Catalogue no. 15-206-XIE — No. 007
ISSN: 1710-5269
ISBN: 978-0-662-44835-8

Research Paper

The Canadian Productivity Review

Provincial Labour Productivity Growth, 1997 to 2005

by Guy Gellatly

Micro-economic Analysis Division
18th Floor, R.H. Coats Building, Ottawa, K1A 0T6

Telephone: 1-613-951-4636

Statistics Canada Statistique Canada

Canada

How to obtain more information

Specific inquiries about this product and related statistics or services should be directed to Media Hotline, Communications Division, Statistics Canada, Ottawa, Ontario, K1A 0T6 (telephone: 613-951-4636).

For information on the wide range of data available from Statistics Canada, you can contact us by calling one of our toll-free numbers. You can also contact us by e-mail or by visiting our website.

National inquiries line	1-800-263-1136
National telecommunications device for the hearing impaired	1-800-363-7629
Depository Services Program inquiries	1-800-700-1033
Fax line for Depository Services Program	1-800-889-9734
E-mail inquiries	infostats@statcan.ca
Website	www.statcan.ca

Information to access the product

This product, catalogue no. 15-206-XIE, is available for free. To obtain a single issue, visit our website at www.statcan.ca and select Publications.

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner and in the official language of their choice. To this end, the Agency has developed standards of service that its employees observe in serving its clients. To obtain a copy of these service standards, please contact Statistics Canada toll free at 1-800-263-1136. The service standards are also published on www.statcan.ca under About Statistics Canada > Providing services to Canadians.

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.

The primary distribution medium for this series is the Internet. These studies can be downloaded from the Internet at www.statcan.ca for free.

All papers in *The Canadian Productivity Review* go through institutional review to ensure that they conform to Statistics Canada's mandate as a government statistical agency and adhere to generally accepted standards of good professional practice.

The papers in the series often include results derived from multivariate analysis or other statistical techniques. It should be recognized that the results of these analyses are subject to uncertainty in the reported estimates.

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.

Statistics Canada

Provincial Labour Productivity Growth, 1997 to 2005

Guy Gellatly

Published by authority of the Minister responsible for Statistics Canada

January 2007

Catalogue no. 15-206-XIE, no. 007
Frequency: Occasional

ISSN 1710-5269
ISBN 978-0-662-44835-8

Ottawa

La version française de cette publication est disponible (n° 15-206-XIF au catalogue, n° 007).

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued cooperation and goodwill.

Table of contents

Abstract

Productivity statistics garner much attention because they are key indicators of economic progress. This paper reports on the average growth in provincial labour productivity from 1997 to 2005. It examines how medium-term differences in productivity growth have affected the relative levels of labour productivity in different provinces. The data show that the relative position of most provinces has remained fairly stable over the 1997-to-2005 period when benchmarked against changes in the national average. The notable exception is Newfoundland and Labrador, which experienced much stronger average productivity growth during this period than other provinces. This growth substantially improved its relative labour productivity when evaluated in real terms.

The paper also examines the effect that a second factor—changes in the prices received for products—has had on nominal productivity differences between provinces. The data show that the resource-rich provinces of Alberta and Newfoundland and Labrador have benefited substantially from higher relative prices.

1. Introduction

A recent Statistics Canada release of provincial labour productivity and hours worked data[1] noted that short- and longer-term estimates of productivity growth can yield substantially different impressions of the economic progress being made in certain areas of the country. This earlier release compared estimates of provincial productivity growth for 2005 to annualized growth averages covering the 2000-to-2005 period. It noted that the comparatively large productivity gains experienced in 2005 in Western and Central Canada lose some of their luster when the focus shifts to the longer term, as the post-2000 growth averages in these regions are, on balance, far more modest than the annual rates for 2005. The reverse is true of the Atlantic provinces: while many experienced relatively lackluster productivity growth in 2005, average productivity gains for the post-2000 period have been much stronger. In several Atlantic provinces, these longer term growth averages are similar to those posted in Western and Central Canada.

