Catalogue no. 15-206-X — No. 030
ISSN 1710-5269
ISBN 978-1-100-21907-3

Research Paper

The Canadian Productivity Review

Productivity and Economic Growth in the Canadian Provinces, 1997 to 2010

by Wulong Gu and Beatrix Lee

Economic Analysis Division
R.H. Coats Bldg., 18th floor, 100 Tunney's Pasture Driveway
Ottawa, Ontario K1A 0T6

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.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p}	preliminary
^{r}	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E}	use with caution
F	too unreliable to be published
*	significantly different from reference category ($p < 0.05$)

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The Canadian Productivity Review

The Canadian Productivity Review is a series of applied studies that address issues involving the measurement, explanation, and improvement of productivity. Themes covered in the review include, but are not limited to, economic performance, capital formation, labour, prices, environment, trade, and efficiency at both national and provincial levels. The Review publishes empirical research, at different levels of aggregation, based on growth accounting, econometrics, index numbers and mathematical programming. The empirical research illustrates the application of theory and techniques to relevant public policy issues.

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The level of uncertainty will depend on several factors: the nature of the functional form used in the multivariate analysis; the type of econometric technique employed; the appropriateness of the statistical assumptions embedded in the model or technique; the comprehensiveness of the variables included in the analysis; and the accuracy of the data that are utilized. The peer group review process is meant to ensure that the papers in the series have followed accepted standards to minimize problems in each of these areas.

Publications Review Committee
Analysis Branch, Statistics Canada
18th Floor, R.H. Coats Building
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Acknowledgements

The authors thank John Baldwin and Isabelle Amano for helpful comments.

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Abstract

This paper provides a provincial perspective on the slowdown in productivity and economic growth in the total business sector in Canada between 2000 and 2010 compared to the late 1990s. It uses the most recent provincial multifactor productivity database.

The paper finds that the slowdown in aggregate output and productivity growth between 2000 and 2010 can be traced to what took place in two industries during this period: manufacturing in central Canada; and mining and oil and gas extraction in Alberta.

Aggregate output and productivity growth slowed in almost all provinces between 2000 and 2010. In general, the slowdown in aggregate output and labour productivity growth was larger in central Canada and the Atlantic Provinces than in western Canada during this period. The slowdown in output and productivity growth was largest in Ontario. From 1997 to 2000, Ontario was the main source of growth in aggregate output and productivity in Canada. Between 2000 and 2010, aggregate output and productivity growth in Ontario was among the slowest of the ten provinces.

The goods-producing sector was largely responsible for the slowdown in aggregate output and productivity growth between 2000 and 2010 in almost all provinces. The exact industries within the goods-producing sector that were mostly responsible differ across provinces. For central Canada, the manufacturing sector was the most important contributor to the slowdown in aggregate output and productivity growth. For Alberta, the natural resources industry and natural-resource-related construction accounted for most of the slowdown in aggregate productivity growth.

Executive summary

The productivity and output growth of the business sector in Canada decelerated substantially between 2000 and 2010 relative to the late 1990s. The main objective of this paper is to provide a provincial perspective on the sources of the slowdown in productivity and economic growth that took place in the Canadian business sector between 2000 and 2010. The paper uses the most recent provincial multifactor productivity database.

The provincial multifactor productivity database is constructed using a growth accounting framework that allows analysts to isolate the effects of higher capital intensity, skills upgrading, and increases in multifactor productivity (MFP) on growth in labour productivity.

Labour productivity can grow as a result of higher capital intensity per worker. For example, stronger investment in information technology can raise capital intensity and labour productivity. As information technology has become less expensive, firms have substituted information technology for labour and other forms of capital.

Labour productivity can grow also as a result of an increase in the proportion of skilled workers within the workforce. Upgrading workers' skills via education or via having a more experienced workforce can increase labour productivity. Canadian companies can upgrade their workers' skills through formal schooling, on-the-job experience, or retraining. MFP captures all other effects. It is the residual factor capturing many influences—technological change, organizational innovation, economies of scale, and variations associated with changes in capacity utilization.

Between the period from 1997 to 2000 and the period from 2000 to 2010, output growth and labour productivity growth in the business sector slowed in all provinces. MFP growth rates declined in all provinces, except in Prince Edward Island, between the two periods.

In general, the slowdown in aggregate output and labour productivity growth was larger in central Canada and the Atlantic Provinces than in western Canada. From 1997 to 2000, output growth in the business sector was highest in central Canada and the Atlantic Provinces. Between 2000 and 2010, output growth was slowest in central Canada and the Atlantic Provinces, except Newfoundland and Labrador.

The deceleration was largest in Ontario after 2000. Over the period from 1997 to 2000, Ontario experienced the most rapid output growth in the business sector of any of the ten provinces. Between 2000 and 2010, Ontario had the slowest output growth in the business sector. Output growth declined from 7.5% per year to 1.0% per year in the Ontario business sector between the two periods.

The decline in output growth between 2000 and 2010 reflected the slowdown in both labour productivity and hours worked in all provinces, except Alberta and British Columbia. The decline in the growth in hours worked and the growth in labour productivity between 2000 and 2010 was largest in the Ontario business sector. In general, the decline in the growth in hours worked and in the growth in labour productivity was larger in central Canada and the Atlantic Provinces than in western Canada.

Ontario accounted for 64%, or 2.7 percentage points, of the of 4.3 percentage points slowdown in aggregate output growth in Canada between the period from 1997 to 2000 and the period from 2000 to 2010. The share of the decline in output growth accounted for by Ontario was larger than its output share (about 40% in the period from 2000 to 2010). Quebec accounted for about 23%, or 1.0 percentage point, of the decline in aggregate output growth in Canada, which is slightly larger than its share of output.

Over the period from 1997 to 2000, Ontario accounted for half of the overall growth in the Canadian business sector. However, for the period from 2000 to 2010, Ontario accounted for about 20% of overall growth in Canada. During the period from 2000 to 2010, the contributions of Alberta and Quebec to overall output growth in the Canadian business sector were each as large as that of Ontario.

The provincial contributions to aggregate labour productivity and MFP growth mirror the results for the provincial contributions to aggregate output growth. Ontario accounted for most (more than 60%) of the decline in aggregate labour productivity and MFP growth in the Canadian business sector. Between 1997 and 2000, Ontario accounted for more than half of the overall growth in labour productivity and MFP. Between 2000 and 2010, its contribution to aggregate labour productivity and MFP growth was significantly lower. In fact, Ontario's contribution to aggregate MFP growth between 2000 and 2010 was negative and lowered aggregate MFP growth in Canada by 0.2 percentage points per year.

The slowdown in labour productivity growth can be traced to the contributions from the changes in investment in physical capital, shifts in labour composition, and MFP growth. The decline in labour productivity growth in the Canadian provinces between 2000 and 2010 can be attributed to the decline in MFP growth in all provinces, except Prince Edward Island and Manitoba. The decline in MFP growth was largest in Ontario between 2000 and 2010. MFP grew rapidly in most provinces over the period from 1997 to 2000. Between 2000 and 2010, MFP growth was negative or small in most provinces, except Newfoundland and Labrador.

The slowdown in labour productivity growth in the Canadian provinces between 2000 and 2010 was not due to changes in investment in physical capital. In fact, the contribution of investment in physical capital increased in six provinces. Only four provinces experienced a decline in the capital deepening effect between 2000 and 2010. The largest decline in the capital deepening effect took place in Manitoba. Before 2000, the capital deepening effect in Manitoba was one of the highest among the ten provinces. Between 2000 and 2010, it was among the lowest.

There was little change in the contribution of labour composition to labour productivity growth in all provinces, except in Manitoba and Alberta. The contribution of labour composition in Manitoba and Alberta experienced a significant decline as the pace of the compositional shift toward more experienced and more educated workers slowed in those two provinces. The decline contributed 0.3 percentage points to the overall slowdown in labour productivity growth in Manitoba and 0.2 percentage points to the overall decline in labour productivity growth in Alberta. For the other provinces, there were no significant changes in the contribution of labour composition to labour productivity growth.

The goods-producing sector was largely responsible for the slowdown in aggregate output and productivity growth between 2000 and 2010 in all provinces, except Manitoba. In Manitoba, slow aggregate output growth was due mainly to slower output growth in the services-producing industries.

While the goods-producing sector was largely responsible for the decline in aggregate output and productivity growth in almost all provinces, the exact industries within the goods-producing sector that were mostly responsible differ across provinces. For central Canada (Ontario and Quebec), the manufacturing sector was the most important contributor to the decline in aggregate output and productivity growth. For Alberta, the natural resources industry and natural-resource-related construction accounted for most of the decline in aggregate productivity growth. For British Columbia, it was the mining and oil and gas extraction sector and the manufacturing sector. For Saskatchewan, Newfoundland and Labrador, and Nova Scotia, it was the mining and oil and gas extraction sector. For Prince Edward Island and New Brunswick, it was the manufacturing and construction industries.

As a result of a large deceleration in output and productivity growth in the goods-producing industries between 2000 and 2010, the services-producing sector became the main source of aggregate output and productivity growth between 2000 and 2010 in all provinces, except Newfoundland and Labrador. For Newfoundland and Labrador, the main source of aggregate output and productivity growth was the mining and oil and gas extraction sector.

