



Catalogue no. 11-624-MIE — No. 011

ISSN: 1708-0169

ISBN: 0-662-39550-6

Analytical Paper

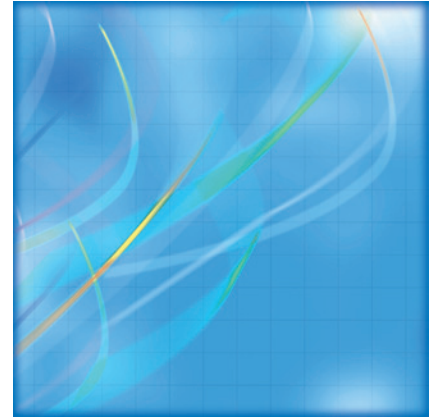
Insights on the Canadian Economy

Interprovincial Differences in GDP per Capita, Labour Productivity and Work Intensity: 1990-2003

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February 2005

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Published by authority of the Minister responsible for Statistics Canada

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Aussi disponible en français

Abstract

This paper compares output per person across Canadian provinces—using nominal or current dollar GDP per capita as the metric over the period 1990 to 2003. Differences in GDP per capita can be attributed to differences in the underlying efficiency of provincial economies. This is measured by labour productivity or GDP per hours worked. Differences also arise from the amount of human resources that are employed, as measured by work intensity or hours worked per capita. This paper examines the extent to which differences in GDP per capita can be attributed to each of these two factors.

Introduction

The success of an economy is often measured using Gross Domestic Product (GDP) per capita—a measure subject to a number of well-known criticisms as a welfare indicator, but a meaningful indicator nonetheless of an economy’s ability to produce marketed goods and services. GDP captures the money value of goods and services that are available to the nation from economic activity. When divided by the population of a region, it provides a measure of the amount of goods and services produced per person in the region.

Frequently, GDP per capita has been used to measure differences across countries in the value of goods and services produced. Recently, expansion of the provincial economic accounts has made it possible to do the same across Canadian provinces.¹ This paper compares the relative size of the provincial economies—using nominal or current dollar GDP per capita as the metric.

Differences in GDP per capita can be attributed to differences in the underlying efficiency of provincial economies, as measured by labour productivity, and in the amount of resources that are employed, as measured by hours worked per capita or what will be referred to here as work intensity. This paper examines the extent to which differences in GDP per capita can be attributed to each of these two factors.

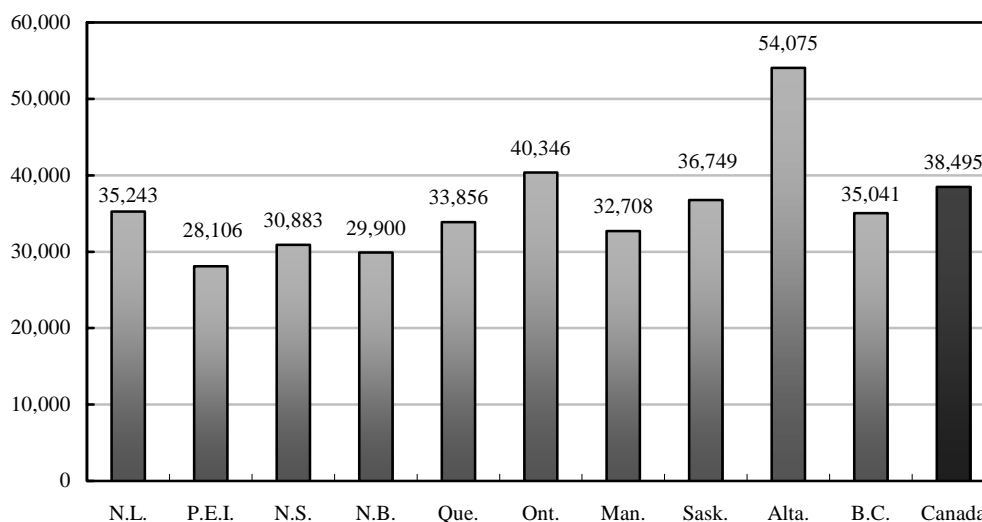
The paper examines relative GDP per capita at the provincial level from 1990 to 2003. It divides this thirteen-year period into two—from 1990-1997 and from 1997-2003. The first period was marked by a major recession and a restructuring of the economy that resulted in part from the implementation of the free trade agreements with the U.S. and Mexico. In contrast, the second period was one of relatively strong economic growth and a revival of productivity growth.

1. For other papers in this series, see Baldwin, Maynard, Sabourin and Zietsma (2001a,b) and Baldwin, Brown, Maynard, and Zietsma (2004).

Nominal GDP per capita in 2003

As of 2003, GDP per capita in current dollars varied considerably across Canadian provinces (Figure 1). Nominal GDP per capita in Ontario and Alberta (\$40,000 and \$54,000 respectively) outpaced that of other provinces.² The remainder of Canadian provinces reported levels of GDP per capita in 2003 that were lower than the national average (\$38,000). Prince Edward Island had the lowest GDP per capita (\$28,000), which was a little more than half that of Alberta (\$54,000). However, with these two outlying provinces removed, interprovincial differences were much smaller.

