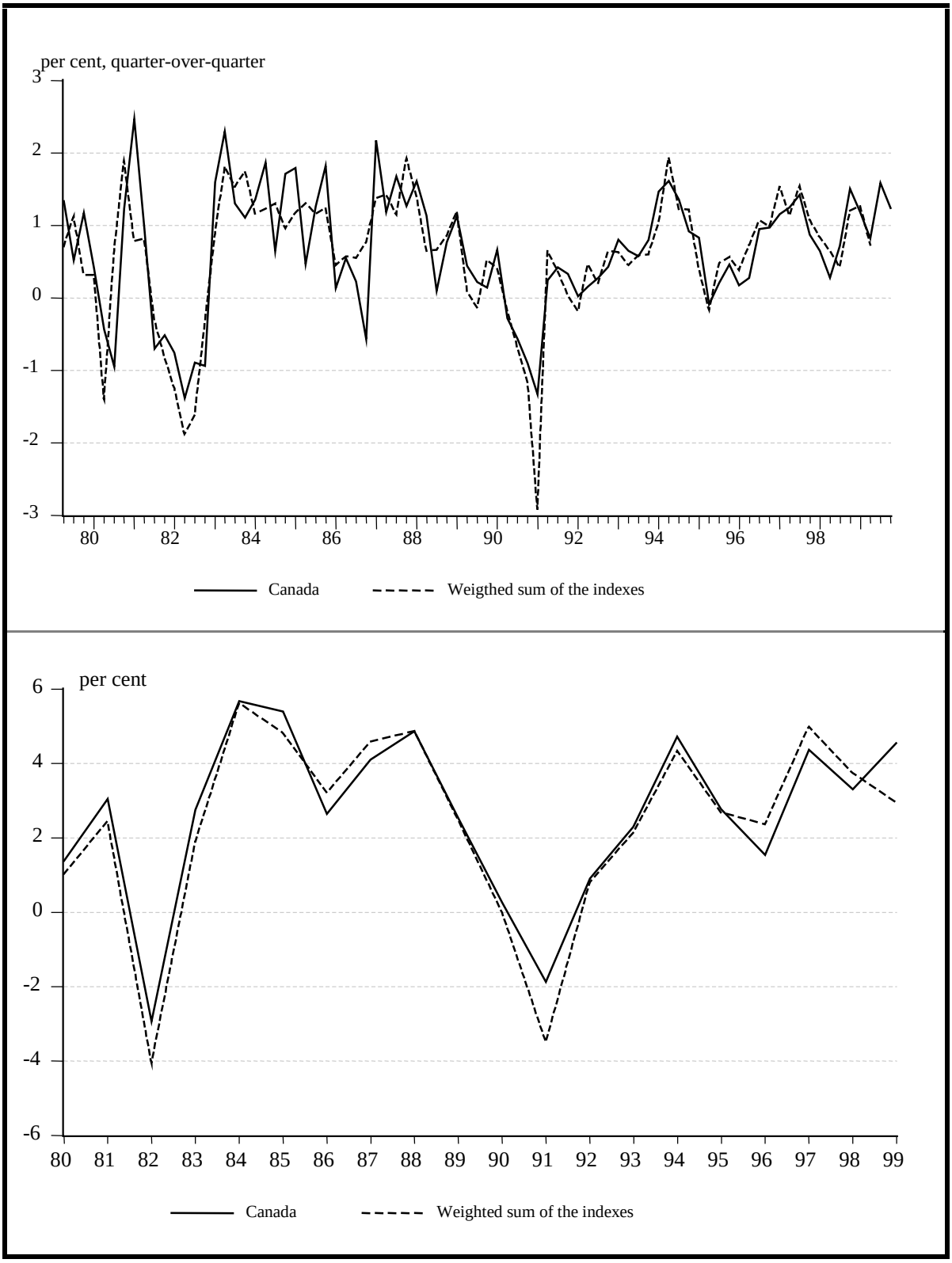
Before presenting and discussing the performance of the composite indexes, we will provide a brief overview of the main results. First, when expressed in percentage change from the previous period, the composite indexes for all jurisdictions, except Saskatchewan, are highly correlated with real GDP growth. The correlations are significantly higher than those of more commonly used regional economic indicators. Second, the indexes have substantial information content in predicting the changes in quarterly real GDP for Québec and Ontario and changes in annual real GDP for most jurisdictions, notably Québec, Ontario, Alberta and British Columbia. The coincident indexes of these four provinces, which represent 90 per cent of Canadian real GDP, are able to predict about 80 per cent or more of the variance in annual real GDP growth since 1982. Third, the confidence ratio is high for most jurisdictions, suggesting that the indexes are reliable in forecasting changes in real GDP growth.

In brief, the results suggest that the composite indexes for most jurisdictions have strong predictive capacity in tracking the state of regional economic growth in Canada over the 1980s and 1990s.

Is the sum of the composite indexes highly correlated with national real GDP growth?