1 Introduction

The productivity and output growth of the business sector in Canada slowed between 2000 and 2010 relative to the late 1990s. Several studies have examined the sources of that slowdown. One strand of research has used the growth accounting framework, which decomposes labour productivity growth into contributions from investment in physical capital, investment in human capital, and multifactor productivity (MFP) growth (Baldwin and Gu 2009; Rao et al. 2005; Sharpe 2010).[1] These studies found that the decline in labour productivity growth is due mostly to the decline in MFP growth, which is commonly associated with technological change, organizational innovation, economies of scale, and variations in capacity utilization. Increases in capital intensity and investment in human capital, while important for the overall growth in labour productivity, are not the primary contributing factors to the decline in labour productivity growth in Canada between 2000 and 2010. Two industries—manufacturing, and mining and oil and gas extraction—account for most of the decline in labour productivity and MFP growth in Canada during this period.

Another strand of research tries to understand the causes of the slowdown in labour productivity growth using data from surveys of Canadian businesses. Baldwin et al. (2011) found that the decline in productivity growth in the Canadian manufacturing sector is associated with changes in the environment faced by Canadian manufacturers between 2000 and 2010, including the appreciation of the Canadian dollar and the recession in the United States in the early 2000s. These changes significantly reduced Canadian manufacturing exports to the U.S. market and led to the development of excess capacity in Canadian manufacturing plants. Baldwin et al. (2011) also found that at least half of the slowdown in aggregate productivity growth is attributable to the pro-cyclical nature of productivity growth arising from capacity utilization.

The objective of this paper is to provide a provincial perspective on the slowdown in productivity and economic growth in the total business sector in Canada. The paper uses the provincial multifactor productivity database recently released by Statistics Canada.[2] The paper asks the following questions.

- Was the slowdown in the growth rates of output, labour productivity, and MFP between 2000 and 2010 pervasive across the Canadian provinces or concentrated in a few provinces?
- Which provinces experienced the largest decline in the rates of productivity and economic growth between 2000 and 2010 and accounted for most of the decline in aggregate productivity and economic growth in Canada over that period?
- What was the main source of the slowdown in labour productivity growth across the Canadian provinces—investment or MFP growth?
- What were the industry origins of the slowdown in productivity and economic growth across the Canadian provinces?

The rest of the paper is organized as follows. Section 2 presents the provincial multifactor productivity database and discusses the methodology used to construct that database. Section 3 examines the trends in productivity and economic growth in the total business sector at the national level. Section 4 presents the trends in productivity and economic growth in the total business sector at the provincial level and examines the provincial contributions to output and productivity growth in Canada. Section 5 presents the industry contributions to aggregate output and productivity growth at the provincial level. Section 6 concludes the paper.

1. The data for the studies are obtained from CANSIM tables published by the Multifactor Productivity Program of Statistics Canada (CANSIM table 383-0021 and CANSIM table 383-0026).
2. The data was released in *The Daily*, Statistics Canada, March 12, 2012.

2 The provincial multifactor productivity database

The provincial multifactor productivity database used for this paper was released by Statistics Canada on March 12, 2012, in *The Daily*. The data include MFP, gross domestic product (GDP), capital input, and labour input in the total business sector and in major sub-sectors for the ten Canadian provinces.

This new experimental database is constructed using a methodology that is similar to the one used to construct MFP estimates at the national level. The methodology for the construction of the national MFP estimates is presented in Baldwin et al. (2007). A brief summary of the methodology followed for the construction of the provincial multifactor productivity database is provided here.

The provincial multifactor productivity database is constructed using a growth accounting framework that allows analysts to isolate the effects on the growth in labour productivity of increases in capital intensity, skills upgrading, and growth in MFP. The latter includes everything other than capital intensity and skill upgrading—technological change, organizational innovation, economies of scale, and variations associated with changes in capacity utilization. The decomposition equation for the growth in labour productivity growth can be written as:

$$\Delta(GDP / Hours) = S_k * \Delta(Capital / Hours) + S_l * \Delta LC + \Delta MFP ,$$

where: $\Delta\,(GDP / Hours)$ is the growth in GDP per hour worked, or labour productivity; S_k is the share of GDP accruing to capital; $\Delta\,(Capital / Hours)$ is the growth in the amount of capital (machines, buildings, and engineering structures) available per hour worked; S_l is the share of GDP accruing to labour; ΔLC is the growth in the measure of labour skills; and $\Delta\,MFP$ is the growth in MFP.

The three terms in the decomposition represent the three main contributors to the growth in labour productivity. The contribution of capital deepening is calculated as the product of the nominal output share of capital input and the growth rate of capital services per hour worked. The contribution of labour composition shifts is the product of the nominal output share of labour and changes in the composition of labour. MFP growth is the residual component of labour productivity growth that is not accounted for by capital deepening and shifts in labour composition.

Labour productivity can grow as a result of higher capital intensity per worker. For example, stronger investment in information technology can raise capital intensity. As information technology has become less expensive, firms have substituted information technology for labour and other forms of capital.

Labour productivity can grow also as a result of increases in the proportion of skilled workers within a workforce. Upgrading workers' skills via education or via having a more experienced workforce can increase labour productivity. Canadian companies can upgrade their workers' skills through formal schooling, on-the-job experience, or retraining. MFP captures all other effects. It is the residual factor capturing a host of influences—amongst them, changes in technology.

The estimate of nominal GDP for the provincial MFP database is obtained from provincial input-output tables. The real-GDP estimates are obtained from the provincial GDP program. The data cover all industries in the business sector. The construction of these estimates involves the splitting of the chained-Fisher GDP index for all economic activities between the business and non-business sectors. The share of the business sector in total economic activities is estimated as the portion of the GDP in chained-Laspeyres dollars going to the business sector for the period from 1997 to 2002. Between 2002 and 2010, the share is extrapolated using the growth in hours worked for the non-business sector and assuming that there is no productivity growth for the non-business sector for that period.

Labour input for the provincial MFP measures reflects shifts in labour composition by education, experience, and worker class (paid versus self-employed), as is the case for the national MFP measures. The growth of labour input (labour services) is an aggregate of the growth in hours worked by different classes of workers, weighted by the hourly wages of each class.

Capital input for the provincial MFP estimates measures the services that flow from the stock of capital. The growth of capital input is an aggregate of the growth of capital stock by different types of fixed assets, weighted by the user cost of capital for each type of asset. The methodologies for estimating capital input differ slightly in the provincial and national multifactor productivity databases. For the national MFP database, both fixed reproducible assets (machinery and equipment, and construction) and land and inventory assets are included, in order to estimate capital input, and the user cost of capital is estimated by taking into account the effect of taxes. For the provincial MFP database, land and inventory are excluded, and the effect of tax parameters is ignored in the estimation of the user cost of capital. The difference in the estimation of capital input between the provincial and national estimates has little effect on the growth rates of capital input.

3 Productivity and economic growth in Canada

This section documents the trends in productivity and output growth in the Canadian business sector at the national level. These trends have been documented in previous studies (e.g., Baldwin and Gu 2009). This paper extends the work to more recent periods. The data for the analysis in this section are obtained from the national multifactor productivity database published in Statistics Canada CANSIM table 383-0021.

Major events affected the Canadian business sector between 2000 and 2010 (Baldwin et al. 2011). This period was characterized by the end of the high tech boom, appreciation of the Canadian dollar, increases in global commodity prices, the expansion of developing countries and a slowdown in the global economy and particularly in Canada's main export market—the United States. Those changes led to a deceleration in output growth in the Canadian business sector. This section will focus on a comparison of the trends in output and productivity growth between two periods: the period from 2000 to 2010 and the previous two decades.

This section has three main tasks. First, the output growth in the Canadian business sector is decomposed into the contributions from growth in the output per unit of labour (or labour productivity) and growth in the amount of labour utilized in production.

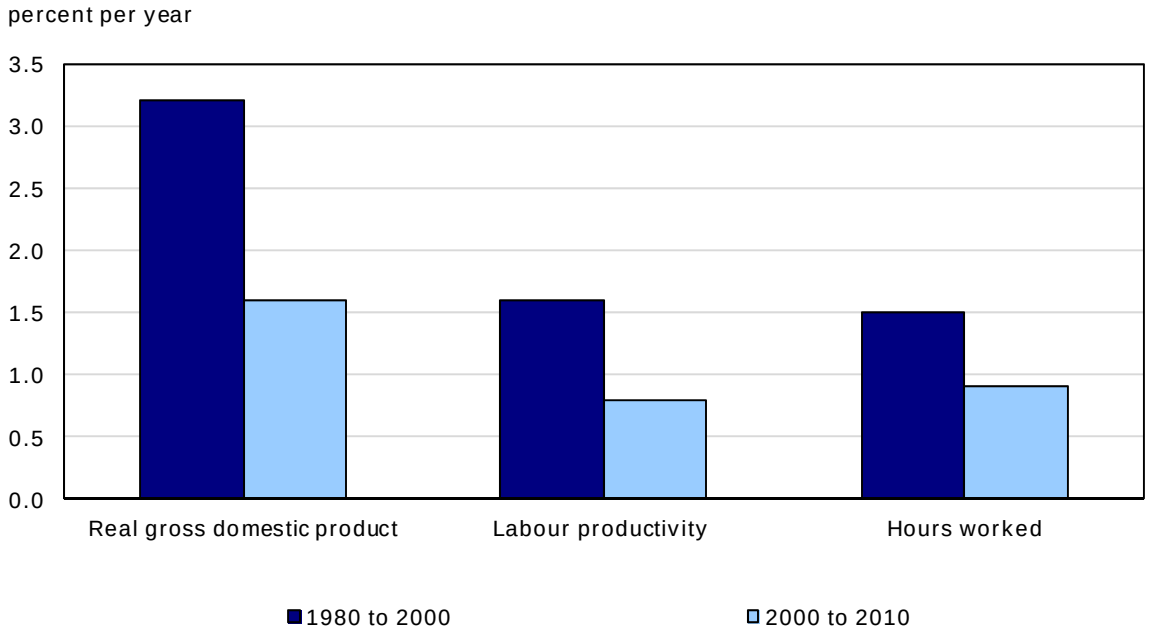
Second, the growth in labour productivity is decomposed into contributions from the following: capital deepening associated with increases in capital intensity, shifts in labour composition arising from investment in human capital; and MFP growth (which captures the effect of technological and organizational changes).