Figure 1. Nominal GDP per capita of Canadian provinces, 2003 (dollars)



The level of GDP per capita produced by an economy is a function of several different factors. First, it will depend upon the proportion of the population that can be gainfully employed. This proportion is determined by demographic conditions. In some economies, the total population will have a large percentage of children who are not members of the labour force. *Ceteris paribus*, this means there will be less produced per capita. Demographic shifts can affect GDP per capita by increasing or decreasing the size of the working age population.

The second factor that will determine GDP per capita is the employment rate—the percentage of the potential working-age population that is employed. All else being held constant, the larger is this ratio, the higher will be GDP. The employment rate will capture the number who choose to work, but will also partly reflect the ability of workers to find employment.

2. It is worth noting that interprovincial differences in GDP per capita are not the same as differences in personal income or consumption per capita—two other measures that are sometimes used to measure well-being. This is because corporate profits, a component of GDP, are not necessarily spent in the province of origin. Moreover, GDP does not take into account government transfers, which are an important source of income for people living in some provinces. For example, using GDP per capita produces a 50% gap between the highest performing and the least performing province. This figure drops to 30% when personal income is used instead.

The third factor affecting GDP per capita is the intensity of work, or how many hours people are working. *Ceteris paribus*, the more hours worked the greater will be the output. The hours worked per employee depend both on labour market conditions, the desire for work time, and institutional constraints.

Finally, GDP per capita levels will depend upon productivity. When GDP per hours worked is higher, per capita GDP itself will be higher, all else being held equal.

Together, these factors—how many people in the total population are available for work, the percentage of these who find employment, the hours worked per employed person, and the productivity of the hours worked—can be combined mathematically using an identity to relate each and all of these factors to GDP per capita in a region. This identity consists of components representing labour productivity, the intensity of work effort, the employment rate, and the share of the population in the labour force. These various components are affected by technology, labour-market conditions and demographics. Use of this identity is helpful in that it allows us to concentrate on which of these factors have contributed to differences in GDP per capita across provinces.³

$$\frac{GDP}{Pop} \equiv \frac{GDP}{Hours} * \frac{Hours}{Employment} * \frac{Employment}{Pop^{15+}} * \frac{Pop^{15+}}{Pop} \quad (1)$$

where:

- GDP = Gross domestic product (overall economy)
- Hours = Total hours worked (overall economy)
- Employment = Number of people employed (measured here by jobs)
- Pop15+ = Working age population (15 years and over)⁴
- Pop = Total population

Each of the four terms of the GDP decomposition captures the contribution of different factors to the overall level of GDP per capita. The first term on the right hand side of the equation measures the contribution made by labour productivity. The second, third and fourth terms together capture differences in hours worked per capita—or what might be broadly defined as work intensity. The second term on the right hand side measures effort (how hard the employed work, measured in terms of hours per employee).⁵ The third term is a type of participation rate—the number employed relative to the working age population (those 15 and over). The fourth term is referred to here as the demographic component and measures the potential workforce, or the working-age population available from a particular population. Provinces with more children will have a lower potential work force at a point in time.

3. For an application to Canada/U.S. comparisons, see Wells, S., J. R. Baldwin, and J.P. Maynard. (2000) “Productivity Growth in Canada and the United States.” *Isuma*. Vol. 1 (Spring 2000), Ottawa Policy Research Institute.

4. Results vary marginally when population aged 15+ is used versus using population aged 15-64.

5. Differences in labour productivity reflect, in turn, differences in capital intensity among other factors. Labour productivity level is usually higher in provinces where the industrial structure is very capital intensive.

The second, third, and fourth terms can be combined to provide an aggregate term (hours worked per capita) that summarizes the ability and desire of the population to work and the success of the economy in providing jobs. This term will vary across provinces because of variations in demography and the demand for labour. The latter is affected by the robustness of provincial economies, differences in the seasonal nature of industries in each province, and/or conscious decisions on the part of individuals to work fewer hours for reasons of personal choice (relating to differences in the desire to take holidays, retirement, or child rearing).

Our purpose is to study how the various factors that contribute to differences in GDP per capita vary across provinces. To this end, we examine differences in labour productivity, a combination of the second and third terms—hours worked per person aged 15+ and the fourth term (the demographic factor).

Part of the observed differences in GDP per capita in current dollars can be explained by the differences in work intensity that arise from the combined differences in hours worked per employee and the number of employees per member of the population aged 15 and over. For example, Alberta, which possessed the highest GDP per capita in the year 2003, also displays the highest number of hours worked per person of 15 years of age and over (see Figure 2). In 2003, the population 15 and over in Alberta devoted 1,259 hours per year to work. This represents 151 hours more than Ontario. In contrast, the Atlantic Provinces that generally rank among the lowest in terms of GDP per capita levels are also the provinces where the working-age population devotes less than the national average to working time.⁶

While there are substantial differences across provinces in the hours worked per person aged 15 and over, there is less difference in terms of the demographic component (population over 15 relative to the total population), as Figure 3 demonstrates. The Canadian average is 0.82 and values for each of the provinces are grouped closely around this mean. Saskatchewan, Alberta and Manitoba are lowest at around 0.80, while Newfoundland and Labrador is highest at 0.84.

