



LIBRARY of PARLIAMENT
BIBLIOTHÈQUE du PARLEMENT

BACKGROUND PAPER



Productivity in Canada: Concepts and Issues

Publication No. 2014-84-E
16 September 2014

André Léonard

Economics, Resources and International Affairs Division
Parliamentary Information and Research Service

Library of Parliament ***Background Papers*** provide in-depth studies of policy issues. They feature historical background, current information and references, and many anticipate the emergence of the issues they examine. They are prepared by the Parliamentary Information and Research Service, which carries out research for and provides information and analysis to parliamentarians and Senate and House of Commons committees and parliamentary associations in an objective, impartial manner.

© Library of Parliament, Ottawa, Canada, 2014

Productivity in Canada: Concepts and Issues
(Background Paper)

Publication No. 2014-84-E

Ce document est également publié en français.

CONTENTS

1	INTRODUCTION.....	1
2	BASIC CONCEPTS.....	1
2.1	Real Gross Domestic Product Per Capita.....	1
2.2	Labour Productivity	1
2.3	Labour Utilization	2
2.3.1	Hours Worked per Job.....	2
2.3.2	Ratio of Employment to the Labour Force.....	2
2.3.3	Ratio of the Labour Force to the Total Population	2
2.4	Interaction Between Productivity and Labour Utilization.....	2
2.5	Multifactor Productivity	3
3	DETERMINANTS OF PRODUCTIVITY	3
3.1	Human Capital	4
3.2	Physical Capital.....	4
3.3	Research and Development	5
3.4	Macroeconomic Factors.....	5
3.5	Goods and Services Produced	5
3.6	Information and Communications Technologies.....	6
3.7	Business Size.....	6
3.8	Organizational Change and Competition	6
3.9	Demographic Factors.....	6
4	PRODUCTIVITY CHANGES IN CANADA AND OTHER COUNTRIES	6
4.1	Canada's Labour Productivity and Gross Domestic Product.....	6
4.2	Productivity in Canada: Provincial Perspectives.....	7
4.3	International Comparisons	8
4.4	Productivity Gap Between Canada and the United States	9
5	PUBLIC POLICY OPTIONS.....	10
6	CONCLUSION	11

PRODUCTIVITY IN CANADA: CONCEPTS AND ISSUES

1 INTRODUCTION

Productivity is an indicator that can be used to measure the economic performance of a worker, a business, an industry or a geographic region, such as a province or a country.

This background paper summarizes the key basic concepts related to productivity and its determinants. It then looks at how productivity has changed in Canada, the provinces and internationally in recent years, highlighting the differences in productivity between Canada and the United States. Lastly, it explores possible solutions that could help boost Canadian productivity and move it closer to that of the U.S.

2 BASIC CONCEPTS

2.1 REAL GROSS DOMESTIC PRODUCT PER CAPITA

The real gross domestic product (GDP) per capita – that is, GDP adjusted to remove variations due to inflation, divided by the number of inhabitants – is commonly used to measure the value of production or the standard of living for a given period. It can be used to compare data from different periods or regions with quite different populations.

It can be broken down as follows:

$$\frac{\text{Real GDP}}{\text{Total population}} = \frac{\text{Real GDP}}{\text{Hours worked}} \times \frac{\text{Hours worked}}{\text{Employment}} \times \frac{\text{Employment}}{\text{Labour force}} \times \frac{\text{Labour force}}{\text{Total population}}$$

The first term on the right side of the equation represents “labour productivity,” while the following three make up what is called “labour utilization.”

2.2 LABOUR PRODUCTIVITY

Labour productivity may be estimated by dividing the total value of production (real GDP) by the total number of hours worked.

This means that a geographic region may report high productivity because it produces high-value goods and services; this is the case, for example, in Canadian provinces where oil and natural gas are produced. These regions may also see their productivity fluctuate simply because of variations in the price of the commodities they produce.

Productivity may also be high in businesses, industries and regions that use a great deal of physical capital (equipment, machinery, etc.; see section 3.2 of this paper), but not many workers. For example, operating a hydroelectric dam requires few workers but can generate high-value production, which would be reflected by high labour productivity.

2.3 LABOUR UTILIZATION

Labour utilization is the number of hours worked per capita, which can be broken down into three components:

- hours worked per job;
- the ratio of employment to the labour force; and
- the ratio of the labour force to the total population.

The following analysis of these components shows that in Canada, labour utilization can no longer be a significant factor in real GDP per capita growth, and that this growth will therefore need to come mainly from increases in labour productivity.