Third, the growth in output, labour productivity, and MFP in the total business sector is traced to the contribution of each industry. This allows for an examination of the relative importance of individual industries to the growth in overall output and productivity in the total business sector.

Chart 1 shows that average output growth in the Canadian business sector declined substantially between 2000 and 2010. Real GDP grew at 1.6% per year for this period, which was about half the average growth rate of 3.2% per year recorded for the period from 1980 to 2000. The slowdown in output growth is a result of the decline in both labour input and labour productivity growth. Of the 1.5 percentage points decline in annual output growth between the 1980-to-2000 period and the 2000-to-2010 period, 0.9 percentage points can be attributed to the decline in labour productivity growth, and the remaining 0.7 percentage points can be attributed to the decline in the growth in hours worked.

Chart 1

Annual average growth in output and labour productivity in the Canadian business sector



Source: Statistics Canada, CANSIM table 383-0026.

The slowdown in labour productivity growth in the period from 2000 to 2010 is decomposed into the contributions from changes in capital intensity, changes in labour composition, and MFP growth in Table 1. Almost all of the decline in labour productivity growth in the Canadian business sector for the period from 2000 to 2010 was due to the decline in MFP growth. Investment in physical capital made similar contributions to labour productivity growth in the two periods and is thus not a factor contributing to the slower labour productivity growth between 2000 and 2010. Investment in human capital as measured by the change in labour composition made a slightly lower contribution to aggregate labour productivity growth between 2000 and 2010. However, the slower increase in labour composition was not the main factor behind the slower labour productivity growth between 2000 and 2010.

Table 1

Sources of annual average growth in labour productivity in the total business sector

	1980 to 2000	2000 to 2010	Difference
	percent	percent	percentage points
Real gross domestic product	3.2	1.6	-1.5
Labour productivity	1.6	0.8	-0.9
Hours worked	1.5	0.9	-0.7
Contribution to labour productivity			
Capital deepening	1.0	1.0	0.0
Labour composition	0.4	0.3	-0.1
Multifactor productivity	0.3	-0.5	-0.8

Source: Statistics Canada, CANSIM table 383-0021.

Tables 2, 3, and 4 present the contributions of different industries to output growth, labour productivity growth, and MFP growth, respectively, in the total business sector. The direct contribution of an industry to aggregate output growth in the total business sector is calculated as the output growth in the industry multiplied by the industry's share of nominal output. The difference between the output growth in the total business sector and the sum of direct contributions across all industries is known as the effect of reallocation on aggregate output growth. The industry contributions to aggregate labour productivity and MFP growth are calculated similarly.

Between the 1980-to-2000 period and the 2000-to-2010 period, output growth decelerated in all industries of the business sector except the construction and retail trade sectors (Table 2). The largest slowdown in output growth occurred in the manufacturing industry. Output growth in the manufacturing sector fell dramatically. Output in this sector experienced an average increase of 3.2% per year over the period from 1980 to 2000, but it declined at an average rate of 1.6% per year over the period from 2000 to 2010. The manufacturing sector is the only industry that experienced an outright decline in real output over the period from 2000 to 2010.

The last three columns of Table 2 present the industry contributions to aggregate output growth. The large decline in output in the manufacturing sector recorded between 2000 and 2010 accounted for most of the deceleration in output growth in the total business sector. This accounted for 1.1 percentage points of the overall 1.5 percentage point decline in output growth of the total business sector between the 1980-to-2000 period and the 2000-to-2010 period. The remaining 0.4 percentage point decline is evenly distributed among the other industries, with the exception of the construction and retail trade industries.

Table 2

Industry output growth and industry contributions to average aggregate output growth in Canada

	Average annual growth			Contribution		
	1980 to 2000	2000 to 2010	Difference	1980 to 2000	2000 to 2010	Difference
	percent	percent	percentage points	percent	percent	percentage points
Industry						
Agriculture, forestry, fishing, and hunting	1.9	0.2	-1.7	0.1	0.0	-0.1
Mining and oil and gas extraction	2.1	0.5	-1.6	0.2	0.0	-0.2
Utilities	1.7	1.0	-0.7	0.1	0.0	0.0
Construction	1.1	3.7	2.6	0.1	0.3	0.2
Manufacturing	3.2	-1.6	-4.8	0.8	-0.3	-1.1
Wholesale trade	5.5	3.2	-2.2	0.3	0.2	-0.1
Retail trade	3.6	4.0	0.3	0.3	0.3	0.0
Transportation and warehousing	3.3	1.7	-1.5	0.2	0.1	-0.1
Information and cultural industries	4.9	3.1	-1.8	0.2	0.1	-0.1
Finance, insurance, and real estate	3.7	3.0	-0.7	0.5	0.4	0.0
Professional, scientific, and technical services	5.3	2.8	-2.5	0.2	0.2	-0.1
Other services (excluding public administration)	2.8	2.0	-0.7	0.3	0.3	0.0
Total business sector	…	…	…	3.2	1.6	-1.5
Direct contribution	…	…	…	3.2	1.6	-1.6
Reallocation	…	…	…	0.0	0.0	0.0

Source: Statistics Canada, CANSIM table 383-0021.

Table 3 presents labour productivity growth at the industry level and the contribution of each industry to aggregate labour productivity growth in the total business sector. Average labour productivity

growth slowed in most industries between 2000 and 2010. The largest decline in labour productivity growth between 2000 and 2010 occurred in the two goods-producing industries: mining and oil and gas extraction; and manufacturing. Labour productivity growth in the mining and oil and gas extraction industry fell—from an average 2.0% increase per year in the period from 1980 to 2000 to an average 3.2% decline in the period from 2000 to 2010. Labour productivity growth in the manufacturing sector declined from 3.0% per year to 0.9% per year between those two periods: 1980 to 2000 and 2000 to 2010. The decline in labour productivity growth between 2000 and 2010 was more modest in the services industries. In fact, a number of services industries, such as the retail trade and information and cultural industries, experienced stronger labour productivity growth between 2000 and 2010 than they had before.

The large slowdown in labour productivity growth in the mining and oil and gas extraction and manufacturing industries accounted for almost all of the decline in aggregate labour productivity growth in the total business sector between 2000 and 2010. The mining and oil and gas extraction sector accounted for 0.5 percentage points of the average 0.9 percentage point decline in aggregate labour productivity growth in the total business sector due to an outright decline in the level of productivity in this sector. The manufacturing sector accounted for an additional 0.5 percentage points of the overall decline in aggregate labour productivity growth.

The difference between the aggregate labour productivity growth and the sum of direct industry contributions captures the effect of reallocation of hours worked across industries on the growth in aggregate labour productivity. The reallocation made a positive contribution to aggregate labour productivity growth between 2000 and 2010, while it made a negative contribution over the period from 1980 to 2000. This is the result of a more rapid shift in employment towards the mining and oil and gas extraction industry with a relatively higher level of labour productivity in the period from 2000 to 2010.[3]

3. Rao et al. (2005) added the reallocation effect from the mining sector to the direct contribution of the mining sector to overall productivity growth, and found that the total contribution of the mining sector to overall productivity growth did not decline between 2000 and 2010. This paper follows a more standard approach, by focusing on the direct contribution of the mining sector to overall productivity growth (Jorgenson et al. 2005; Stiroh 2002; and van Ark et al. 2008).

Table 3

Industry labour productivity growth and industry contributions to aggregate labour productivity growth in Canada

	Average annual growth			Contribution		
	1980 to 2000	2000 to 2010	Difference	1980 to 2000	2000 to 2010	Difference
	percent	percent	percentage points	percent	percent	percentage points
Industry						
Agriculture, forestry, fishing, and hunting	2.8	3.2	0.4	0.1	0.1	0.0
Mining and oil and gas extraction	2.0	-3.2	-5.2	0.2	-0.3	-0.5
Utilities	0.8	-0.9	-1.7	0.0	0.0	-0.1
Construction	0.2	-0.3	-0.6	0.0	0.0	0.0
Manufacturing	3.0	0.9	-2.1	0.7	0.2	-0.5
Wholesale trade	3.5	3.0	-0.5	0.2	0.2	0.0
Retail trade	2.3	3.0	0.7	0.2	0.2	0.1
Transportation and warehousing	1.7	0.5	-1.1	0.1	0.0	-0.1
Information and cultural industries	2.0	2.3	0.3	0.1	0.1	0.0
Finance, insurance, and real estate	1.8	0.8	-1.1	0.2	0.1	-0.1
Professional, scientific, and technical services	0.6	0.4	-0.2	0.0	0.0	0.0
Other services (excluding public administration)	-0.1	0.7	0.8	0.0	0.1	0.1
Total business sector	…	…	…	1.6	0.8	-0.9
Direct contribution	…	…	…	1.9	0.7	-1.2
Reallocation	…	…	…	-0.2	0.1	0.3

Source: Statistics Canada, CANSIM table 383-0021.