Most of the interprovincial differences in the intensity of work effort (hours worked per capita) comes from the employment ratios (employment to population aged 15 and over—a proxy for the potential labour force) rather than from the intensity of hours worked (hours worked per employee) or from the demographic component—the ratio of the population of working age (15 and over) divided by total population (see Appendix B, Table F).

The pattern of interprovincial differences in work intensity (hours worked per capita) determines whether interprovincial differences in labour productivity are larger or smaller than differences in GDP per capita. Provinces that have relatively high productivity and relatively more hours worked per capita will have higher GDP per capita. On the other hand, high labour productivity may be offset by relatively lower work intensity to produce a relatively low GDP per capita.

6. The components for each of the terms in equation 1 are presented in Appendix B, Tables A, B, and C.

Figure 2. Hours worked per person aged 15 years and over: 2003

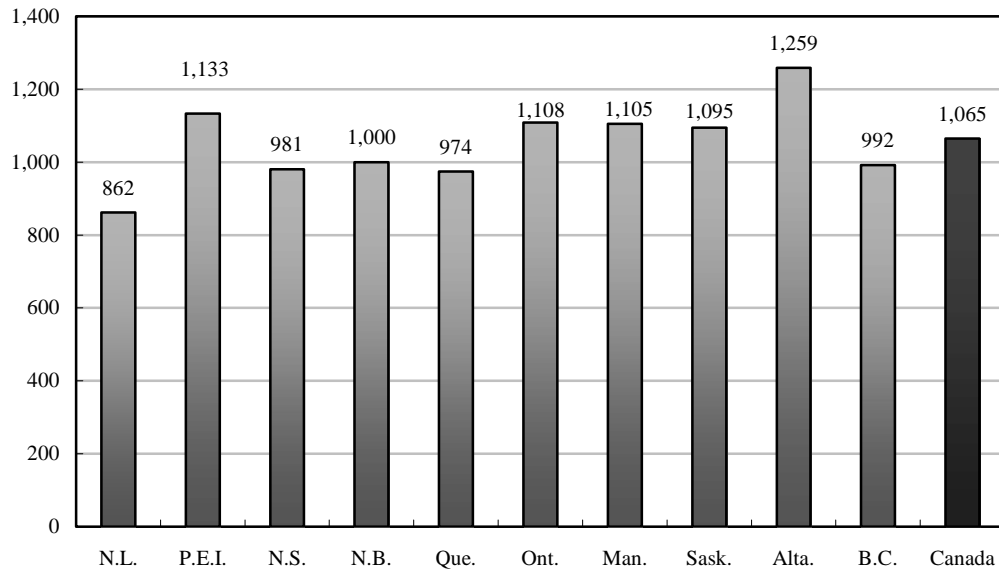


Figure 3. Ratio of number of persons aged 15 years and over to total population: 2003

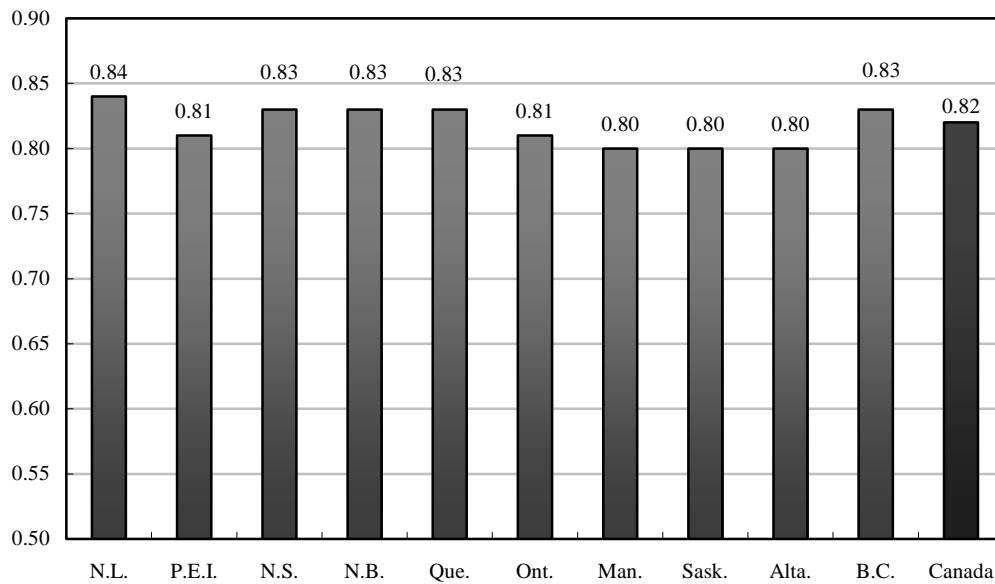
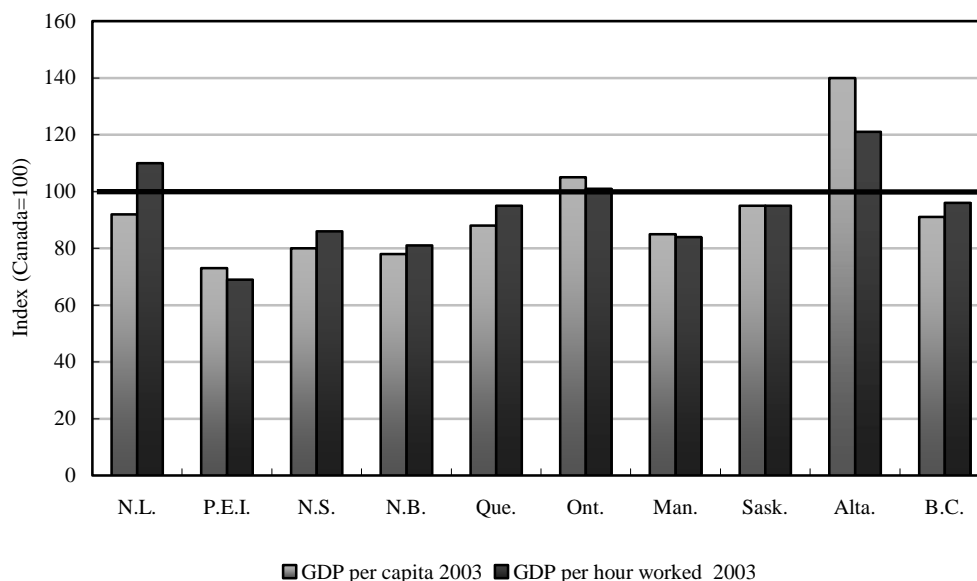