Observations of the sort noted above invariably raise questions about how, in the final analysis, productivity performance compares in different regions of the country, and whether much has changed over time. The central focus of Statistics Canada's productivity program rests with the estimation of annual growth rates—statistics that are designed to measure short-run changes in the efficiency with which an economy transforms its production inputs into market outputs. Historically, less emphasis has been placed on examining the absolute differences in productivity that exist at different stages of the growth process—i.e., shifts in relative position over the short, medium and longer term.

This paper aims at bringing medium-term changes in the productivity performance of Canadian provinces into clearer view. In what follows, we report on the average growth in provincial labour productivity from 1997 to 2005, and examine how differences in productivity growth across provinces have affected relative levels of labour productivity over this nine-year period. Two methodological issues warrant emphasis.

First, our choice of a nine-year reference period[2] is not arbitrary, as this corresponds to the period for which the Canadian Productivity Accounts publishes data that are consistent with the new North American Industry Classification System. While a longer time series would also be advantageous for comparative purposes, here we limit our focus to the better part of the last decade.

Second, both productivity growth rates and productivity levels are calculated using constant (1997) dollars. In order to compare output across two points in time in a world where there are multiple goods, these goods have to be aggregated. An aggregated index weights each output by a price. In order to abstract from price changes, these indices usually hold prices constant—at beginning-period prices, end-period prices or some combination of beginning and end periods. In this paper, we compare growth between 1997 and 2005 by holding prices constant at their values in the opening period (1997), thereby providing measures of 'real' or constant dollar relative productivity that abstract from (or remove) the effect of price changes.

While it is standard to report growth rates in real terms, differences in the output levels across provinces are usually examined in current dollars because these reflect the actual price conditions relevant to the time period being used for the comparison. The relative position of a

province may change over time because it increases its output with prices held constant, and/or because the prices it receives for this output change relative to those received by other provinces. The former is often referred to as the result of growth in 'real' output; the latter as the effect of relative price changes.

These price movements can affect perceptions of relative productivity. A province may experience comparatively strong growth in real productivity along with a decline, relative to other provinces, in its nominal productivity, if it specializes more than other provinces in the production of commodities whose prices are in relative decline. Or the reverse can happen. A province may not experience as much growth in real terms as other provinces but its relative position may improve when examined using the prices at which transactions take place, if the prices it receives increase relative to those in other provinces. In this paper, we report on level differences between provinces in 2005 based on 1997 prices—in order to avoid the distorting effects of relative price movements. But we also ask what the relative position of each province is in 2005 using the prices that existed in that year.

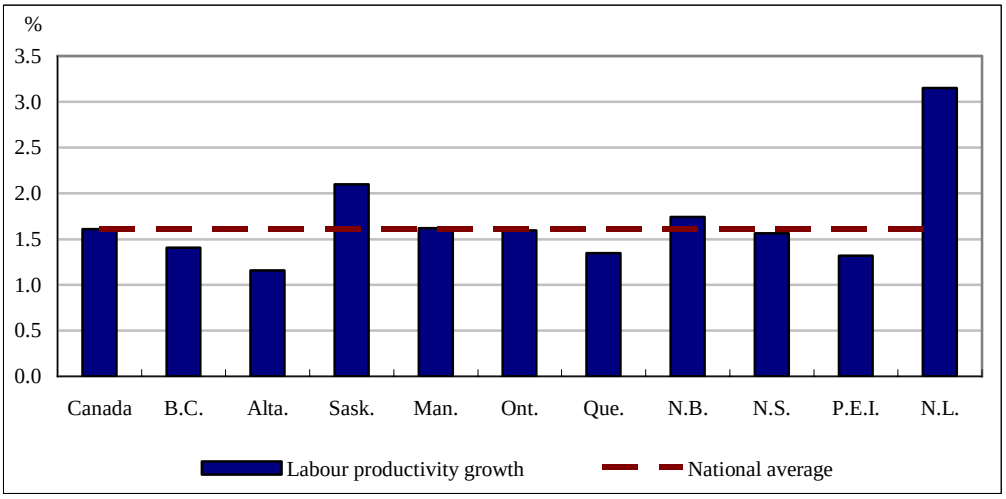
2. Provincial productivity growth, 1997 to 2005