The results for MFP growth at the industry level and industry contributions to aggregate MFP growth shown in Table 4 mirror the results for labour productivity growth. The MFP growth declined in all goods-producing industries between 2000 and 2010, and the largest decline occurred in the mining and oil and gas extraction and manufacturing sectors. In contrast, all services industries, except the wholesale trade and transportation industries, experienced an increase in MFP growth between 2000 and 2010. The two goods-producing sectors—manufacturing, and mining and oil and gas extraction—accounted for almost all of the decline in aggregate MFP growth in the total business sector between 2000 and 2010.

Over the period from 2000 to 2010, three services-producing industries (wholesale trade, retail trade, and information and culture) had high positive MFP growth despite the overall decline in MFP growth in the total business sector. MFP increased at an average of about 1.5% per year in these three industries. Baldwin and Lafrance (2011) showed that this growth is associated with dramatic shifts in market shares between firms.

Table 4

Industry multifactor productivity growth and industry contributions to aggregate multifactor productivity growth in Canada

	Annual growth			Contribution		
	1980 to 2000	2000 to 2010	Difference	1980 to 2000	2000 to 2010	Difference
	percent	percent	percentage points	percent	percent	percentage points
Industry						
Agriculture, forestry, fishing, and hunting	2.4	1.1	-1.3	0.1	0.0	-0.1
Mining and oil and gas extraction	-0.3	-5.3	-5.0	0.0	-0.5	-0.5
Utilities	0.3	-1.0	-1.3	0.0	0.0	0.0
Construction	-0.2	-0.7	-0.5	0.0	-0.1	0.0
Manufacturing	1.8	-0.3	-2.1	0.4	-0.1	-0.5
Wholesale trade	2.3	1.5	-0.7	0.1	0.1	0.0
Retail trade	1.2	1.6	0.5	0.1	0.1	0.0
Transportation and warehousing	0.6	-0.4	-1.0	0.0	0.0	-0.1
Information and cultural industries	0.1	1.6	1.6	0.0	0.1	0.1
Finance, insurance, and real estate	-0.5	0.4	0.9	-0.1	0.1	0.1
Professional, scientific, and technical services	-2.3	-0.5	1.8	-0.1	0.0	0.1
Other services (excluding public administration)	-1.5	-0.7	0.8	-0.2	-0.1	0.1
Total business sector	…	…	…	0.3	-0.5	-0.8
Direct contribution	…	…	…	0.4	-0.4	-0.8
Reallocation	…	…	…	-0.2	-0.1	0.1

Source: Statistics Canada, CANSIM table 383-0021.

4 Aggregate productivity and economic growth at the provincial level

This section provides a provincial perspective on the slowdown in the growth rates of aggregate output and productivity growth. It will focus on a comparison of the period from 1997 to 2000 and the period from 2000 to 2010, two periods for which the provincial productivity data are available. The analysis will address the first three questions raised in the introduction of the paper. First, was the deceleration in productivity and economic growth that occurred between 2000 and 2010 pervasive across the Canadian provinces or concentrated in a few provinces? Second, which provinces experienced the largest decline in productivity and economic growth between 2000 and 2010 and accounted for most of the decline in aggregate productivity and economic growth in Canada over that period? Third, what was the main source of the decline in labour productivity growth in the Canadian provinces—investment or MFP growth?

Table 5 presents the growth rates of output and labour productivity in the total business sector at the provincial level. It also outlines three main contributors to labour productivity growth: capital deepening, shifts in labour composition, and MFP growth.

Between the 1997-to-2000 period and the 2000-to-2010 period, output growth in the business sector slowed in all provinces. The slowdown in output growth between 2000 and 2010 was larger in central Canada and the Atlantic Provinces than in western Canada. Between 1997 and 2000, output growth in the business sector was faster in central Canada and the Atlantic Provinces. Between 2000 and 2010, output growth was slowest in central Canada and the Atlantic Provinces, except Newfoundland and Labrador.

The largest deceleration was for Ontario. Over the period from 1997 to 2000, Ontario experienced the most rapid output growth in the business sector among the ten provinces. Between 2000 and 2010, Ontario had the slowest growth in output in the business sector. Output growth declined from an average of 7.5% per year to 1.0% per year in the Ontario business sector between the two periods.

The slowdown in output growth between 2000 and 2010 reflects the deceleration in both labour productivity and hours worked growth in all provinces, except Alberta and British Columbia. The decline in the growth in hours worked and the growth in labour productivity between 2000 and 2010 were largest in the Ontario business sector. In general, the decline in the growth in hours worked and in labour productivity growth was larger in central Canada and the Atlantic Provinces than in western Canada. For the period from 2000 to 2010, the growth in hours worked was higher in the western provinces than in the other provinces. During that period, the growth in hours worked was highest in Alberta and British Columbia among the ten provinces. Hours worked increased by 2% per year in Alberta in that period, more than twice the national average growth rate. This resulted in a reallocation of the workforce towards western Canada.

The decline in labour productivity growth can be traced to the contributions from the changes in investment in physical capital, changes in labour composition, and MFP growth. The decline in labour productivity growth in the Canadian provinces between 2000 and 2010 as shown in Table 5 reflects the slowdown in MFP growth in all provinces, except Prince Edward Island and Manitoba. The slowdown in MFP growth in Ontario was the largest among the Canadian provinces between 2000 and 2010. MFP grew rapidly in most provinces over the period from 1997 to 2000. Between 2000 and 2010, MFP growth was negative or small in all provinces, except Newfoundland and Labrador.

The decline in labour productivity growth in the Canadian provinces between 2000 and 2010 is not due to changes in investment in physical capital in many provinces. In fact, the contribution of investment in physical capital increased in six provinces. The largest decline in the capital deepening effect was recorded in Manitoba. Over the period from 1997 to 2000, the capital deepening effect in Manitoba was among the highest among the ten provinces. Between 2000 and 2010, it was among the lowest. The capital deepening effect was generally higher in the western provinces than in the other provinces for both the period from 1997 to 2000 and the period from 2000 to 2010. There has been a general shift in capital investment towards western Canada (Bloskie et al. 2013). This shift reflects the importance of natural resources in western Canada.

There was generally a small decline in the labour composition component of labour productivity growth in all provinces, except Manitoba and Alberta. The effect was somewhat larger in Manitoba (0.3 percentage points) and Alberta (0.2 percentage points).

Table 5

Annual output and labour productivity growth in the business sector at the provincial level

	Output	Hours worked	Labour productivity	Capital deepening	Labour composition	Multifactor productivity
			percent			
1997 to 2000						
Canada	5.9	2.9	3.1	1.0	0.4	1.7
Newfoundland and Labrador	8.7	3.0	5.7	0.0	0.2	5.4
Prince Edward Island	4.4	2.2	2.1	1.9	0.3	-0.1
Nova Scotia	5.8	2.4	3.3	0.8	0.2	2.3
New Brunswick	5.5	2.9	2.6	0.8	0.3	1.5
Quebec	6.0	3.2	2.8	0.9	0.2	1.7
Ontario	7.5	3.7	3.9	0.6	0.3	2.9
Manitoba	4.0	0.6	3.3	1.9	0.5	0.9
Saskatchewan	2.6	-0.6	3.3	2.2	0.3	0.8
Alberta	4.4	2.5	1.8	2.4	0.4	-0.9
British Columbia	3.0	0.9	2.2	1.0	0.2	1.0
2000 to 2010						
Canada	1.6	0.9	0.8	1.0	0.3	-0.5
Newfoundland and Labrador	3.3	0.0	3.3	0.9	0.2	2.2
Prince Edward Island	1.6	0.1	1.5	1.1	0.3	0.1
Nova Scotia	1.6	0.5	1.0	0.6	0.2	0.3
New Brunswick	1.6	-0.2	1.8	1.5	0.2	0.1
Quebec	1.4	0.6	0.8	0.7	0.2	-0.2
Ontario	1.0	0.5	0.5	0.8	0.3	-0.6
Manitoba	2.0	0.5	1.4	0.8	0.3	0.3
Saskatchewan	1.4	0.1	1.3	2.8	0.3	-1.8
Alberta	2.2	2.0	0.2	2.7	0.2	-2.6
British Columbia	2.1	1.1	0.9	1.4	0.1	-0.6
			percentage points			
2000 to 2010, less 1997 to 2000						
Canada	-4.3	-2.0	-2.3	0.0	-0.1	-2.1
Newfoundland and Labrador	-5.4	-3.0	-2.4	0.8	-0.1	-3.2
Prince Edward Island	-2.8	-2.1	-0.7	-0.8	-0.1	0.2
Nova Scotia	-4.2	-1.9	-2.3	-0.2	-0.1	-2.0
New Brunswick	-3.8	-3.1	-0.8	0.7	-0.1	-1.3
Quebec	-4.6	-2.6	-2.0	-0.2	0.1	-1.9
Ontario	-6.6	-3.2	-3.4	0.1	0.0	-3.4
Manitoba	-2.0	-0.1	-1.9	-1.1	-0.3	-0.5
Saskatchewan	-1.2	0.7	-1.9	0.6	0.1	-2.6
Alberta	-2.2	-0.5	-1.6	0.3	-0.2	-1.7
British Columbia	-1.0	0.3	-1.2	0.4	-0.1	-1.5

Source: Statistics Canada, CANSIM table 383-0026.