Figure 4. Interprovincial variations in GDP per capita and labour productivity, 2003 (Canada=100)



To demonstrate how the two factors interact, we plot the provincial value of GDP per capita and GDP per hours worked in Figure 4, where these values are all calculated relative to the national average (i.e., Canada=100).⁷ Where the value of relative GDP per capita is higher than the value of relative labour productivity, the work intensity is also greater than the national average.

Alberta’s GDP per capita is considerably higher than its relative labour productivity because its work intensity is also greater than the national average. Therefore, both labour productivity and work intensity contribute to Alberta’s superior performance. Several other provinces—P.E.I., Ontario and Manitoba—also have their relative GDP per capita enhanced by their work intensity.

In contrast to Alberta, Newfoundland and Labrador has a GDP per capita that is relatively smaller than its labour productivity—because its work intensity is much smaller than the national average. The same occurs for Nova Scotia, New Brunswick, Quebec, and British Columbia. The greatest difference is found in Newfoundland and Labrador.

In 2003, it is generally more common for labour productivity to have less variation around the national average than GDP per capita. Differences in work intensity then exacerbate rather than alleviate differences in GDP per capita across provinces. An example of this is provided by a comparison of Quebec and Alberta. In 2003, GDP per hours worked for Alberta is 121% of the national average, while in Quebec it is 95% for a difference of 26 percentage points. But hours worked per member of the provincial population 15+ is 118% of the national average in Alberta, while it is only 91% of the national average in Quebec (see Appendix B, Table F). As a result, the 26 percentage point difference in GDP per hours worked (a proxy for productivity) is translated into a 52 percentage point difference in GDP per capita.

7. The components for each term in equation 1 calculated relative to the Canadian average are presented in Appendix Tables D, E, and F.

It should be noted that the differences in labour productivity plotted here reflect a number of factors—differences in the efficiency with which labour is transformed into goods and services, differences in prices, and finally, differences in industrial structure across provinces.

Differences exist in the prices of goods and services across provinces. Létourneau (1992) develops an intercity price index for consumption that takes on a value of 105.8 for Toronto in 1988 but only 96.8 in Halifax.⁸ To compare ‘real’ GDP per capita across provinces or real labour productivity, an adjustment using purchasing power prices (PPPs) is needed in order to take into account differences in the cost of living. At present, Statistics Canada does not produce provincial PPPs.

Provincial differences in GDP per capita also stem from differences in the industrial structure of the economies of provinces. Some provinces support industries that have very high labour productivity. In general, labour productivity levels are higher in provinces where the industrial structures are capital intensive. For example, the oil and gas extraction sector, a dominant industry in Alberta’s economy, is capital intensive and explains, in part, Alberta’s leading position in terms of GDP per capita. Baldwin *et al.* (2001a,b) examine the extent to which differences in industry structure account for the differences observed in provincial labour productivity.