We begin by reporting the average annual rates of labour productivity growth from 1997 to 2005 (Figure 1). Nationally, labour productivity grew at an average rate of 1.6% per annum during this nine-year period.[3] Newfoundland and Labrador (3.2%) experienced much stronger average productivity growth than the other provinces. Saskatchewan (2.1%) was the only other province whose labour productivity grew markedly faster than the national average. Average labour productivity growth in New Brunswick, Manitoba, Ontario, Nova Scotia and British Columbia was near or at the national average (ranging from 1.7% in New Brunswick to 1.4% in British Columbia). Quebec (1.3%), Prince Edward Island (1.3%) and Alberta (1.2%) experienced the smallest average gains in labour productivity during this nine-year period.

What do these differences in medium-term growth imply about the relative strength of labour productivity in different parts of the country? Before we examine this, these growth averages, and the implicit rankings they engender, should be set in context. They are designed to tell us something about the changes in economic progress that have occurred over the better part of the last decade. During this time, Newfoundland and Labrador clearly stands apart from other provinces in terms of improving its labour productivity. Alberta, despite its booming economy, experienced relatively lackluster average productivity growth during this period.

It is important to bear in mind that these perceptions of relative performance can be at odds with short-run movements, such as the growth in provincial productivity that occurred between 2004 and 2005. Indeed there is a negative correlation between the medium-term growth rates reported here and the 2005 growth rates (the correlation coefficient between the two series is -0.31). These discrepancies between the medium and short runs can certainly complicate perceptions of relative progress. Let us consider Alberta and Newfoundland and Labrador—the two provinces with the smallest and largest nine-year growth averages respectively. At 3.4%, Alberta enjoyed the largest increase in productivity in 2005, while Newfoundland and Labrador, at -0.2%, had the second lowest rate of productivity growth in 2005, ahead of only Prince Edward Island.

Figure 1 Average annual growth in labour productivity, 1997 to 2005



Source: Statistics Canada, Canadian Productivity Accounts.

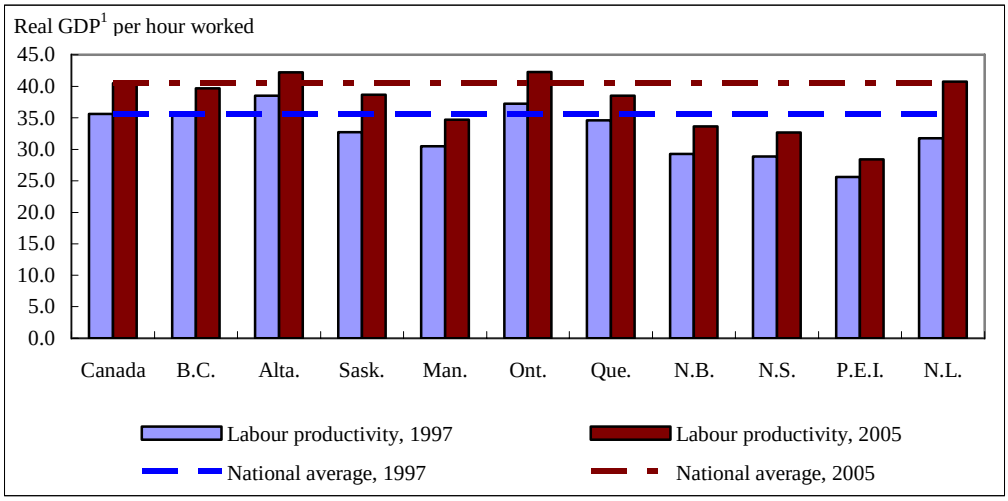
While rates of productivity growth can look very different in the short and medium terms, productivity growth in individual provinces can also vary substantially in the short run. The relative distribution of productivity growth rates across provinces is often quite different from one year to the next. When we examined the correlation between productivity growth rates in adjacent years, only one of the seven sets of adjacent rates exhibited a strong positive correlation. Most were strongly or weakly negative. Hence, provinces that experience large increases in productivity in one year often experience much weaker growth in the next, and vice-versa. Here too, Newfoundland and Labrador is illustrative, as it generally posted either very high or low rates of productivity growth, depending on the year.