A first way to assess the reliability of the composite indexes is to see if their sum, when properly weighted, would give a reasonable crude estimate of real GDP growth for Canada as a whole. We should expect so if each composite index is a good representation of economic activity. Chart 15(a) shows the quarter-over-quarter percentage changes in Canada real GDP, as estimated by Statistics Canada, and the quarter-over-quarter percentage changes in the weighted sum of the composite indexes. What is clearly obvious from the chart is the strong correlation between the two series since 1979, notably around cyclical turning points and during contractions. Overall, the coefficient of correlation is slightly above 0.80 from the first quarter of 1979 to the first quarter of 2000. This is an interesting and reassuring result and suggests that the composite indexes comprise useful and reliable information about the sate of regional economies. Obviously, we would have a stronger correlation between the two series if we could improve the reliability of the Nova Scotia and Saskatchewan indexes. Chart 15(b) shows the annual year-over-year changes since 1980. The strong correlation between the two series is more evident and close to one.

Chart 15(a) and 15(b)
Growth in Canada Real GDP and Weighted Sum of the Composite Indexes



Simple correlation analysis

We investigated the relationship of each composite index with respect to the reference series with correlation analysis. We also computed the correlation of some commonly used high-frequency individual economic indicators with the reference series to better evaluate the relative efficacy of the composite indexes. These economic indicators, which are also components of the composite indexes, are total employment, real total labour income, real retail sales, real total manufacturing shipments, and urban housing starts. The correlation coefficients are calculated on a quarterly basis from 1982 to 1998 for Ontario and Québec and on an annual basis over the same period for all jurisdictions.

The correlations of each composite index and individual economic indicators with the reference series are given in Table 26 (page 44). The quarterly results are presented in parentheses. All the variables are expressed in percentage change from the previous period.

The annual correlation between the composite indexes and real GDP growth is the highest for Ontario and Québec, slightly above 0.90. At 0.74, the quarterly correlations are also high for the two provinces. The table also reveals that each of the two composite indexes is more strongly correlated with real GDP growth than commonly used individual economic indicators. Except for Saskatchewan, the composite index of every other jurisdiction is also strongly correlated with real GDP growth. We also found that individual economic indicators are generally less correlated with real GDP growth.

In brief, the correlation analysis suggests that the composite indexes are generally the economic indicators that are the most closely related to real GDP growth. This is true on a quarterly basis for Québec and Ontario and on an annual basis for all jurisdictions.

Performance of the composite indexes

The performance of the composite indexes in monitoring the state of regional economic activity was further evaluated with an indicator model. The indicator model for each jurisdiction includes two variables: real GDP growth as the endogenous variable and the current growth of the composite index as the exogenous variable. For most jurisdictions, the models were estimated with annual data from 1982 to 1998. A quarterly model was also estimated for Québec and Ontario.

Three criteria were used to assess the in-sample performance of each coincident indicator model in forecasting real GDP growth.[40] The first criterion is the R^2. That statistic measures the variance of real GDP growth that is explained by the composite index. The second criterion is the U-Theil inequality coefficient, which is equal to the ratio of the root mean

[40] The out-of-sample performance of the coincident indicator models was also assessed. The results, which are not reported in this paper, suggest substantial information content in predicting real GDP growth for most jurisdictions.

square error (RMSE) of a coincident indicator model to that of a naïve model of no change. If the ratio is less than unity, the coincident indicator model's forecast is superior to the naïve model. Hence, the closer the U-Theil is to zero, the better the indicator model's forecast compared to those of the naïve model of no change. The U-Theil inequality coefficient is calculated over the entire sample period. The third criterion is the confidence ratio.[41] It is the number of times a composite index gives the correct direction of change in real GDP growth as a percentage of the total number of changes. The confidence ratio was computed for the in-sample 1983 to 1998 period.

The results for each composite index are reported in Table 25 on page 43. The in-sample power of each composite index in forecasting real GDP growth is also illustrated in Chart 16(a) to 16(l) on pages 45 to 48. We will discuss first the results for Québec and Ontario, and then the results for all other jurisdictions.

Ontario and Québec

The composite indexes for Ontario and Québec forecast both quarterly and annual real GDP growth very well. On a quarterly basis, these two indexes predicted 55 per cent of the corresponding variance in real GDP growth.[42] On an annual basis, the R^2 reaches roughly 0.90 for both indicator models. Charts 16(a) to 16(d) (page 45) illustrate the predictive power of each composite index. Their performance is notably strong around cyclical turning points and during contractions. The U-Theil inequality coefficients for both coincident indicator models are well below unity and are the lowest among all jurisdictions. The confidence ratio is also very high, reinforcing the view that both composite indexes have a substantial ability to predict changes in real GDP growth.

All other jurisdictions

The composite indexes of Alberta and British Columbia follow Ontario and Québec in predictive power. They predict about 80 per cent of the variance of annual real GDP growth since 1982. The predictive power of each index is illustrated in Chart 16(k) and 16(l) (page 47). It is also worth mentioning that the composite index for Alberta was able to predict the sharp and frequent accelerations and decelerations in growth over the last two decades. Furthermore, the U-Theil inequality coefficients associated with the two coincident indicator models are well below unity and are among the lowest of all models. The confidence ratio also indicates strong ability to predict change in real GDP growth.