Changes in nominal GDP per capita from 1990 to 2003

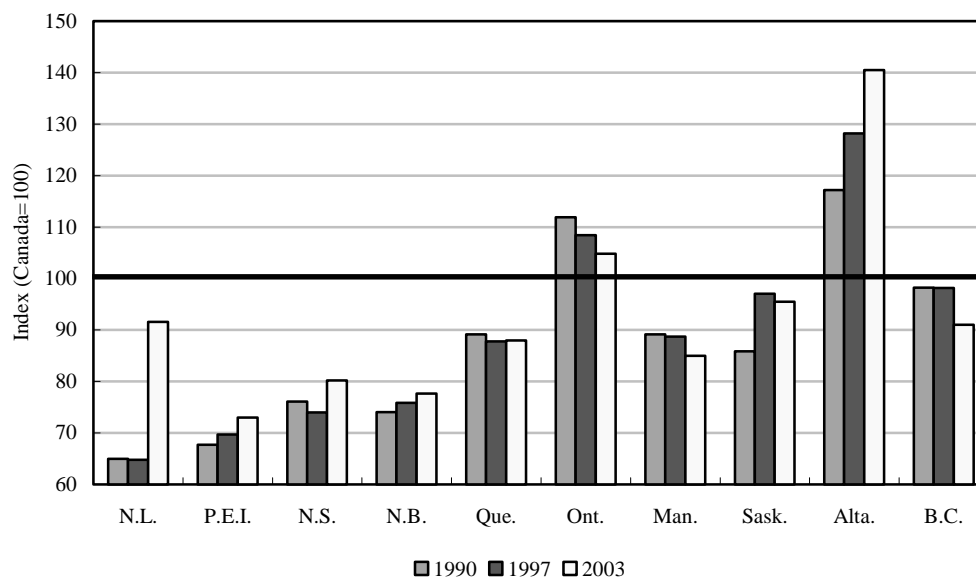
Since 1990, there have been changes in the relative position of the Canadian provinces. In Figure 5, we plot the nominal value of GDP per capita in each province in 1990, 1997, and 2003 relative to the Canadian average for that same year (Canada=100). In Figure 5, an increase in the height of a bar indicates that the province has moved up relative to the national average. A decrease indicates that it has fallen behind.⁹

The eastern provinces have made headway in decreasing their gap in GDP per capita with the national average. Newfoundland and Labrador saw its GDP per capita increase from 65% of the national average in 1990 to 92% in 2003. Nova Scotia, New Brunswick and Prince Edward Island also experienced increases, but they involved smaller percentage point gains. In the West, Manitoba and British Columbia experienced losses that pulled them further below the national average, with British Columbia falling from around parity in 1990 to 9 percentage points below the average by 2003. Ontario descended from being 12 percentage points above the average to only 5 percentage points above in 2003. In contrast, both Alberta and Saskatchewan moved up. In Saskatchewan’s case, GDP per capita moved from 86% to 95% of the average. In Alberta’s case, GDP per capita moved from 117% to 140% of the average.

8. See Létourneau (1992).

9. Appendix B, tables A, B, and C contain the values of GDP per capita and GDP per hours worked for 1990, 1997, and 2003. Appendix B, tables D, E and F present the value for each province indexed to the national average.

Figure 5. GDP per capita by province relative to the National average: 1990, 1997, and 2003



The changes in GDP per capita were generated both by changes in relative productivity (GDP per hours worked) and in changes in work intensity. These changes are presented in Appendix A.

Measures of GDP per capita are sometimes confused with measures of productivity. As the previous section has shown, they are related but they sometimes move in different directions. It is true that in some provinces productivity change was the primary driver of relative changes in GDP per capita. This occurred in Saskatchewan (upward) and Manitoba (downward). But there were some provinces where the primary driver of movements in relative GDP per capita was not productivity but labour market conditions. In New Brunswick and Prince Edward Island, labour conditions drove up relative GDP per capita. Quebec experienced a decline in relative GDP per capita not because of a long-run change in relative productivity but because of a decline in relative hours worked per capita.

In most provinces, changes in labour productivity and work intensity reinforced one another. For example, labour productivity and hours worked per capita both increased towards the national average in Newfoundland and Labrador, in Nova Scotia, and in Saskatchewan—all provinces where GDP per capita crept up toward the national average. Alberta, which experienced an increase in relative GDP per capita, also saw both labour productivity and hours worked per capita increase jointly. In Ontario and British Columbia, both labour productivity and hours worked per capita decreased in relative terms over the period and both contributed to the decline in the relative GDP per capita of these provinces. All of this indicates that work intensity and the labour market environment can reinforce changes in productivity. GDP per capita changes are, therefore, generally associated with similar changes in labour productivity but are not completely explained by labour productivity alone. More importantly, changes in GDP per capita are sometimes larger than changes in labour productivity when changes in work intensity reinforce the changes in labour productivity.

Conclusions

Measures of GDP per capita differ substantially across Canada—though interprovincial differences have been generally reduced since 1990. While Alberta has pulled away from the national average, the other provinces have converged towards it.

A part of the interprovincial differences in GDP per capita results from differences in the amount of output produced per hour worked—a measure of labour productivity. A part of the difference is the result of differences in work intensity—the amount of hours worked per capita. And the impact of each tends to reinforce one another. Provinces with lower labour productivity also tend to have lower work intensity. Alberta has the highest labour productivity and also the highest work intensity. Nova Scotia, on the other hand, is characterized by a lower than average labour productivity and a lower than national average work intensity that pulls its relative GDP per capita even further below the national average.