This year-to-year volatility is consistent with the view that growth is a highly stochastic process—which implies that one must exercise caution when extending short-run perceptions of relative performance to the longer term. The nine-year averages reported in Figure 1 capture the cumulative effect of these year-to-year movements. While these growth rates tell us something about the sum of all marginal changes during this period, the real issue for many is what these growth differences imply in terms of the actual productivity differentials that exist between provinces. Simply put, how wide are the productivity gaps between provinces, and to what extent have these gaps changed over time? We turn to this in the next section.

3. Provincial labour productivity, 1997 and 2005

Differences in levels of provincial labour productivity stem from many factors, such as differences in industrial structure, urbanization, prices and technology use.[4] Figure 2 reports provincial labour productivity in 1997 and 2005, presented in the familiar west-to-east configuration. These data are reported in basic units of productivity—the amount of constant dollar GDP (gross domestic product) produced per hour worked. The dashed lines denote the national productivity averages in 1997 and 2005 respectively.

Figure 2 Labour productivity, 1997 and 2005 (in 1997 constant dollars)



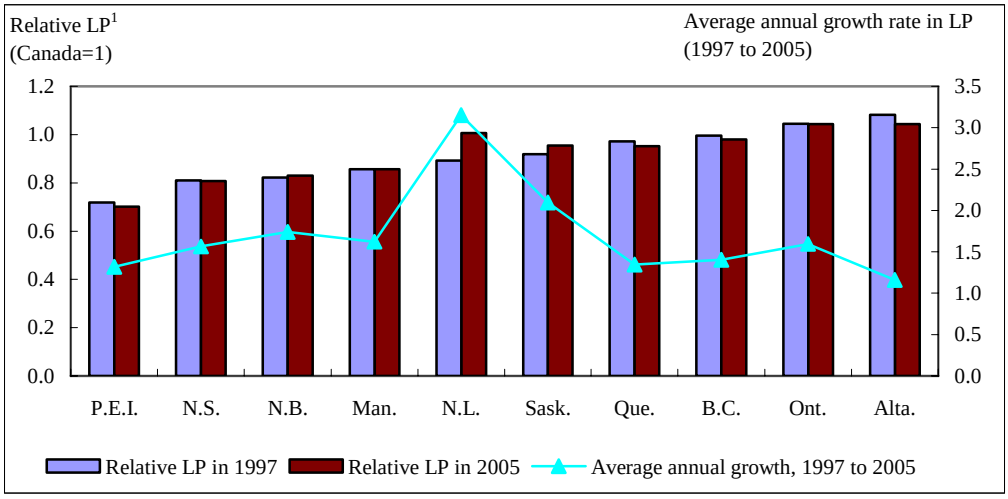
1. Gross domestic product.
Source: Statistics Canada, Canadian Productivity Accounts.

Nationally, real GDP per hour worked increased from $35.6 in 1997 to $40.5 in 2005 (both figures are measured in 1997 prices). Labour productivity was highest in Alberta and Ontario, two provinces that exceeded the Canadian average in both years. Productivity in British Columbia mirrored the national average in 1997 and, to a lesser extent, in 2005. Real GDP per hour worked in Quebec stood just below the Canadian average in 1997, and, by 2005, had declined slightly relative to the national level. In 1997, Saskatchewan's labour productivity was lower than Quebec's, but stronger productivity growth in Saskatchewan brought its real GDP per hour worked into line with Quebec's by 2005. Labour productivity in Manitoba and in the three Maritime provinces remained well back of labour productivity in the other provinces in 2005.

Not surprisingly in light of its high growth rate, the most dramatic shift in relative labour productivity during this nine-year period occurred in Newfoundland and Labrador. In 1997, its GDP per hour worked stood below Saskatchewan's, and well below Quebec's and British Columbia's. By 2005, Newfoundland and Labrador produced more real GDP per hour worked than any of these provinces.