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[41] The confidence ratio is the opposite of the confusion index. That index is one of the criteria used by Paquet et al. (1999) to evaluate short-term forecasting models of labour market variables in Canada. The authors defined the confusion index as "the number of times a model gives incorrect directional predictions of a variable over a testing sample", Paquet et al. (1999).

[42] For comparison purposes, the U.S. composite index of coincident indicators, published by the U.S. Conference Board, explained 60 per cent of the variance in quarterly U.S. real GDP growth over the same period.

The composite indexes for Newfoundland, Prince Edward Island, New Brunswick and Manitoba also perform well in predicting real GDP growth. Their respective strength is illustrated in Chart 16 (e, f, and h) page 46 for the first three provinces and Chart 16(j) page 47 for the last province. The composite index for each of these four provinces has predicted between 55 and 60 per cent of the variance in annual real GDP growth since 1982 (Table 25). Again, the U-Theil statistics are well below unity. The ability to predict correctly the change in real GDP growth is very satisfactory with a value between 0.6 and 0.8 for the confidence ratio.

The coincident indicator model for Yukon performs reasonably well in predicting real GDP growth, when we take into account that the standard deviation is 5.6 per cent of annual real GDP growth. The same conclusion applies to the Northwest Territories model. The results for Nova Scotia and Saskatchewan are not very satisfactory. The composite index for each of these two provinces has predicted less than 40 per cent of the variance in provincial real GDP growth since 1982. Further work is needed to improve the reliability of those two composite indexes to be able to accurately monitor the strength and direction of economic activity in these two provinces.

Table 25
Monitoring Reliability of the Composite Indexes

	R^2	U-Theil Inequality Coefficient (in-sample)	Confidence ratio[1]
Newfoundland	0.57	0.27	0.69
Prince Edward Island	0.56	0.25	0.75
Nova Scotia	0.36	0.26	0.63
New Brunswick	0.60	0.23	0.63
Québec[2]	0.89 (0.55)	0.13 (0.28)	0.88 (0.67)
Ontario[2]	0.86 (0.55)	0.15 (0.32)	0.88 (0.62)
Manitoba	0.57	0.31	0.75
Saskatchewan	0.24	0.43	0.63
Alberta	0.76	0.20	0.81
British Columbia	0.81	0.19	0.81
Yukon	0.43	0.42	0.87
Northwest Territories	0.46	0.42	0.81

Note: The confidence ratio is calculated with in-sample forecasts from 1983 to 1998 for most jurisdictions. The numbers in ( ) were obtained with the quarterly coincident indicator model.

Table 26
Correlation between the Composite Indexes and
Commonly Used Regional Economic Indicators with Real GDP Growth
(1982-1998)

	Nfld	P.E.I.	N.S.	N.B.	Qué.	Ont.	Man.	Sask.	Alb.	B.C.	Yuk.[4]	NWT[5]
Composite index	0.76	0.75	0.60	0.77	0.94 (0.74)	0.93 (0.74)	0.75	0.49	0.87	0.90	0.66	0.68
Total employment[1]	0.68	0.65	0.32	0.20	0.84 (0.49)	0.85 (0.62)	0.64	0.53	0.66	0.79	0.28	0.38
Real labour income[6]	0.65	0.21	0.70	0.12	0.73 (0.55)	0.79 (0.61)	0.21	0.17	0.71	0.75	0.74	0.49
Real retail sales	0.53	0.39	0.60	0.42	0.89 (0.58)	0.80 (0.49)	0.64	0.15	0.70	0.83	0.26	0.30
Real total shipments[2]	0.59	0.31	0.62	0.38	0.78 (0.62)	0.89 (0.59)	0.29	0.30	0.61	0.85	N/A[3]	N/A[3]
Urban housing starts	0.21	0.54	0.32	0.71	0.42 (0.35)	0.43 (0.17)	0.12	N/A[3]	0.10	0.70	N/A[3]	N/A[3]

Note: The numbers in ( ) refer to quarterly correlation. The correlation coefficients for Newfoundland, Nova Scotia, Yukon are computed from 1983.

1. Total actual hours worked.
2. Non-durable shipments for Newfoundland, Nova Scotia.
3. Not part of the composite index.
4. The statistics are calculated from 1984.
5. The statistics are calculated from 1986.
6. Wage and salaries for Yukon and Northwest Territories.