Changes in relative labour productivity since 1990 have generally also been reinforced by changes in work intensity. Provinces that experienced an increase (decrease) in their labour productivity also generally experienced an increase (decrease) in their work intensity. For instance, Newfoundland and Labrador increased its relative labour productivity from 89% of the national average to 110% of the national average, while at the same time increasing hours worked per pop15+ from 75% of the national average to 81% of the national average.

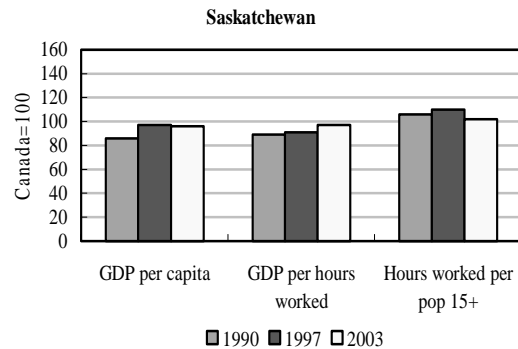
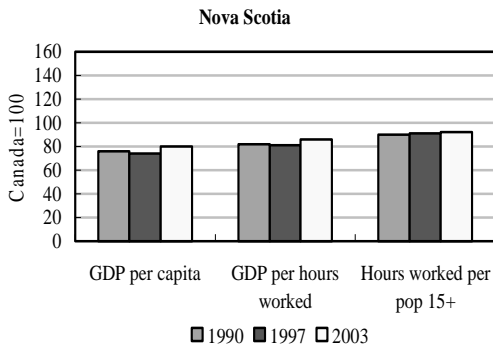
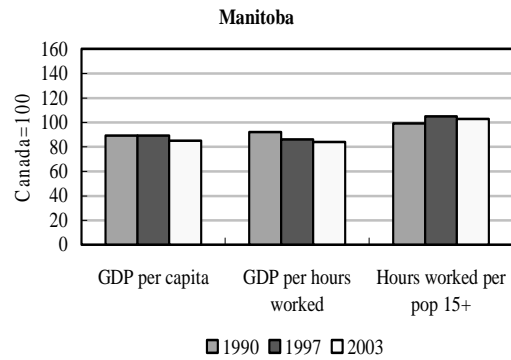
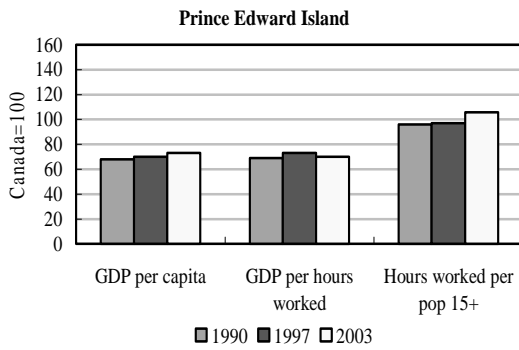
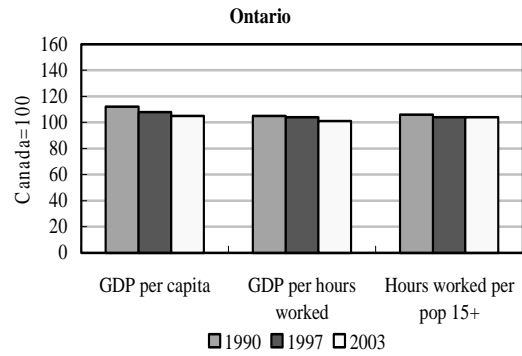
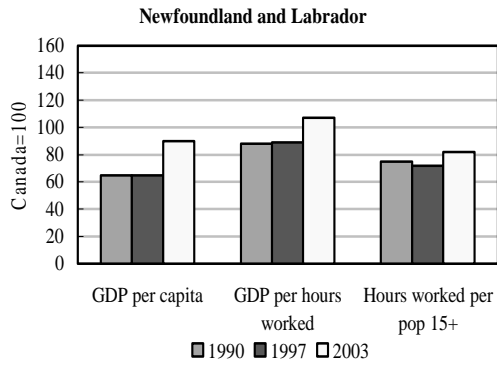
While labour productivity and work intensity are related, these findings suggest that caution should be used when employing GDP per capita measures interchangeably with GDP per hour figures. Newfoundland and Labrador may have lower GDP per capita than the national average but it does not have a lower labour productivity. Similarly, Quebec's GDP per capita may be only 88% of the national average—but its labour productivity is only slightly behind the national average at 95% in 2003. While self evident from the data contained herein, relative GDP per capita reflects both relative labour productivity and relative work effort and not all users of the data are careful to draw this distinction.

Labour productivity is of interest since it captures the efficiency with which intensity of work effort is transformed into output. This will depend upon technology, capital intensity, organization, scale economies and the skill of the labour force. But equally important is the economic environment that determines the amount of intensity of work effort that the population of a region devotes to economic activity.