In Figure 3, we examine shifts in relative labour productivity more directly by indexing provincial levels to the national average in each year. Provinces are sorted leftward to rightward by their relative labour productivity in 1997, ranging from Prince Edward Island (72% of the national average) to Alberta (108% of the national average). The left and right bars in each pairing denote relative labour productivity in 1997 and 2005 respectively. Figure 3 also plots the average annual rate of growth in labour productivity for each province from 1997 to 2005 (which we connect from province to province to highlight the size of these growth differentials). The left axis is relative labour productivity (Canada = 1), while the right axis is the average annual growth rate.

Figure 3 Provincial relative labour productivity, 1997 and 2005, and average annual growth rate in labour productivity, 1997 to 2005 (in 1997 constant dollars)



1. Labour productivity.
Source: Statistics Canada, Canadian Productivity Accounts.

Alberta, Ontario, British Columbia and Quebec—the four provinces with the highest levels of real GDP per hour worked in 1997—saw no improvement in their relative productivity from 1997 to 2005. In Alberta, real GDP per hour worked declined from 108% of the national average in 1997 to 104% in 2005 (when measured in 1997 prices). Relative labour productivity in Quebec and British Columbia also fell slightly over this period, to 95% and 98% of the 2005 Canadian average respectively.[5] In Ontario, relative labour productivity was virtually identical in 1997 and 2005. At 4% above the national average, Ontario's real GDP per hour worked was, in 2005, the same as Alberta's.

Stronger average productivity growth in Saskatchewan led to an improvement in its relative position. Saskatchewan's real GDP per hour worked increased from 92% of the Canadian average in 1997 to 95% in 2005.

Relative labour productivity in New Brunswick and Nova Scotia remained stable from 1997 to 2005, as growth rates in these provinces mirrored the national rate. In 2005, real GDP per hour worked in New Brunswick and Nova Scotia stood at 83% and 81% of the national average, respectively. Slower average productivity growth in Prince Edward Island saw relative productivity decline slightly, to 70% of the national average.

These relative estimates help bring the large productivity gains in Newfoundland and Labrador into clearer view. At 89% of the Canadian average in 1997, labour productivity in Newfoundland and Labrador was already substantially higher than in the rest of Atlantic Canada. By 2005, this gap had widened substantially, as labour productivity in Newfoundland and Labrador equalled the national average.

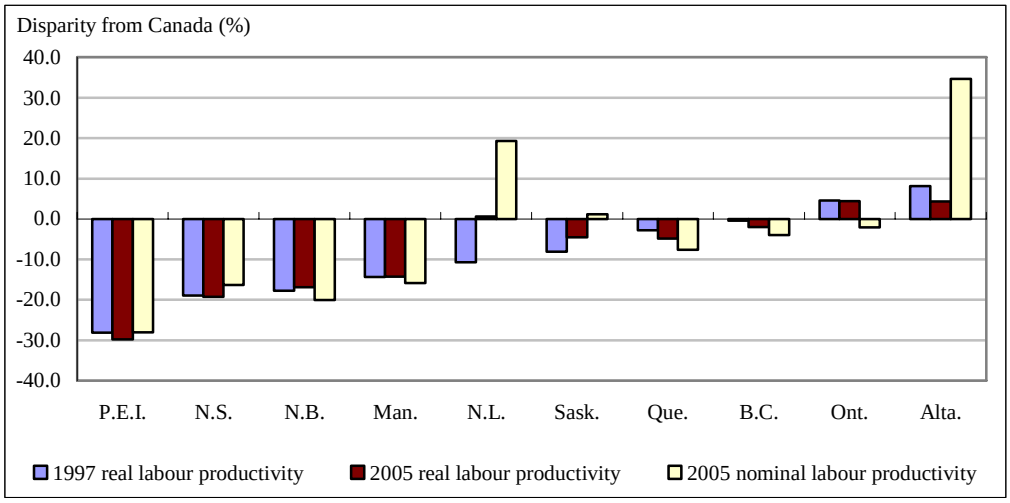
The case of Newfoundland and Labrador represents the only substantial shift in the implicit productivity rankings reported in Figure 3. In 1997, Newfoundland and Labrador's real GDP per

hour worked was slightly lower than Saskatchewan's, and substantially lower than Quebec's. By 2005, Newfoundland and Labrador stood well ahead of Saskatchewan and Quebec in terms of real GDP per hour worked, behind only Ontario and Alberta.