Chart 16(a) - 16(d)
In-Sample Performance of the Composite Indexes in Forecasting Real GDP Growth

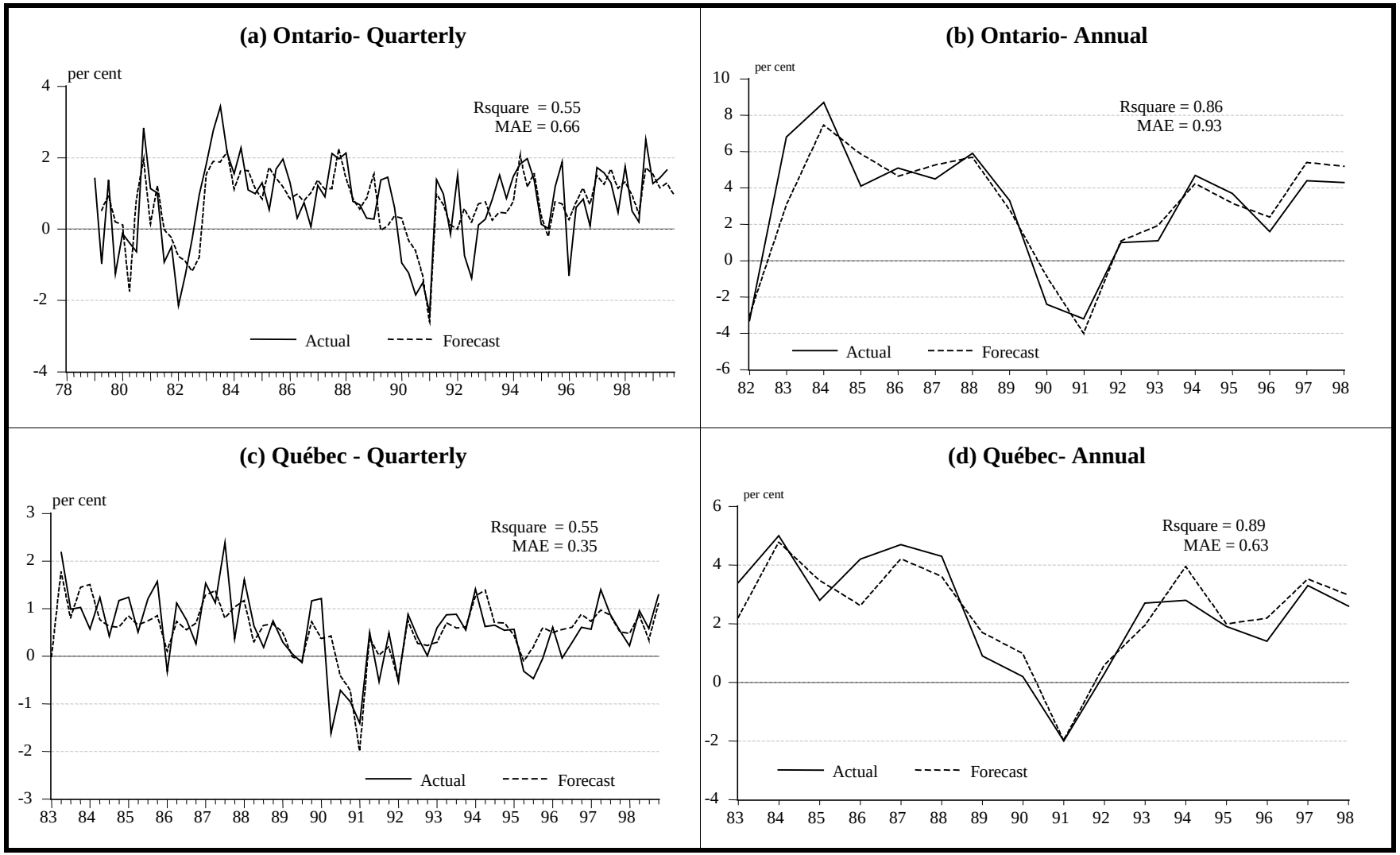

Chart 16(e) - 16(h)
In-Sample Performance of the Composite Indexes in Forecasting Real GDP Growth