Table 6 presents provincial contributions to aggregate output growth in the Canadian business sector. Ontario accounted for 64%, or 2.7 percentage points, of the 4.3 percentage point decline in aggregate output growth in Canada between the 1997-to-2000 period and the 2000-to-2010 period. The share of the decline in output growth accounted for by Ontario was larger than its output share (about 40% in the period from 2000 to 2010). Quebec accounted for about 23%, or 1.0 percentage point, of the decline in aggregate output growth in Canada, which is slightly larger than its share of output.

From 1997 to 2000, Ontario accounted for half of the overall output growth in the Canadian business sector. However, for the period from 2000 to 2010, it accounted for only about 20% of the overall output growth in Canada. During the period from 2000 to 2010, the contributions of Alberta and Quebec to overall output growth in the Canadian business sector were each as large as that of Ontario.

Table 6

Provincial contributions to annual aggregate output growth in the business sector

	Average share 2000 to 2010	1997 to 2000	2000 to 2010	Difference
		percent		percentage points
Contributions by province				
Newfoundland and Labrador	1.6	0.1	0.1	0.0
Prince Edward Island	0.2	0.0	0.0	0.0
Nova Scotia	1.9	0.1	0.0	-0.1
New Brunswick	1.6	0.1	0.0	-0.1
Quebec	19.7	1.3	0.3	-1.0
Ontario	38.7	3.1	0.4	-2.7
Manitoba	3.0	0.1	0.1	-0.1
Saskatchewan	3.8	0.1	0.1	0.0
Alberta	17.9	0.6	0.4	-0.2
British Columbia	11.7	0.4	0.2	-0.1
Canada	…	5.9	1.6	-4.3
Provincial contributions	…	5.9	1.5	-4.4
Reallocation	…	0.0	0.1	0.1

Source: Statistics Canada, CANSIM table 383-0026.

The provincial contributions to aggregate labour productivity and MFP growth are shown in Tables 7 and 8, and the results mirror the results on the provincial contributions to aggregate output growth. Ontario accounted for much (more than 60%) of the decline in aggregate labour productivity and MFP growth in the Canadian business sector. During the period from 1997 to 2000, Ontario accounted for more than half of the overall growth in labour productivity and MFP. Between 2000 and 2010, Ontario's contribution to aggregate labour productivity and MFP growth was small. In fact, Ontario's contribution to aggregate MFP growth between 2000 and 2010 was negative and lowered aggregate MFP growth in Canada by 0.2 percentage points per year.

Table 7

Provincial contributions to annual aggregate labour productivity growth in the business sector

	Average share 2000 to 2010	1997 to 2000	2000 to 2010	Difference
		percent		percentage points
Contributions by province				
Newfoundland and Labrador	1.6	0.1	0.1	0.0
Prince Edward Island	0.2	0.0	0.0	0.0
Nova Scotia	1.9	0.1	0.0	0.0
New Brunswick	1.6	0.0	0.0	0.0
Quebec	19.7	0.6	0.2	-0.4
Ontario	38.7	1.6	0.2	-1.4
Manitoba	3.0	0.1	0.0	-0.1
Saskatchewan	3.8	0.1	0.1	-0.1
Alberta	17.9	0.3	0.0	-0.2
British Columbia	11.7	0.3	0.1	-0.2
Canada	...	3.1	0.8	-2.3
Provincial contributions	...	3.1	0.7	-2.4
Reallocation	...	0.0	0.1	0.1

Source: Statistics Canada, CANSIM table 383-0026.

Table 8

Provincial contributions to annual aggregate multifactor productivity growth in the business sector

	Average share 2000 to 2010	1997 to 2000	2000 to 2010	Difference
		percent		percentage points
Contributions by province				
Newfoundland and Labrador	1.6	0.1	0.0	0.0
Prince Edward Island	0.2	0.0	0.0	0.0
Nova Scotia	1.9	0.0	0.0	0.0
New Brunswick	1.6	0.0	0.0	0.0
Quebec	19.7	0.4	0.0	-0.4
Ontario	38.7	1.2	-0.2	-1.4
Manitoba	3.0	0.0	0.0	0.0
Saskatchewan	3.8	0.0	-0.1	-0.1
Alberta	17.9	-0.1	-0.5	-0.3
British Columbia	11.7	0.1	-0.1	-0.2
Canada	...	1.7	-0.5	-2.1
Provincial contributions	...	1.7	-0.8	-2.5
Reallocation	...	-0.1	0.3	0.4

Source: Statistics Canada, CANSIM table 383-0026.

5 Industry contributions to aggregate output and productivity growth at the provincial level

This section presents the industry contributions to aggregate output growth, aggregate labour productivity growth, and aggregate MFP growth. It addresses the following question. What were the industry origins of the deceleration in productivity and economic growth in the Canadian provinces? It also addresses the issue of which industries were the main contributors to aggregate output and (both labour and multifactor) productivity growth at the provincial level from 2000 to 2010, when industries underwent major changes as a result of changes in exchange rates, commodity prices, and global competition.

The section will first present more detailed results for the three provinces—Ontario, Quebec, and Alberta—that accounted for most of the slowdown in aggregate output and productivity growth in Canada between 2000 and 2010. It then presents a summary of results for all ten provinces.

5.1 Results for Ontario

Tables 9, 10, and 11 present the industry contributions to aggregate output and productivity growth of the business sector in Ontario. The growth in output, labour productivity, and MFP slowed in almost all industries in the Ontario business sector between 2000 and 2010. The decline occurred in both the goods-producing and services sectors. The exception is the information and culture sector, which experienced an increase in labour productivity and MFP growth between 2000 and 2010.

Real output growth in the Ontario business sector slowed by 6.6 percentage points—from 7.5% in the 1997-to-2000 period to 1.0% in the 2000-to-2010 period. Labour productivity and MFP growth both slowed by 3.4 percentage points between those two periods. The largest contributor to the decline in aggregate output and productivity growth between 2000 and 2010 in Ontario was the manufacturing sector. The manufacturing sector accounted for 3.0 percentage points, or 45%, of the overall decline, in aggregate output growth. It accounted for about 50% of the decline in aggregate labour productivity growth and for about 60% of the decline in aggregate MFP growth. The contribution of the manufacturing sector to the decline in aggregate output and productivity growth is much larger than this sector's share of nominal GDP, which was about 25% from 2000 to 2010.

Table 9

Industry output growth and industry contributions to aggregate output growth in Ontario

	Annual growth			Contribution		
	1997 to 2000	2000 to 2010	Difference	1997 to 2000	2000 to 2010	Difference
	percent	percent	percentage points	percent	percent	percentage points
Industry						
Agriculture, forestry, fishing, and hunting	5.4	0.3	-5.0	0.1	0.0	-0.1
Mining and oil and gas extraction	2.7	-4.3	-7.0	0.0	-0.1	-0.1
Utilities	-0.8	1.0	1.8	0.0	0.0	0.1
Construction	6.1	2.6	-3.5	0.4	0.2	-0.2
Manufacturing	7.8	-2.9	-10.8	2.3	-0.7	-3.0
Wholesale trade	9.6	2.3	-7.3	0.7	0.2	-0.6
Retail trade	6.7	3.3	-3.4	0.4	0.2	-0.2
Transportation and warehousing	5.0	1.5	-3.4	0.3	0.1	-0.2
Information and cultural industries	12.4	2.9	-9.4	0.5	0.1	-0.4
Finance, insurance, and real estate	6.8	2.7	-4.1	1.2	0.5	-0.7
Professional and other business services	14.8	1.6	-13.3	0.9	0.1	-0.8
Administrative and support services	7.9	2.8	-5.1	0.2	0.1	-0.1
Arts, entertainment, and recreation	4.7	1.4	-3.3	0.0	0.0	0.0
Accommodation and food	7.6	-0.1	-7.7	0.2	0.0	-0.2
Other private services	5.8	2.0	-3.9	0.3	0.1	-0.2
Total business sector	…	…	…	7.5	1.0	-6.6
Direct contribution	…	…	…	7.6	0.9	-6.7
Reallocation	…	…	…	0.0	0.1	0.1

Source: Statistics Canada, CANSIM table 383-0026.

A number of service-producing industries also contributed significantly to the slowdown in aggregate output and labour productivity growth. These include: wholesale trade; finance, insurance, and real estate (FIRE); and professional and other business services. The services industries contributing to the decline in aggregate MFP growth include the wholesale and retail trade sectors.