To this point, we have focused strictly on the changes in labour productivity that are associated with underlying changes in real, or constant dollar, GDP. We have done so in order to remove the impact of relative price changes from our provincial comparisons. Below we examine how level estimates for 2005 differ when they are based on the actual price conditions that existed in that year.

Figure 4 converts the labour productivity differentials reported in Figure 3 into percentage deviations from the national average in 1997 and 2005. Three estimates are reported for each province. The first two bars depict deviations in GDP per hour worked from the national average in 1997 and 2005, using 1997 dollars in each case. The third bar re-estimates the deviation in 2005 based on 2005 prices (i.e., substituting nominal dollar GDP for constant dollar GDP). Differences between the second and third bars occur because relative nominal prices in 2005 are not the same as relative real prices in 2005 (which are measured in 1997 constant dollars). As in Figure 3, provinces are ranked leftward to rightward (lowest to highest), based on their labour productivity in 1997.

Figure 4 Percentage deviation from national average, 1997 and 2005



Source: Statistics Canada, Canadian Productivity Accounts.

For two resource-rich provinces—Alberta and Newfoundland and Labrador—the impact of relative price changes is very substantial. As noted earlier, Alberta's relative labour productivity actually declined from 1997 to 2005 when its output is measured in constant (1997) dollars—from 8% to 4% above the national average. But the price of its natural resources (primarily oil and gas) has increased relative to the commodities produced in other provinces, leading to a dramatic increase in relative performance when viewed in nominal terms. In 2005, Alberta's nominal dollar GDP per hour worked was 35% higher than the national average.

Improvements in the relative position of Newfoundland and Labrador, already well apparent in real terms, are far more dramatic when GDP per hour worked is evaluated in nominal terms. When changing relative prices are taken into account, Newfoundland and Labrador's GDP per hour worked increased to 19% above the national average.

The results for Saskatchewan, Ontario and Quebec also warrant emphasis, as changing price conditions in these provinces affect perceptions of relative performance. Saskatchewan's relative productivity increased in real terms, from 8% below the national average in 1997 to 5% below in 2005 (when measured in 1997 dollars). But when the latter estimate is recalculated using 2005 prices, Saskatchewan's GDP per hour worked actually exceeds the national average by a slight margin (1.2%).

These nominal dollar adjustments have the opposite effect in Ontario and Quebec. In real terms, Ontario's relative labour productivity remained virtually unchanged in 1997 and 2005, at around 5% above the national average. But when nominal prices are used, Ontario's GDP per hour worked in 2005 is 2% below the Canadian average. In Quebec, the decline in relative labour productivity that is apparent in real terms is accentuated by the shift to nominal prices. Quebec's GDP per hour worked in 2005 was 5% below the national average when measured in 1997 prices—this falls to 8% when 2005 prices are used.

4. Conclusion

Productivity statistics garner much attention because they are key indicators of economic progress. This paper reports on the growth in provincial labour productivity from 1997 to 2005. It examines how differences in average productivity growth have influenced relative labour productivity in different provinces.

All provinces have grown their labour productivity in an absolute sense—with each producing more constant dollar gross domestic product per hour worked in 2005 than in 1997. This said, the relative productivity of most provinces that abstracts from price changes has remained fairly stable over this period when benchmarked against movements in the national average. The notable exception is Newfoundland and Labrador, which experienced much stronger average productivity growth during this nine-year period than other provinces. This growth substantially improved Newfoundland and Labrador's relative labour productivity, which, in 2005, was equivalent to the national average.

It is also apparent from our tabulations that productivity statistics that abstract from price changes provide only partial information on the relative performance of different provinces. In reality, the prices that prevail in one period are not those that prevail in the next. And how provinces fare relative to one another will depend not only on whether they have managed to grow their productivity in real terms, but also on whether the prices for their outputs have increased relative to those in other provinces. As this paper shows, the resource-rich provincial economies of Alberta and Newfoundland and Labrador have benefited substantially from these relative price changes.