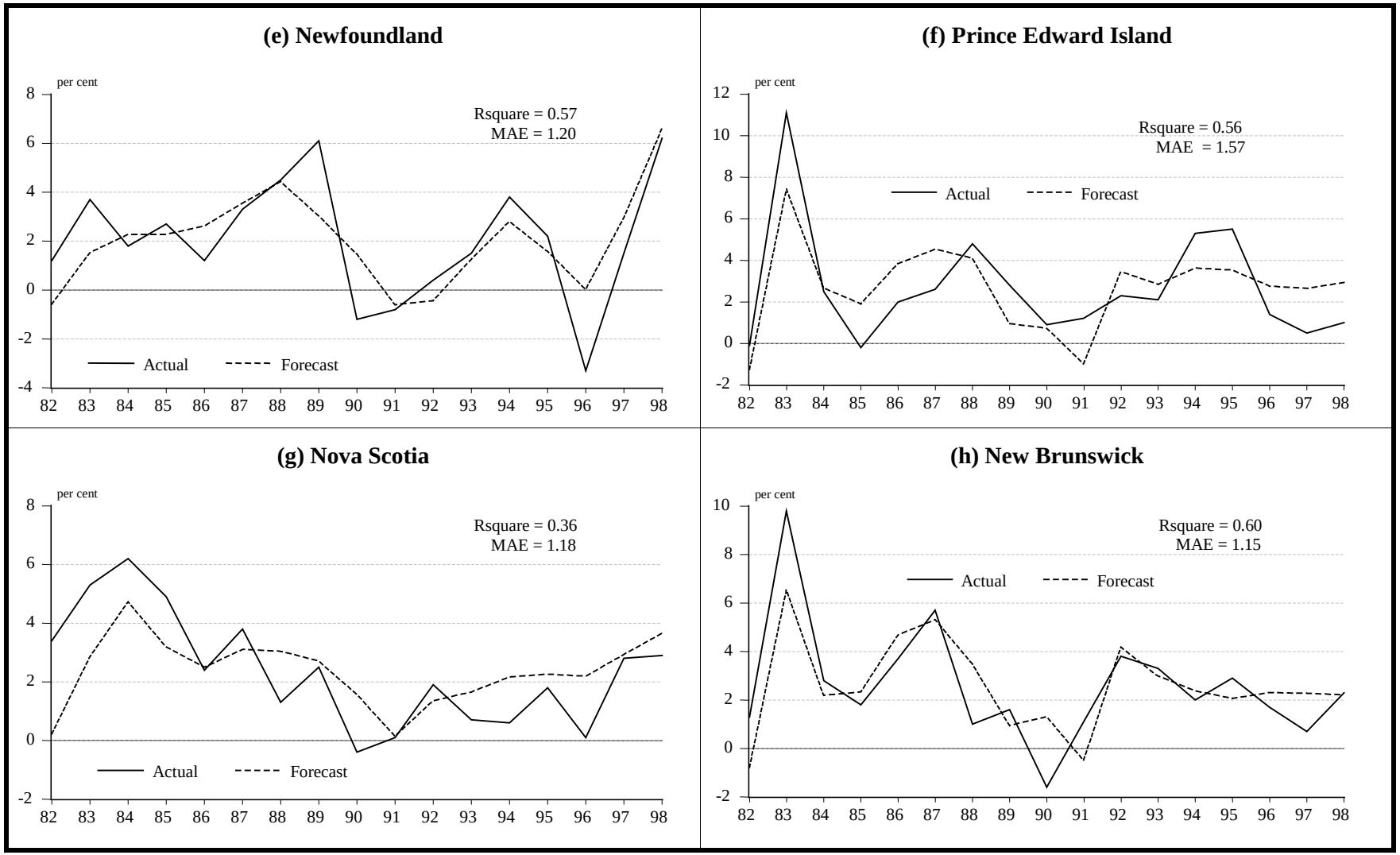

Chart 16(i)-16(l)
In-Sample Performance of the Composite Indexes in Forecasting Real GDP Growth