Table 10

Industry labour productivity growth and industry contributions to aggregate labour productivity growth in Ontario

	Annual growth			Contribution		
	1997 to 2000	2000 to 2010	Difference	1997 to 2000	2000 to 2010	Difference
	percent	percent	percentage points	percent	percent	percentage points
Industry						
Agriculture, forestry, fishing, and hunting	9.9	1.7	-8.2	0.1	0.0	-0.1
Mining and oil and gas extraction	6.1	-7.1	-13.2	0.1	-0.1	-0.2
Utilities	3.2	-0.9	-4.1	0.1	0.0	-0.1
Construction	4.1	-0.2	-4.2	0.2	0.0	-0.3
Manufacturing	6.2	0.0	-6.2	1.8	0.0	-1.8
Wholesale trade	6.1	2.8	-3.3	0.5	0.2	-0.2
Retail trade	4.1	2.3	-1.8	0.3	0.2	-0.1
Transportation and warehousing	0.9	0.4	-0.5	0.0	0.0	0.0
Information and cultural industries	0.1	2.0	1.9	0.0	0.1	0.1
Finance, insurance, and real estate	2.6	1.0	-1.6	0.4	0.2	-0.3
Professional and other business services	3.7	0.0	-3.7	0.2	0.0	-0.2
Administrative and support services	0.8	-0.5	-1.3	0.0	0.0	0.0
Arts, entertainment, and recreation	0.1	-0.3	-0.3	0.0	0.0	0.0
Accommodation and food	1.4	0.2	-1.2	0.0	0.0	0.0
Other private services	3.8	0.3	-3.5	0.2	0.0	-0.2
Total business sector	…	…	…	3.9	0.5	-3.4
Direct contribution	…	…	…	4.1	0.6	-3.5
Reallocation	…	…	…	-0.3	-0.1	0.1

Source: Statistics Canada, CANSIM table 383-0026.

For the period from 2000 to 2010, the main contributors to aggregate output and productivity growth in Ontario were all services-producing industries. This is in sharp contrast to the period from 1997 to 2000, when manufacturing was the most important contributor to aggregate output and productivity growth in Ontario. The services industries contributing most to aggregate output and productivity growth in Ontario for the period from 2000 to 2010 include wholesale trade, retail trade, and information and culture industries. FIRE was a significant source of the output and labour productivity growth in Ontario between 2000 and 2010, but was not a source of aggregate MFP growth for that period.

Table 11

Industry multifactor productivity growth and industry contributions to aggregate multifactor productivity growth in Ontario

	Annual growth			Contribution		
	1997 to 2000	2000 to 2010	Difference	1997 to 2000	2000 to 2010	Difference
	percent	percent	percentage points	percent	percent	percentage points
Industry						
Agriculture, forestry, fishing, and hunting	6.0	1.2	-4.8	0.1	0.0	-0.1
Mining and oil and gas extraction	4.9	-7.4	-12.3	0.1	-0.1	-0.2
Utilities	1.0	-1.2	-2.2	0.0	0.0	-0.1
Construction	3.4	-0.4	-3.8	0.2	0.0	-0.2
Manufacturing	5.8	-1.2	-7.0	1.7	-0.3	-2.0
Wholesale trade	5.6	0.8	-4.7	0.4	0.1	-0.4
Retail trade	3.1	0.5	-2.6	0.2	0.0	-0.2
Transportation and warehousing	0.6	-0.6	-1.2	0.0	0.0	-0.1
Information and cultural industries	0.7	1.7	0.9	0.0	0.1	0.0
Finance, insurance, and real estate	0.0	0.1	0.1	0.0	0.0	0.0
Professional and other business services	0.7	-0.4	-1.1	0.0	0.0	-0.1
Administrative and support services	2.4	-2.2	-4.7	0.1	-0.1	-0.2
Arts, entertainment, and recreation	-0.4	-0.2	0.2	0.0	0.0	0.0
Accommodation and food	3.5	-0.2	-3.7	0.1	0.0	-0.1
Other private services	0.5	-1.7	-2.1	0.0	-0.1	-0.1
Total business sector	…	…	…	2.9	-0.6	-3.4
Direct contribution	…	…	…	3.0	-0.5	-3.5
Reallocation	…	…	…	-0.1	-0.1	0.0

Source: Statistics Canada, CANSIM table 383-0026.

5.2 Results for Quebec

Tables 12, 13, and 14 present the industry contributions to aggregate output and productivity growth of the business sector in Quebec. Real output growth in the Quebec business sector slowed by 4.6 percentage points—from 6.0% in the 1997-to-2000 period to 1.4% in the 2000-to-2010 period. Labour productivity growth slowed by 2.0 percentage points and MFP growth slowed by 1.9 percentage points between those two periods. The results with respect to the industry origins of business sector growth in Quebec were similar to those in Ontario, albeit generally not as pronounced. First, output and productivity growth decelerated in almost all industries in Quebec between 2000 and 2010. The decline occurred in both the goods-producing and services sectors. The exceptions are the information and culture and transportation industries, which experienced faster labour productivity and MFP growth between 2000 and 2010.

Second, the largest contributor to the decline in aggregate output and productivity growth between 2000 and 2010 in Quebec was the manufacturing sector. It accounted for 65% of the decline in aggregate output, labour productivity, and MFP growth in the Quebec business sector between 2000 and 2010. The contribution of the manufacturing sector to the decline in aggregate output and productivity growth in Quebec was much larger than the province's share of total value-added, which was about 25% for the period from 2000 to 2010.

Table 12

Industry output growth and industry contributions to aggregate output growth in Quebec

	Annual growth			Contribution		
	1997 to 2000	2000 to 2010	Difference	1997 to 2000	2000 to 2010	Difference
	percent	percent	percentage points	percent	percent	percentage points
Industry						
Agriculture, forestry, fishing, and hunting	5.6	1.8	-3.7	0.1	0.0	-0.1
Mining and oil and gas extraction	2.4	-2.5	-4.9	0.0	0.0	-0.1
Utilities	0.0	1.5	1.5	0.0	0.1	0.1
Construction	4.0	4.5	0.5	0.2	0.3	0.1
Manufacturing	8.4	-1.9	-10.2	2.5	-0.5	-3.0
Wholesale trade	6.1	2.5	-3.6	0.4	0.2	-0.2
Retail trade	4.9	3.4	-1.5	0.4	0.3	-0.1
Transportation and warehousing	4.8	1.6	-3.2	0.3	0.1	-0.2
Information and cultural industries	6.6	2.3	-4.3	0.3	0.1	-0.2
Finance, insurance, and real estate	4.6	2.7	-1.9	0.6	0.4	-0.3
Professional and other business services	10.1	2.8	-7.3	0.5	0.2	-0.3
Administrative and support services	10.4	2.4	-8.0	0.3	0.1	-0.2
Arts, entertainment, and recreation	6.2	0.4	-5.8	0.1	0.0	-0.1
Accommodation and food	2.5	1.8	-0.8	0.1	0.1	0.0
Other private services	3.5	1.6	-1.8	0.2	0.1	-0.1
Total business sector	…	…	…	6.0	1.4	-4.6
Direct contribution	…	…	…	6.0	1.3	-4.7
Reallocation	…	…	…	0.0	0.1	0.1

Source: Statistics Canada, CANSIM table 383-0026.

Third, a number of services industries also contributed significantly to the decline in aggregate output and labour productivity growth. These include: FIRE; and professional and other business services. The services industries contributing to the decline in aggregate MFP growth include the retail trade sector.

Table 13

Industry labour productivity growth and industry contributions to aggregate labour productivity growth in Quebec

	Annual growth			Contribution		
	1997 to 2000	2000 to 2010	Difference	1997 to 2000	2000 to 2010	Difference
	percent	percent	percentage points	percent	percent	percentage points
Industry						
Agriculture, forestry, fishing, and hunting	6.2	3.4	-2.8	0.2	0.1	-0.1
Mining and oil and gas extraction	6.6	-2.8	-9.3	0.1	0.0	-0.1
Utilities	0.5	-0.3	-0.9	0.0	0.0	0.0
Construction	2.5	0.8	-1.7	0.2	0.1	-0.1
Manufacturing	5.5	1.1	-4.3	1.6	0.3	-1.3
Wholesale trade	1.8	2.9	1.2	0.1	0.2	0.1
Retail trade	3.8	1.8	-2.0	0.3	0.1	-0.1
Transportation and warehousing	-0.4	1.8	2.2	0.0	0.1	0.1
Information and cultural industries	-3.4	0.5	3.9	-0.2	0.0	0.2
Finance, insurance, and real estate	3.0	0.4	-2.6	0.4	0.1	-0.4
Professional and other business services	2.1	0.6	-1.5	0.1	0.0	-0.1
Administrative and support services	0.6	-0.1	-0.7	0.0	0.0	0.0
Arts, entertainment, and recreation	-0.2	-1.7	-1.5	0.0	0.0	0.0
Accommodation and food	3.1	0.5	-2.6	0.1	0.0	-0.1
Other private services	0.2	0.2	0.0	0.0	0.0	0.0
Total business sector	…	…	…	2.8	0.8	-2.0
Direct contribution	…	…	…	2.9	0.9	-1.9
Reallocation	…	…	…	-0.1	-0.2	-0.1

Source: Statistics Canada, CANSIM table 383-0026.

Fourth, during the period from 2000 to 2010, the main contributors to aggregate output and labour productivity growth in Quebec were the services industries. This differs from the period from 1997 to 2000, when the goods-producing sector, primarily the manufacturing industry, was the predominant source of the growth in aggregate output and labour productivity in Quebec. While the services sector was the main contributor to aggregate labour productivity growth for the period from 2000 to 2010 in Quebec, it was not a main source of aggregate MFP growth. The gains in labour productivity in the services sector in Quebec between 2000 and 2010 were due to increases in capital intensity in that sector.