Endnotes

1. See "Hours worked and labour productivity in the provinces and territories," *The Daily*, May 9, 2006.
2. Our analysis period encompasses nine separate annual estimates of gross domestic product (GDP) and hours worked, from 1997 to 2005 inclusive.
3. All tabulations in this analysis are based on GDP at market prices. Average annual productivity growth for province *i* from 1997 to 2005 is calculated as $\bar{\Delta p}^{i} = [([\frac{LP^{i}_{2005}}{LP^{i}_{1997}}]^{0.125}) - 1] * 100$ where labour productivity, LP^{i}, is GDP divided by hours worked. These productivity estimates cover the total economy, and include economic activity in both the business and non-business sectors.
4. Several Statistics Canada research papers have examined the factors that underlie provincial differences in labour productivity and GDP per capita. We summarize several of these below.

   Baldwin et al. (2001) used decomposition methods to disentangle the extent to which productivity differences across provinces are due to (a) industry-mix effects or (b) real productivity effects (the differences that persist after controlling for the impact of industry structure). The authors found that, on balance, real productivity effects account for more of the variation in productivity levels across provinces than do industry-mix effects.

   Other papers have examined the role of labour productivity in explaining provincial differences in GDP per capita. Baldwin, Brown and Maynard (2005) evaluated the extent to which provincial differences in GDP per capita are related to differences in labour productivity or work intensity. The results show that these two factors reinforce one another—provinces with lower (higher) GDP per capita tend to have both lower (higher) labour productivity and lower (higher) work intensity. In an earlier study, Baldwin et al. (2004) found that differences in GDP per capita were predominantly associated with differences in labour productivity, although "labour market conditions…also prove[d] to be an influential factor" (p. 21). This analysis also differentiated (as does this paper) between real effects and relative price effects. In a recent study, Beckstead and Brown (2005) show that provincial differences in GDP per capita also depend, in part, on basic differences in urban–rural composition.
5. It is worth noting that, for most provinces, the absolute magnitude of these shifts in relative labour productivity is qualitatively small. Small shifts, such as the slight declines in relative productivity apparent for British Columbia, Quebec and Prince Edward Island, should be interpreted with some measure of caution, as all point estimates of productivity are subject to statistical error. For background on the precision of productivity measures, see Baldwin and Harchaoui (2001). For a more general discussion of measurement issues, developed within the context of international comparisons, see Baldwin et al. (2005).

References

Baldwin, J.R., W.M. Brown and J.-P. Maynard. 2005. *Interprovincial Differences in GDP per Capita, Labour Productivity and Work Intensity: 1990-2003.* Insights on the Canadian Economy Research Paper Series. Catalogue no. 11-624-MIE2005011. Ottawa: Statistics Canada.

Baldwin, J.R., W.M. Brown, J.-P. Maynard and D. Zietsma. 2004. *Catching Up and Falling Behind: The Performance of Provincial GDP per Capita from 1990 to 2003*. Economic Analysis Research Paper Series. Catalogue no. 11F0027MIE2004024. Ottawa: Statistics Canada.

Baldwin, J.R. and T. Harchaoui. 2001 "The Precision of Productivity Measures." In *Productivity Growth in Canada*. Catalogue no. 15-204-XIE2001. Ottawa: Statistics Canada.

Baldwin, J.R., J.-P. Maynard, D. Sabourin and D. Zietsma. 2001. *Differences in Interprovincial Productivity Levels*. Analytical Studies Branch Research Paper Series. Catalogue no. 11F0019MIE2001180. Ottawa: Statistics Canada.

Baldwin, J.R., J.-P. Maynard, M. Tanguay, F. Wong and B. Yan. 2005. *A Comparison of Canadian and U.S. Productivity Levels: An Exploration of Measurement Issues*. Economic Analysis Research Paper Series. Catalogue no. 11F0027MIE2005028. Ottawa: Statistics Canada.

Beckstead, D. and W.M. Brown. 2005. *Provincial Income Disparities Through an Urban-Rural Lens: Evidence from the 2001 Census*. Insights on the Canadian Economy Research Paper Series. Catalogue no. 11-624-MIE2005012. Ottawa: Statistics Canada.