2.3.1 HOURS WORKED PER JOB

The number of hours worked per job is the total number of hours worked divided by the total number of jobs in an economy. In Canada, this figure has been fairly stable, if not in slight decline since 2000 (34.13 hours in 2000 versus 32.07 hours in 2013).¹

2.3.2 RATIO OF EMPLOYMENT TO THE LABOUR FORCE

Employment divided by the labour force, which is made up of employed and unemployed workers (individuals who are not working but are looking for work), is the inverse of the unemployment rate. For example, if the unemployment rate is 7%, then the ratio of jobs to the labour force is 93%. The unemployment rate was 7.1% in 2013 and 7% in August 2014. This is very close to the lowest annual level recorded since 1976, which was 6% in 2007.²

Based on historical Canadian data, it would appear difficult to raise the jobs–labour force ratio, given that there is always what is referred to as “frictional” unemployment, made up of unemployed workers voluntarily changing jobs, and “structural” unemployment, which exists because that there is not a perfect match between the jobs available and workers’ skills.

2.3.3 RATIO OF THE LABOUR FORCE TO THE TOTAL POPULATION

The labour force is made up of employed and unemployed workers aged 15 and over. Individuals 65 and over are not as active in the labour market: in 2013, their participation rate was only 13%, while the participation rate of those aged 25 to 44 was 87.1%.³ On 1 July 2013, people 65 and over made up 15.3% of the Canadian population.⁴ This number is expected to reach 23.7% in 2036,⁵ which should drive down the ratio of the labour force to the total population.

2.4 INTERACTION BETWEEN PRODUCTIVITY AND LABOUR UTILIZATION

The two potential sources of real GDP growth (labour productivity and labour utilization) are not necessarily independent. For example, when the unemployment rate decreases or the participation rate increases, workers who are less productive than average tend to enter the labour market.

This does not mean that a policy that increases the participation rate or decreases the unemployment rate is counterproductive – quite the opposite. If the goal is to boost real GDP per capita, such a policy, even if it might reduce average productivity, would achieve the desired result. New workers, even with below-average productivity, would contribute to real GDP.

This can be illustrated using a simple example:

- Suppose that there is an island with a population of 10, nine of them working 1,000 hours per year and one not working, and that each of the nine who work produces goods worth \$50,000. This means that labour productivity is \$50 per worked hour ($\$450,000/9,000$ hours of work) and the GDP per capita is \$45,000 ($\$450,000/10$ inhabitants).
- Now suppose that the 10th person starts working, that this person is not as skilled as the others and also works 1,000 hours, but produces goods valued at only \$25,000 per year. This means that labour productivity drops from \$50 to \$47.50 ($\$475,000/10,000$ hours of work), but the GDP per capita rises from \$45,000 to \$47,500 ($\$475,000/10$ inhabitants).

2.5 MULTIFACTOR PRODUCTIVITY

Labour productivity only takes into account the number of hours worked. There is a slightly more complex measure, multifactor productivity (MFP), which takes into account how many different inputs are required to produce goods and services, such as physical capital (equipment, machinery, etc.; see section 3.2 of this paper) and education level. The MFP compares real GDP per capita for two periods, taking into account not only the hours worked, but also the machinery used by workers and their level of education.

In the business (private) sector,⁶ the MFP index had a reference value of 100 in 2007, but it dropped to 96.5 in 2012, lower than the reference value in 1977 (97.4). However, between 1977 and 2012, average real GDP grew by 2.8% per year.

This increase is therefore not because of MFP growth, which in fact decreased slightly, but rather an increase in the inputs used in the production process: the number of hours worked; the make-up or quality of hours worked, measured by the workers' level of education; and how much physical capital was utilized.

3 DETERMINANTS OF PRODUCTIVITY

A number of factors influence productivity and economic growth. Table 1 summarizes the findings of a study on the determinants of long-term economic growth for 21 countries in the Organisation for Economic Cooperation and Development (OECD) from 1971 to 1998.⁷ Since, in the long term, labour utilization is rather stagnant, these effects can be easily attributed to productivity. However, the cost of increasing these different variables is not mentioned.

Table 1 – Impact of Certain Variables on the Long-Term Level of Gross Domestic Product (GDP) Per Capita, 1971–1998

Driving Factor	Measure Used	Change	Impact
Human capital	Average years of education	+ 1 year	4%–7%
Physical capital	Private non-resident investment as a % of GDP	+ 1 point	1.3%
Research and development	Value as a % of GDP	+ 0.1 point	> 1.2%
Trade exposure	Average of exports and imports as a % of GDP	+ 10 points	4%
Tax burden	Government revenue as a % of GDP	- 1 point	0.6%–0.7%
Inflation level	Final consumption deflator	- 1 point	0.4%–0.5%
Inflation variability	Final consumption deflator standard deviation	- 1 point	2%

Source: Peter J. Nicholson, "[The Growth Story: Canada's Long-run Economic Performance and Prospects](#)," *International Productivity Monitor*, No. 7, Fall 2003, Table 3.