Table 14

Industry multifactor productivity growth and industry contributions to aggregate multifactor productivity growth in Quebec

	Annual growth			Contribution		
	1997 to 2000	2000 to 2010	Difference	1997 to 2000	2000 to 2010	Difference
	percent	percent	percentage points	percent	percent	percentage points
Industry						
Agriculture, forestry, fishing, and hunting	5.0	2.9	-2.1	0.1	0.1	-0.1
Mining and oil and gas extraction	2.4	-3.9	-6.3	0.0	0.0	-0.1
Utilities	2.7	0.3	-2.4	0.1	0.0	-0.1
Construction	2.0	0.5	-1.5	0.1	0.0	-0.1
Manufacturing	4.3	0.2	-4.0	1.3	0.1	-1.2
Wholesale trade	0.4	0.4	0.0	0.0	0.0	0.0
Retail trade	3.2	0.4	-2.9	0.2	0.0	-0.2
Transportation and warehousing	-1.4	-0.1	1.3	-0.1	0.0	0.1
Information and cultural industries	-3.7	2.0	5.7	-0.2	0.1	0.3
Finance, insurance, and real estate	-0.1	-0.7	-0.6	0.0	-0.1	-0.1
Professional and other business services	0.0	-0.2	-0.3	0.0	0.0	0.0
Administrative and support services	4.9	-1.2	-6.0	0.1	0.0	-0.2
Arts, entertainment, and recreation	2.5	-2.3	-4.8	0.0	0.0	-0.1
Accommodation and food	3.4	0.2	-3.2	0.1	0.0	-0.1
Other private services	-4.3	-2.5	1.9	-0.3	-0.2	0.1
Total business sector	…	…	…	1.7	-0.2	-1.9
Direct contribution	…	…	…	1.7	0.0	-1.8
Reallocation	…	…	…	0.0	-0.1	-0.1

Source: Statistics Canada, CANSIM table 383-0026.

5.3 Results for Alberta

Tables 15, 16, and 17 present industry contributions to the slowdown in aggregate output and productivity growth for Alberta between 1997 and 2010. Real output growth in the Alberta business sector slowed by 2.2 percentage points—from 4.4% in the 1997-to-2000 period to 2.2% in the 2000-to-2010 period. Labour productivity growth slowed by 1.6 percentage points and MFP growth slowed by 1.7 percentage points between those two periods. For Alberta, the decline in aggregate output growth after 2000 reflects the decline in aggregate output growth in both the goods-producing and services sectors, while the decline in aggregate labour productivity and MFP growth can be traced to the natural resources industry (or oil and gas extraction) and natural-resource-related construction activities. The mining and oil and gas extraction sector accounted for 1.5 percentage points of the 1.6 percentage point slowdown in labour productivity growth that took place in the Alberta business sector between 2000 and 2010. The construction sector contributed 0.7 percentage points to the decline. The reallocation of resources across industries towards the mining and oil and gas extraction industry also made a significant contribution to aggregate labour productivity growth between 2000 and 2010.

The goods-producing sector had negative or slower output and productivity growth between 2000 and 2010 in Alberta. The main sources of output, labour productivity, and MFP growth were the services industries. A number of services sectors experienced rapid output and productivity growth in Alberta between 2000 and 2010, including retail trade and information and culture.

Table 15

Industry output growth and industry contributions to aggregate output growth in Alberta

	Annual growth			Contribution		
	1997 to 2000	2000 to 2010	Difference	1997 to 2000	2000 to 2010	Difference
	percent	percent	percentage points	percent	percent	percentage points
Industry						
Agriculture, forestry, fishing, and hunting	6.5	1.3	-5.2	0.2	0.0	-0.2
Mining and oil and gas extraction	-0.2	0.2	0.4	-0.1	0.1	0.1
Utilities	0.6	1.5	0.9	0.0	0.0	0.0
Construction	9.8	2.7	-7.1	0.8	0.3	-0.5
Manufacturing	5.8	0.3	-5.5	0.7	0.0	-0.7
Wholesale trade	3.3	3.9	0.6	0.2	0.2	0.0
Retail trade	7.0	5.6	-1.4	0.3	0.3	-0.1
Transportation and warehousing	5.1	2.8	-2.2	0.3	0.1	-0.2
Information and cultural industries	9.9	4.5	-5.4	0.3	0.1	-0.2
Finance, insurance, and real estate	3.7	4.7	1.0	0.4	0.4	0.0
Professional and other business services	8.7	5.1	-3.6	0.4	0.3	-0.2
Administrative and support services	7.5	5.1	-2.4	0.1	0.1	0.0
Arts, entertainment, and recreation	-1.7	2.5	4.2	0.0	0.0	0.0
Accommodation and food	4.2	1.8	-2.4	0.1	0.0	-0.1
Other private services	6.2	4.1	-2.1	0.3	0.2	-0.1
Total business sector	…	…	…	4.4	2.2	-2.2
Direct contribution	…	…	…	4.1	2.1	-2.0
Reallocation	…	…	…	0.2	0.1	-0.1

Source: Statistics Canada, CANSIM table 383-0026.

Table 16

Industry labour productivity growth and industry contributions to aggregate labour productivity growth in Alberta

	Annual growth			Contribution		
	1997 to 2000	2000 to 2010	Difference	1997 to 2000	2000 to 2010	Difference
	percent	percent	percentage points	percent	percent	percentage points
Industry						
Agriculture, forestry, fishing, and hunting	14.5	7.1	-7.4	0.5	0.2	-0.3
Mining and oil and gas extraction	0.2	-3.9	-4.1	0.1	-1.4	-1.5
Utilities	1.5	-4.7	-6.2	0.0	-0.1	-0.1
Construction	5.2	-2.3	-7.4	0.4	-0.2	-0.7
Manufacturing	1.6	0.5	-1.1	0.2	0.1	-0.1
Wholesale trade	1.7	2.7	0.9	0.1	0.1	0.0
Retail trade	4.3	3.1	-1.2	0.2	0.1	-0.1
Transportation and warehousing	3.4	2.0	-1.4	0.2	0.1	-0.1
Information and cultural industries	3.3	4.7	1.4	0.1	0.1	0.0
Finance, insurance, and real estate	0.3	1.4	1.1	0.0	0.1	0.1
Professional and other business services	4.7	1.6	-3.1	0.2	0.1	-0.1
Administrative and support services	-0.2	1.6	1.8	0.0	0.0	0.0
Arts, entertainment, and recreation	-6.5	-0.8	5.7	0.0	0.0	0.0
Accommodation and food	-0.8	2.0	2.8	0.0	0.0	0.1
Other private services	3.6	2.7	-0.9	0.1	0.1	0.0
Total business sector	…	…	…	1.8	0.2	-1.6
Direct contribution	…	…	…	2.1	-0.6	-2.8
Reallocation	…	…	…	-0.3	0.8	1.1

Source: Statistics Canada, CANSIM table 383-0026.

Table 17

Industry multifactor productivity growth and industry contributions to aggregate multifactor productivity growth in Alberta

	Annual growth			Contribution		
	1997 to 2000	2000 to 2010	Difference	1997 to 2000	2000 to 2010	Difference
	percent	percent	percentage points	percent	percent	percentage points
Industry						
Agriculture, forestry, fishing, and hunting	7.9	3.0	-4.9	0.2	0.1	-0.2
Mining and oil and gas extraction	-4.2	-6.7	-2.4	-1.2	-2.4	-1.2
Utilities	-3.7	-4.3	-0.6	-0.1	-0.1	0.0
Construction	6.4	-3.8	-10.2	0.5	-0.4	-0.9
Manufacturing	-0.6	-0.5	0.1	-0.1	0.0	0.0
Wholesale trade	0.5	0.2	-0.2	0.0	0.0	0.0
Retail trade	4.6	2.2	-2.4	0.2	0.1	-0.1
Transportation and warehousing	-2.6	0.3	2.8	-0.2	0.0	0.2
Information and cultural industries	-0.6	2.9	3.5	0.0	0.1	0.1
Finance, insurance, and real estate	-3.3	0.3	3.6	-0.3	0.0	0.3
Professional and other business services	3.1	-0.5	-3.7	0.2	0.0	-0.2
Administrative and support services	2.4	-0.5	-2.9	0.0	0.0	-0.1
Arts, entertainment, and recreation	-9.7	-1.4	8.3	-0.1	0.0	0.0
Accommodation and food	0.2	0.8	0.5	0.0	0.0	0.0
Other private services	-2.4	-0.5	1.9	-0.1	0.0	0.1
Total business sector	…	…	…	-0.9	-2.6	-1.7
Direct contribution	…	…	…	-0.8	-2.7	-1.8
Reallocation	…	…	…	-0.1	0.0	0.1

Source: Statistics Canada, CANSIM table 383-0026.

5.4 A summary of results for all provinces

This section presents a summary of the results for the industry contributions to aggregate output and productivity growth for all ten provinces. The industries are aggregated to the goods-producing and services sectors. Results are shown in Tables 18, 19, and 20.