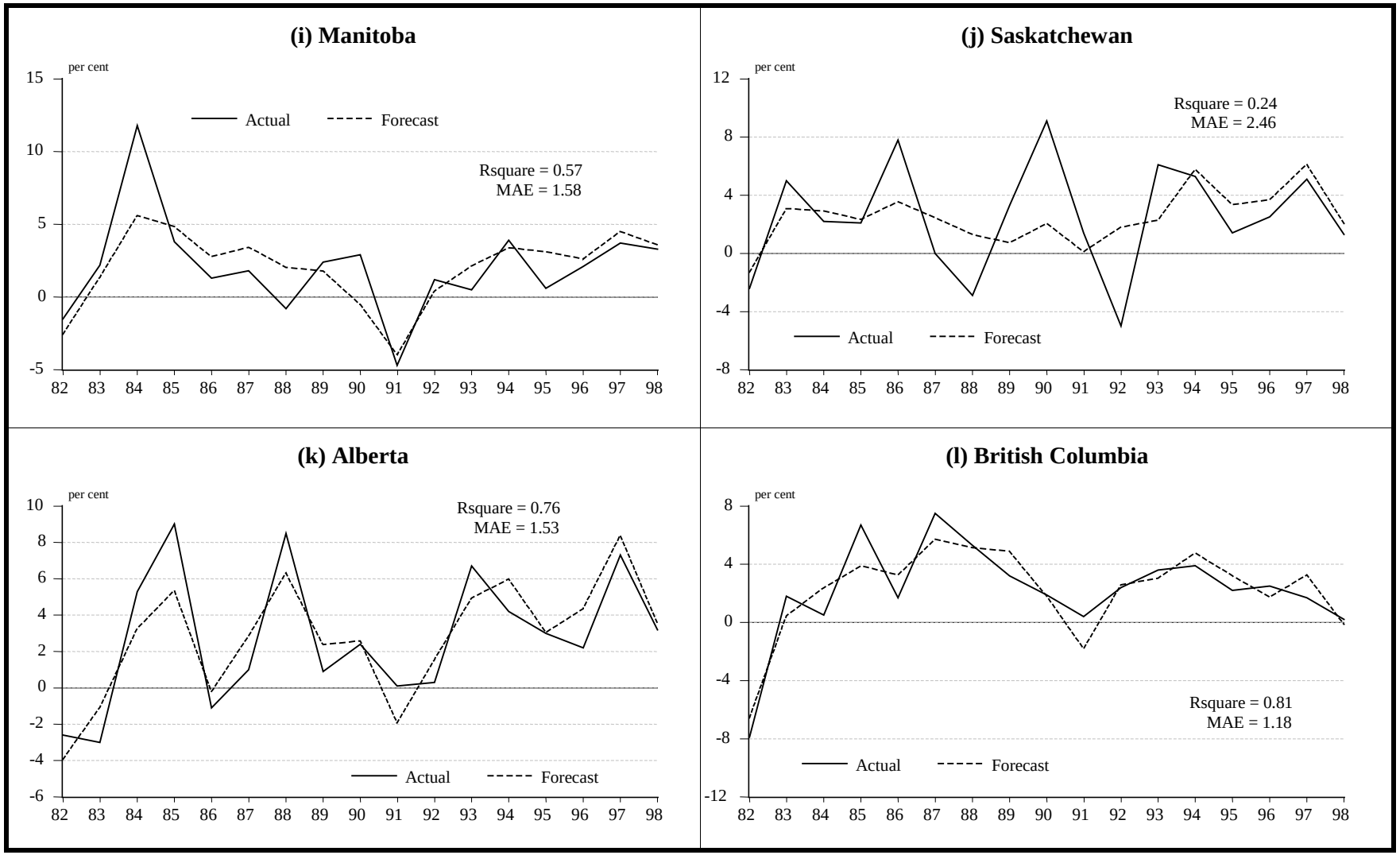

Chart 16(m)-16(n)
In-Sample Performance of the Composite Indexes in Forecasting Real GDP Growth

4. CONCLUSION

Economists generally assess developments in regional economic activity in Canada by examining individual series, such as total employment, retail sales, dwelling starts and manufacturing shipments. But it is often quite difficult to draw a clear picture of the strength and direction of regional economic growth using this approach. Using the cyclical indicator approach can effectively deal with that difficulty. This paper describes the construction process and presents new composite indexes of coincident indicators for each Canadian province and two of its territories. The results suggest that the new indexes will help to gauge with more reliability the actual state of overall economic activity across Canada.

The composite indexes are constructed with the U.S. NBER methodology and they are diversified in their coverage of the economic sectors, a very important property. Large and diversified coverage is necessary to capture as much as possible the cyclical developments of regional economic activity. Most composite indexes include one component from every key economic sector, such as the labour market, production, income, household demand and the foreign market. Resource indicators are included in the composite indexes for 9 of the 12 jurisdictions.

The last part of the paper assesses the performance of the composite indexes in monitoring the state of regional economic activity in Canada over the 1980s and 1990s. The results indicate that the composite indexes are generally more highly correlated with real GDP growth than some commonly used high-frequency regional economic indicators. The results also show that the composite indexes perform well in predicting real GDP growth. On a quarterly basis, the composite indexes for Québec and Ontario explain near 60 per cent of the variance in their respective real GDP growth. On annual basis, the composite indexes for Québec, Ontario, Alberta and British Columbia - four provinces representing 90 per cent of Canadian real GDP – predict about 80 per cent and more of the variance of their respective real GDP growth. The confidence ratio is high for most jurisdictions, suggesting that the indexes are reliable in monitoring changes in real GDP.

The composite indexes have substantial information content and will permit us to assess with more confidence the current strength and direction in most regional economies in Canada. A key property of the composite indexes is their timeliness. Each index can be updated with a lag of only two months after the end of the reference quarter. For example, the change in the composite index for 1999 as a whole was computed in February 2000 and available at the same time as Statistics Canada released the national economic and financial accounts for the fourth quarter of 1999. Thus, at that time, it was possible to determine with more reliability the strength in regional economic growth at the end of the year and the year as a whole. Lastly, the indexes are intended to provide only an indication of the strength and direction of regional economic activity. The rate of growth of a composite index by itself is meaningless and therefore should never be used as a forecast of growth in real GDP.

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APPENDIX A

Chart A
Provincial Quarterly Real GDP Estimated by the Conference Board of Canada