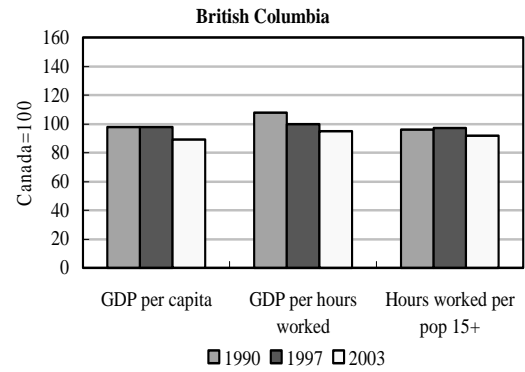
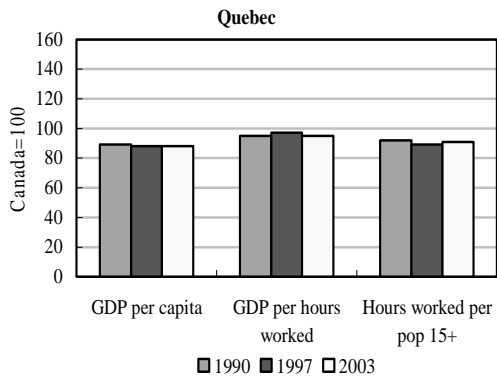
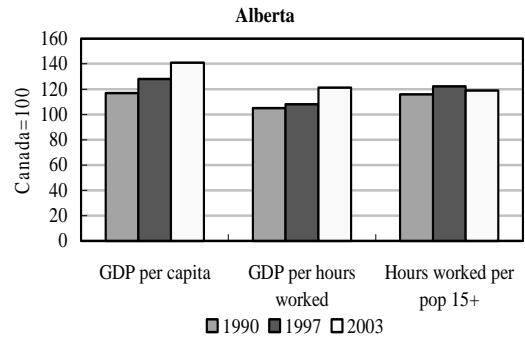
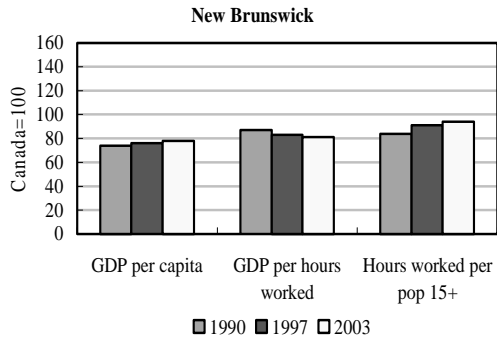
The economic environment is affected by macro conditions related to the state of the economy, to legislation that affects the length of the work week and the extent of holidays, to tax regimes, to programs that encourage activities that do not contribute to output (subsidies that encourage seasonal activities), and to desires by the population for recreation or retirement time. The data provided here suggest that the overall economic environment that affects differences in work effort sometimes provides an important part of the explanation for the deviation of the GDP per capita in a particular province from the national average.

Appendix A Figures

Provincial experience



Provincial experience



Appendix B: Tables

Table A. Nominal value of GDP per capita, labour productivity and labour-market related variables, 1990

Province	GDP per Capita (\$)	GDP per hours worked	Hours worked per Pop 15+	Hours worked per job	Jobs per Pop 15+	Pop 15+ to Pop
N.L.	15,949	25.6	808.1	1,840.5	0.44	0.77
P.E.I.	16,616	20.8	1,034.3	1,826.0	0.57	0.77
N.S.	18,681	24.2	969.6	1,771.0	0.55	0.80
N.B.	18,184	25.5	904.4	1,778.1	0.51	0.79
Que.	21,892	27.6	987.6	1,726.1	0.57	0.80
Ont.	27,465	30.4	1,132.2	1,758.0	0.64	0.80
Man.	21,881	26.4	1,062.1	1,713.2	0.62	0.78
Sask.	21,077	24.5	1,133.2	1,792.8	0.63	0.76
Alta.	28,760	30.2	1,247.4	1,830.1	0.68	0.76
B.C.	24,113	29.2	1,035.2	1,736.0	0.60	0.80
Canada	24,548	28.9	1,073.0	1,756.7	0.61	0.79

Table B. Nominal value of GDP per capita, labour productivity and labour-market related variables, 1997

Province	GDP per Capita (\$)	GDP per hours worked	Hours worked per Pop 15+	Hours worked per job	Jobs per Pop 15+	Pop 15+ to Pop
N.L.	19,116	32.1	735.4	1,818.3	0.40	0.81
P.E.I.	20,572	26.2	995.2	1,805.7	0.55	0.79
N.S.	21,843	28.9	937.3	1,762.1	0.53	0.81
N.B.	22,384	29.5	937.6	1,815.2	0.52	0.81
Que.	25,902	34.5	925.0	1,726.2	0.54	0.81
Ont.	32,004	37.3	1,076.1	1,771.8	0.61	0.80
Man.	26,186	30.7	1,089.4	1,744.8	0.63	0.78
Sask.	28,640	32.6	1,132.7	1,809.9	0.63	0.77
Alta.	37,825	38.5	1,263.5	1,833.1	0.69	0.78
B.C.	28,968	35.5	1,008.2	1,690.1	0.60	0.81
Canada	29,516	35.6	1,035.0	1,758.4	0.59	0.80

Table C. Nominal value of GDP per capita, labour productivity and labour-market related variables, 2003