Table 18
The industry origins of annual aggregate output growth by province

	Goods	Services	Direct contribution	Reallocation	Total business sector
			percent		
2000 to 2010					
Newfoundland and Labrador	3.6	1.0	4.6	-1.3	3.3
Prince Edward Island	0.1	1.5	1.6	0.0	1.6
Nova Scotia	0.0	1.4	1.4	0.1	1.6
New Brunswick	0.2	1.3	1.6	0.1	1.6
Quebec	-0.1	1.4	1.3	0.1	1.4
Ontario	-0.6	1.5	0.9	0.1	1.0
Manitoba	0.5	1.4	2.0	0.0	2.0
Saskatchewan	0.2	1.1	1.3	0.1	1.4
Alberta	0.4	1.7	2.1	0.1	2.2
British Columbia	0.4	1.6	2.1	0.0	2.1
			percentage points		
2000 to 2010, less 1997 to 2000					
Newfoundland and Labrador	-5.0	-1.1	-6.0	0.7	-5.4
Prince Edward Island	-2.9	-0.2	-3.0	0.3	-2.8
Nova Scotia	-2.5	-1.9	-4.4	0.2	-4.2
New Brunswick	-2.4	-1.6	-4.0	0.2	-3.8
Quebec	-3.0	-1.7	-4.7	0.1	-4.6
Ontario	-3.3	-3.4	-6.7	0.1	-6.6
Manitoba	-0.3	-1.7	-1.9	-0.1	-2.0
Saskatchewan	-0.6	-0.5	-1.1	-0.1	-1.2
Alberta	-1.3	-0.7	-2.0	-0.1	-2.2
British Columbia	-0.8	-0.2	-1.0	0.0	-1.0

Source: Statistics Canada, CANSIM table 383-0026.

Table 19
The industry origins of annual aggregate labour productivity growth by province

	Goods	Services	Direct contribution	Reallocation	Total business sector
			percent		
2000 to 2010					
Newfoundland and Labrador	3.1	0.9	4.0	-0.7	3.3
Prince Edward Island	0.3	1.3	1.6	-0.1	1.5
Nova Scotia	0.1	0.9	1.0	0.1	1.0
New Brunswick	0.5	1.3	1.8	0.0	1.8
Quebec	0.4	0.6	0.9	-0.2	0.8
Ontario	-0.1	0.7	0.6	-0.1	0.5
Manitoba	0.6	1.0	1.5	-0.1	1.4
Saskatchewan	-1.1	0.9	-0.2	1.5	1.3
Alberta	-1.5	0.9	-0.6	0.8	0.2
British Columbia	0.3	0.9	1.2	-0.2	0.9
			percentage points		
2000 to 2010, less 1997 to 2000					
Newfoundland and Labrador	-3.2	-0.1	-3.3	1.0	-2.4
Prince Edward Island	-1.0	1.1	0.1	-0.7	-0.7
Nova Scotia	-2.1	-1.2	-3.3	1.0	-2.3
New Brunswick	-0.8	-0.6	-1.4	0.6	-0.8
Quebec	-1.7	-0.3	-1.9	-0.1	-2.0
Ontario	-2.5	-1.1	-3.5	0.1	-3.4
Manitoba	-0.1	-1.2	-1.3	-0.6	-1.9
Saskatchewan	-2.4	-1.0	-3.4	1.5	-1.9
Alberta	-2.7	-0.1	-2.8	1.1	-1.6
British Columbia	-1.1	0.2	-0.9	-0.4	-1.2

Source: Statistics Canada, CANSIM table 383-0026.

Table 20
The industry origins of annual aggregate multifactor productivity growth by province

	Goods	Services	Direct contribution	Reallocation	Total business sector
			percent		
2000 to 2010					
Newfoundland and Labrador	3.6	0.2	3.8	-1.6	2.2
Prince Edward Island	-0.4	0.6	0.2	-0.1	0.1
Nova Scotia	-0.1	0.3	0.2	0.1	0.3
New Brunswick	-0.1	0.3	0.2	-0.1	0.1
Quebec	0.1	-0.2	0.0	-0.1	-0.2
Ontario	-0.4	0.0	-0.5	-0.1	-0.6
Manitoba	0.1	0.4	0.5	-0.1	0.3
Saskatchewan	-2.4	0.4	-1.9	0.2	-1.8
Alberta	-2.8	0.2	-2.7	0.0	-2.6
British Columbia	-0.4	0.1	-0.3	-0.2	-0.6
			percentage points		
2000 to 2010, less 1997 to 2000					
Newfoundland and Labrador	-3.7	0.3	-3.4	0.2	-3.2
Prince Edward Island	-1.9	1.8	-0.1	0.3	0.2
Nova Scotia	-2.4	-0.2	-2.6	0.6	-2.0
New Brunswick	-1.2	-0.2	-1.3	0.0	-1.3
Quebec	-1.6	-0.2	-1.8	-0.1	-1.9
Ontario	-2.5	-1.0	-3.5	0.0	-3.4
Manitoba	-0.1	-0.2	-0.3	-0.2	-0.5
Saskatchewan	-2.5	-0.2	-2.7	0.1	-2.6
Alberta	-2.2	0.4	-1.8	0.1	-1.7
British Columbia	-1.8	0.3	-1.5	0.0	-1.5

Source: Statistics Canada, CANSIM table 383-0026.

The goods-producing sector was largely responsible for the deceleration in aggregate output and productivity growth between 2000 and 2010 in all provinces, except Manitoba. In Manitoba, the decline in aggregate output growth was due mainly to the slower output growth in the services industries.

While the goods-producing sector was largely responsible for the decline in aggregate output and productivity growth in almost all provinces, the exact industries within the goods-producing sector that were mostly responsible differ across provinces. For central Canada, the manufacturing sector was the most important contributor to the decline in aggregate output and productivity growth. For Alberta, the natural resources industry and natural-resource-related construction accounted for most of the decline in aggregate productivity growth. For British Columbia, it was the mining and oil and gas extraction sector and the manufacturing sector. For Newfoundland and Labrador, Nova Scotia, and Saskatchewan, it was the mining and oil and gas extraction sector. For Prince Edward Island and New Brunswick, it was the manufacturing and construction industries.

As a result of a large deceleration in output and productivity growth in the goods-producing industries between 2000 and 2010, the services sector became the main driver of aggregate output and productivity growth during that period in all provinces, except Newfoundland and Labrador. For Newfoundland and Labrador, the main source of aggregate output and productivity growth was the mining and oil and gas extraction sector.

The variation in the contributions of the services sector to aggregate output and productivity growth across provinces is much less than the cross-province variations in the contributions of the goods-

producing sector to overall growth. The difference in aggregate output and productivity growth among provinces is accounted for largely by the difference in output and productivity growth in the goods-producing sector among provinces. The contribution of the services sector to aggregate output and productivity growth is similar across provinces. The *R-squared* from the cross-province regression of aggregate labour productivity growth on the contribution of the goods-producing sector to labour productivity growth in the period from 2000 to 2010 is 0.7. This means that about 70% of cross-provincial differences in aggregate labour productivity growth are accounted for by the difference in the goods-producing sector across provinces.

The difference between the growth in aggregate output and productivity and the sum of industry contributions was due to the effect of reallocation and restructuring. Reallocation had a large effect on aggregate labour productivity growth over the period from 2000 to 2010 in the three resource-rich provinces: Newfoundland and Labrador, Saskatchewan, and Alberta. The effect of reallocation on aggregate labour productivity growth was negative in Newfoundland and Labrador for the period from 2000 to 2010, reflecting the reallocation of labour away from the mining and oil and gas extraction industry during that period. The growth in hours worked in mining and oil and gas extraction in Newfoundland and Labrador was slower than that in the total business sector for the period from 2000 to 2010 (1.7% versus 3.0% per year). The effect of reallocation on aggregate labour productivity growth in Alberta and Saskatchewan was positive for the period from 2000 to 2010 as a result of the reallocation of labour towards the mining and oil and gas extraction sector, which had a relatively higher level of labour productivity.

6 Conclusion

This paper provides a provincial perspective on the deceleration in productivity and economic growth that took place in the total business sector in Canada between 2000 and 2010 relative to the late 1990s. The paper uses the most recent provincial multifactor productivity database.

The decline in aggregate output and productivity growth between 2000 and 2010 can primarily be traced to two industries: manufacturing; and mining and oil and gas extraction. The manufacturing sector underwent major changes as a result of several factors including exchange rate movements, increased global competition and slower growth in Canada's main export market: the United States. Those changes led to slower export growth and slower output and productivity growth for the period from 2000 to 2010. The mining and oil and gas extraction sector saw the expansion of both conventional and non-conventional oil and gas extraction activities with higher unit costs and lower productivity growth.

Aggregate output and productivity growth slowed in almost all provinces between 2000 and 2010. In general, the decline in aggregate output and labour productivity growth was larger in central Canada and the Atlantic Provinces than in western Canada. The decline in output and productivity growth was largest in Ontario. From 1997 to 2000, Ontario was the main source of growth in aggregate output and productivity in Canada. Between 2000 and 2010, Ontario's aggregate output and productivity growth was among the slowest in the ten provinces.

The goods-producing sector was largely responsible for the slowdown in aggregate output and productivity growth between 2000 and 2010 in almost all provinces. The exact industries within the goods-producing sector that were mostly responsible differ across provinces. For central Canada, the manufacturing sector was the most important contributor to the deceleration in aggregate output and productivity growth. For Alberta, the natural resources industry and natural-resource-related construction accounted for most of the decline in aggregate productivity growth. For British Columbia, it was the mining and oil and gas extraction sector and the manufacturing sector. For Newfoundland and Labrador, Nova Scotia, and Saskatchewan, it was the mining and oil and gas extraction sector. For Prince Edward Island and New Brunswick, it was the manufacturing and construction industries.

Concomitant with the large deceleration in output and productivity growth in the goods-producing industries between 2000 and 2010, the services-producing sector became the main source of aggregate output and productivity growth between 2000 and 2010 in all provinces, except Newfoundland and Labrador.

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