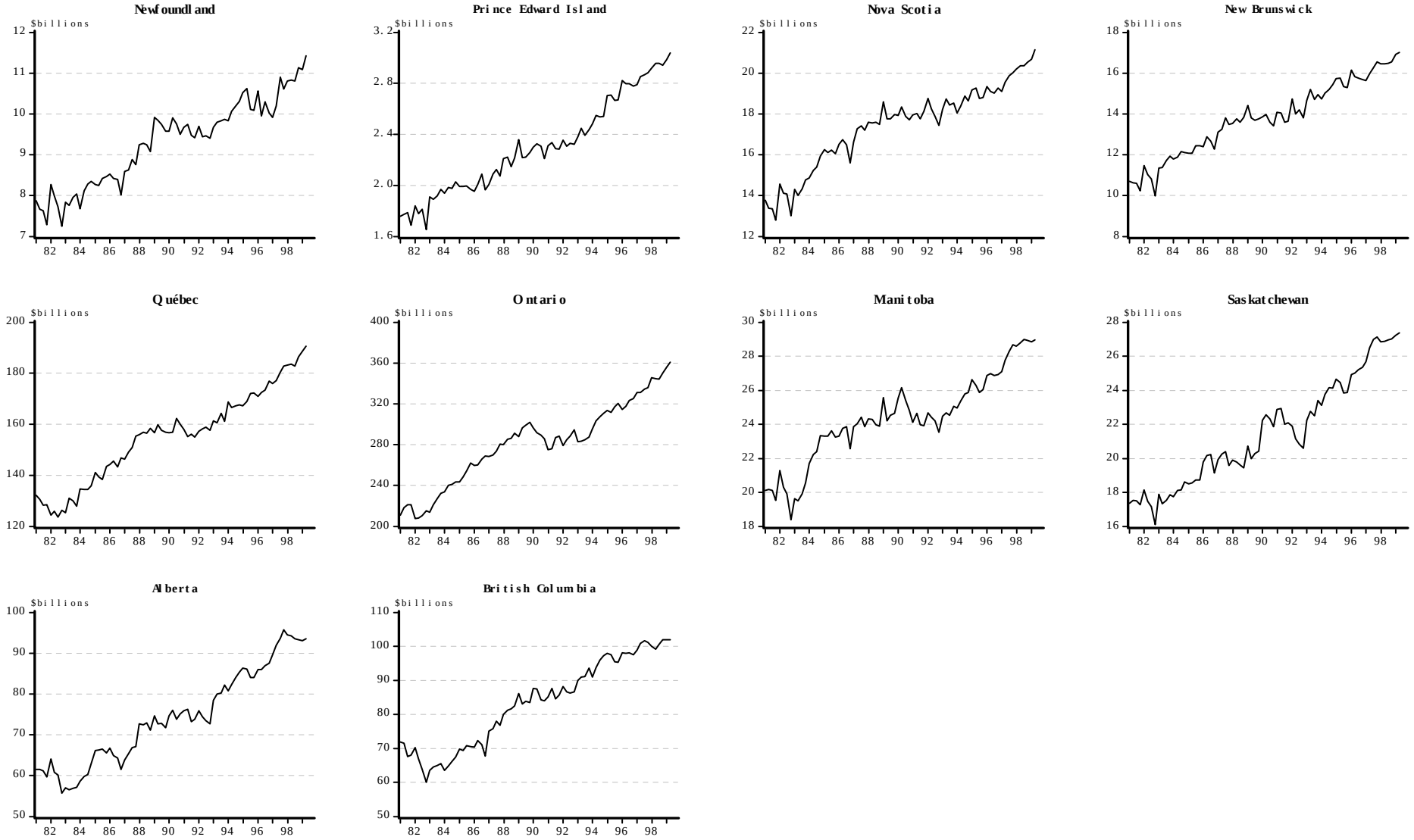

Table A
Correlation between Commonly Used Regional Economic Indicators and Conference Board Quarterly Estimates of Provincial Real GDP: 1981-1998
(percentage change from previous quarter)

	Canada	Nfld	P.E.I.	N.S.	N.B.	Qué.	Ont.	Man.	Sask.	Alb.	B.C.
Total employment	**0.76**	0.11	0.10	0.05	0.10	0.25	0.41	0.10	0.16	0.20	0.36
Real retail sales	**0.64**	0.12	0.08	0.17	0.02	0.33	0.41	0.09	-0.05	0.19	0.28
Real manufacturing shipments	**0.72**	0.22	0.28	0.23	0.31	0.15	0.34	0.35	0.18	0.21	0.45

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APPENDIX B

CONSTRUCTING THE COMPOSITE INDEXES: ALGEBRAIC DESCRIPTION OF THE NBER APPROACH

The NBER approach in constructing a cyclical indicator, such as composite index of leading, coincident or lagging indicators, requires several algebraic operations on both the individual components and the composite index. The construction of a cyclical indicator is done in three main stages, which are:

1. Standardisation and weighting of the selected individual components;
2. Standardisation and cumulation of the composite values;
3. Calculation of the trend-adjust composite index.

The following illustrates algebraically how the composite indexes of coincident indicators for provincial and territorial economies in Canada were created.

1. Standardisation and weighting of selected individual components

The first step is to calculate the month-to-month symmetrical percentage changes for each selected individual component *i* of the composite index that are in level form. The formula is:

$$[1.1] \qquad \dot{Y}_{i,t}^{j} = 200 * (X_{i,t}^{j} - X_{i,t-1}^{j}) / (X_{i,t}^{j} + X_{i,t-1}^{j})$$

where X_i^j *is* a selected individual component *i* for the jurisdiction *j*. For the components that contain zero or negatives values and for the components *i* that are already in percentage form or in ratio form, the formula is:

$$[1.2] \qquad \Delta Y_{i,t}^{j} = 200 * (X_{i,t}^{j} - X_{i,t-1}^{j})$$

The next algebraic operation is the standardization of the selected individual components transformed in [1.1] or [1.2]. The objective of this operation is to prevent a volatile component to dominate the change in the composite index. Each selected individual component, that was transformed with formula [1.1] or [1.2], was standardised by dividing it by their historical average without regard to sign. The formula is:

$$[1.3] \qquad S_{i,t}^{j} = \dot{Y}_{i,t}^{j} \Big/ \sum \left| \dot{Y}_{i,t}^{j} \right| / (n-1) \qquad \textit{or}$$

$$S_{i,t}^{j} = \Delta Y_{i,t}^{j} \Big/ \sum \left| \Delta Y_{i,t}^{j} \right| / (n-1)$$