Province	GDP per Capita (\$)	GDP per hours worked	Hours worked per Pop 15+	Hours worked per job	Jobs per Pop 15+	Pop 15+ to Pop
N.L.	35,243	48.9	861.9	1,795.1	0.48	0.84
P.E.I.	28,106	30.5	1,133.4	1,772.0	0.64	0.81
N.S.	30,883	38.0	980.6	1,721.3	0.57	0.83
N.B.	29,900	36.0	1,000.1	1,797.7	0.56	0.83
Que.	33,856	42.0	974.3	1,678.5	0.58	0.83
Ont.	40,346	44.8	1,108.4	1,742.6	0.64	0.81
Man.	32,708	37.1	1,104.8	1,715.9	0.64	0.80
Sask.	36,749	42.1	1,094.6	1,754.0	0.62	0.80
Alta.	54,075	53.6	1,258.8	1,807.4	0.70	0.80
B.C.	35,041	42.6	991.6	1,676.8	0.59	0.83
Canada	38,495	44.2	1,064.9	1,727.3	0.62	0.82

Table D. Indexes of nominal value of GDP per capita, labour productivity and labour-market related variables, 1990 (Canada=1)

Province	GDP per capita	GDP per hours worked	Hours worked per Pop 15+	Hours worked per job	Jobs per Pop 15+	Pop 15+ to Pop
N.L.	0.65	0.89	0.75	1.05	0.72	0.97
P.E.I.	0.68	0.72	0.96	1.04	0.93	0.98
N.S.	0.76	0.84	0.90	1.01	0.90	1.00
N.B.	0.74	0.88	0.84	1.01	0.83	1.00
Que.	0.89	0.96	0.92	0.98	0.94	1.01
Ont.	1.12	1.05	1.06	1.00	1.05	1.01
Man.	0.89	0.91	0.99	0.98	1.02	0.98
Sask.	0.86	0.85	1.06	1.02	1.03	0.96
Alta.	1.17	1.05	1.16	1.04	1.12	0.96
B.C.	0.98	1.01	0.96	0.99	0.98	1.01
Canada	1.00	1.00	1.00	1.00	1.00	1.00

Table E. Indexes of nominal value of GDP per capita, labour productivity and labour-market related variables, 1997 (Canada=1)

Province	GDP per capita	GDP per hours worked	Hours worked per Pop 15+	Hours worked per job	Jobs per Pop 15+	Pop 15+ to Pop
N.L.	0.65	0.90	0.71	1.03	0.69	1.01
P.E.I.	0.70	0.74	0.96	1.03	0.94	0.99
N.S.	0.74	0.81	0.91	1.00	0.90	1.01
N.B.	0.76	0.83	0.91	1.03	0.88	1.01
Que.	0.88	0.97	0.89	0.98	0.91	1.02
Ont.	1.08	1.05	1.04	1.01	1.03	1.00
Man.	0.89	0.86	1.05	0.99	1.06	0.98
Sask.	0.97	0.92	1.09	1.03	1.06	0.97
Alta.	1.28	1.08	1.22	1.04	1.17	0.97
B.C.	0.98	1.00	0.97	0.96	1.01	1.01
Canada	1.00	1.00	1.00	1.00	1.00	1.00

Table F. Indexes of nominal value of GDP per capita, labour productivity and labour-market related variables, 2003 (Canada=1)

Province	GDP per capita	GDP per hours worked	Hours worked per Pop 15+	Hours worked per job	Jobs per Pop 15+	Pop 15+ to Pop
N.L.	0.92	1.10	0.81	1.04	0.78	1.02
P.E.I.	0.73	0.69	1.06	1.03	1.04	1.00
N.S.	0.80	0.86	0.92	1.00	0.92	1.02
N.B.	0.78	0.81	0.94	1.04	0.90	1.02
Que.	0.88	0.95	0.91	0.97	0.94	1.01
Ont.	1.05	1.01	1.04	1.01	1.03	0.99
Man.	0.85	0.84	1.04	0.99	1.04	0.98
Sask.	0.95	0.95	1.03	1.02	1.01	0.97
Alta.	1.40	1.21	1.18	1.05	1.13	0.98
B.C.	0.91	0.96	0.93	0.97	0.96	1.02
Canada	1.00	1.00	1.00	1.00	1.00	1.00

Appendix C: Data sources

The period from 1990 to 2003 that is covered in this study was partly chosen because comparable data on hours worked by province were available. The number of jobs and hours worked for the overall economy by province, territory and Canada for the 1997-2003 period can be retrieved from Table 383-0009 on CANSIM. The same data for the year 1990 were developed in 1992 during a National Accounts project to set up input-output tables by province for the year 1990. These labour estimates used in this report are coherent with the official data produced for the Canadian Productivity Accounts.¹⁰

The Gross Domestic Product used for this analysis is calculated at market prices and it can be found in CANSIM, Table 384-0002. All the population estimates are obtained from the Estimates of Population by Age and Sex for Canada in CANSIM Table 050-0001. The population of 15 and over is obtained residually by subtracting from the total population, the population of 0 to 14 years old.

10. In Canada, the Canadian Productivity Accounts are under the responsibility of the Micro-economic Analysis Division, National Accounts and Analytical Studies field.

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