The third algebraic operation combines each S_i^j into a composite variable. One way to aggregate the components S_i^j is to assume equal weights. However, a number of other methods are available to determine the weighting scheme that reflects better the relationship and the importance of each component with the reference cycle. For example,

the U.S. Department of Commerce has used the following methodology. They used a scoring system to estimate the weight of a selected component. The weight is derived qualitatively from a scoring system based on seven economic and statistical criteria: economic significance, statistical adequacy, cyclical timing, conformity, smoothness, timeliness and revisions. In contrast to the method used by this U.S. agency, a quantitative method was used by Lamy (1992) in the construction of a composite index of leading indicators for the Canadian economy. Based on bivariate regressions of the standardised percentage changes of the reference series on each standardised component, the author chose the estimated coefficient that was the most statistically significant at lag *k* as a weight.[43] In this project, we followed this quantitative method for Québec and Ontario. For all other jurisdictions, the following method was used. The weight of each component S_t^j was determined using cross-correlation analysis. Simply, a weight, w_t^j, is equal to the contemporaneous correlation coefficient between the standardised percentage change of the reference series for the jurisdictions j and each component S_t^j over the entire historical period.[44] The weighted average of the components S_t^j is then computed using the equation below

$$[1.4] \qquad I_t^j = \sum w_{i,t}^j * S_{i,t}^j$$

where I_t^j is the raw composite value and w_t^j the individual weight. Note that the weights were normalized to sum to one before applying the formula [1.4].

2. Standardisation and cumulation of the composite values

This step is to transform the raw composite value I_t so it has the same historical average (without regard to the sign) as the reference series. The standardised composite values is obtained as follows:

$$[1.5] \qquad I_t^s = I_t \; / \; \{ [\sum \left| I_t^j \right| / (n-1)] / [\sum \left| R_t^j \right| / (n-1)] \}$$

where I^s_t is the standardised composite value. The variable R^j is the symmetrical percentage change of a provincial or territorial reference series. Them the standardised composite value I^s_t is transformed into an index form using the formula below

$$[1.6] \qquad CI_t^s = I_{t-1}^s * (200 + I_t^s) / (200 - I_t^s)$$

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[43] All regressions revealed autocorrelated errors. I re-estimated the bivariate regressions with an autoregressive component of order one to correct for serial correlation. The relative size of those coefficients used as weights in the composite indexes remained virtually unchanged compared to the coefficients generated without the autocorrection correction. Therefore, using the adjusted coefficients had virtually no impact on the historical profile of the composite indexes and their capacity in forecasting their corresponding real GDP growth.

[44] Paine-Webber, a private financial organization in the U.S., also used this method in constructing a leading indicator of inflation for the U.S. economy.

where CI^j_t is the composite index for the province and territory *j*. The composite indexes CI^j_t are transformed in the next step so they have the same long-term trend as the reference series.

3. Trend-adjustment of the composite indexes

The only purpose of this last stage in the construction process is to facilitate the visual comparison of each index with its reference series. The objective of the trend-adjustment is to make the trend of each composite index equal to the trend of the its reference series. For each composite index, we subtracted the trend in a composite index and added in the trend of the reference series. The trend-adjustment factors for each composite index and reference series were estimated with regression techniques.

Appendix C

Table C
Weight Attached to Individual Components of the Composite Indexes by Jurisdictions

	Nfld.	P.E.I.	N.S.	N. B.	Québec	Ontario	Man.	Sask.	Alb.	B.C.	Yukon	NWT
Total employment	0.67	0.64	0.32	0.21	0.50	0.59	0.64	0.63[4]	0.67	0.80	0.27	0.38
Real total shipments	0.64[1]	0.39	0.62[1]	0.38	0.59	0.48	0.33	0.34	0.67	0.82		
Real total labour income	0.66	0.26	0.65	0.17	0.44	0.51	0.25	0.19	0.73	0.76	0.75	0.35
Real retail sales	0.54	0.44	0.60	0.43	0.43	0.38	0.67	0.22	0.74	0.84	0.27	0.14
Urban housing starts	0.20		0.32	0.58	0.27	0.18	0.28		0.20	0.72		
Drilling activity									0.71			
US coincident index	0.36		0.35		0.73	0.70	0.74	0.16	0.60	0.53		
US NAPM index		0.62		0.70								
Japan industrial prod.										0.20		
Non-resident travellers		0.40	0.38	0.51								
Crude oil production	0.30							0.19	0.62			
Natural gas production									0.31	0.33	0.30	0.20
Potash production								0.08				
Iron ore production	0.27											
Coal production										0.10		
Copper production										0.21		
Nickel production							0.41					
Zinc production				0.24						0.11	0.32	0.19
Gold production											0.16	0.56
Total crops production								0.32				
Real farm cash receipts		0.44[2]					0.24[3]		0.50[3]			

1. Durable shipments for Newfoundland and non-durable shipments for Nova Scotia from 1982. Total shipments for both provinces before 1982.
2. Total real farm cash receipts.
3. Real livestock receipts.
4. Total actual hours worked.