Table 1 shows the average impact for the countries studied. It is, however, possible that these impacts are not linear (that is, that they are higher in countries where the initial level was lower, and lower where the initial level was higher). For example, Canada already has a high average level of education, and adding a year to the average number of years of education could have a smaller impact than in a country with a lower average level of education.

3.1 HUMAN CAPITAL

Human capital represents the knowledge and skills of individuals acquired through formal education and in-house and other training. It is considered a determinant of productivity, since it allows employees to work more effectively. However, the measure used may not capture certain details, such as the quality of teaching, the quantity of in-house training and the distribution of the average level of education.

In 2012, 53% of Canadians aged 25 to 64 years had a tertiary level of education (college or university), ranking first among OECD countries, where the average was 32%. However, this figure included the high percentage of Canadians with a college or CEGEP (pre-university program, or education leading to trades or other technical occupations in Quebec) education (24%, ranking first among OECD countries), instead of the proportion of individuals with a university education (28%, ranking seventh among OECD countries).⁸

3.2 PHYSICAL CAPITAL

Physical capital means the physical assets used in the production process: buildings, machinery, tools, computers, etc. Higher quantities and quality of physical capital boost labour productivity for the same number of hours worked.

According to OECD data, the quantity of physical capital grew at an annual rate of 1.1% in Canada between 1995 and 2011, less than the United Kingdom (1.2%), but more than the United States (0.8%).⁹

3.3 RESEARCH AND DEVELOPMENT

Research and development (R&D) is considered a measure of innovation, defined as:

- introduces a good or service that is new or significantly improved (product innovation); or
- establishes
 - a new or significantly improved production or delivery method (process innovation);
 - a new marketing method (marketing innovation); or
 - a new organizational method (organizational innovation).¹⁰

All these types of innovation may boost productivity.

The positive correlation between the sale of innovative products and productivity in Canada is also demonstrated in a study by Therrien and Hanel published in 2011 dealing specifically with the manufacturing sector.¹¹ However, Gu, Terefe and Wang showed in a 2012 paper that the contribution by R&D to productivity growth has been very small since 1981 compared with other types of investment in physical capital.¹²

According to UNESCO data, Canada allocated 1.73% of its GDP to R&D in 2012, compared with 2.92% by Germany, 2.79% by the United States and 2.26% by France.¹³

3.4 MACROECONOMIC FACTORS

Macroeconomic factors such as controlling the size of the government sector and inflation, as well as openness to international trade, are considered measures that allow greater investment and increased competition, thereby stimulating productivity. Institutional stability was another factor cited in a paper by Acemoglu and Robinson (2012).¹⁴

3.5 GOODS AND SERVICES PRODUCED

Countries have different human, natural and financial resources that can determine in which industrial sectors economic output is concentrated. An increase in productivity can arise from a heightened demand for the goods and services produced in a given country. For example, a simple rise in the demand for oil can increase the production without the number of hours worked having to increase to the same extent. This can happen if machinery is underutilized when demand is weaker, so that twice as many working hours are not necessarily needed for an oil well to produce twice as much oil. In this case, productivity would increase following an increase in the demand for oil.

3.6 INFORMATION AND COMMUNICATIONS TECHNOLOGIES

One significant determinant of productivity is the adoption of information and communications technologies (ITCs). A paper by Alexopoulos and Cohen (2012) shows that the adoption of new technologies has a positive impact on productivity, although Canadian businesses are often slow to adopt American technology.¹⁵ The importance of ICTs to productivity growth is also mentioned in a study by Gu and Wang (2004).¹⁶

3.7 BUSINESS SIZE

It is generally acknowledged that productivity is higher in large businesses, partly due to economies of scale. In Canada, productivity in small businesses was only 47% of that for large businesses in 2008, according to a study by Baldwin, Leung and Rispoli (2014).¹⁷

3.8 ORGANIZATIONAL CHANGE AND COMPETITION

According to a paper by Pilat (2005), organizational changes, particularly the adoption of new technologies or innovations, may help improve operations within a business. The paper also draws on other studies showing that competition, measured by the entry and exit of businesses and changes in market shares, is an important driver of productivity.¹⁸

3.9 DEMOGRAPHIC FACTORS

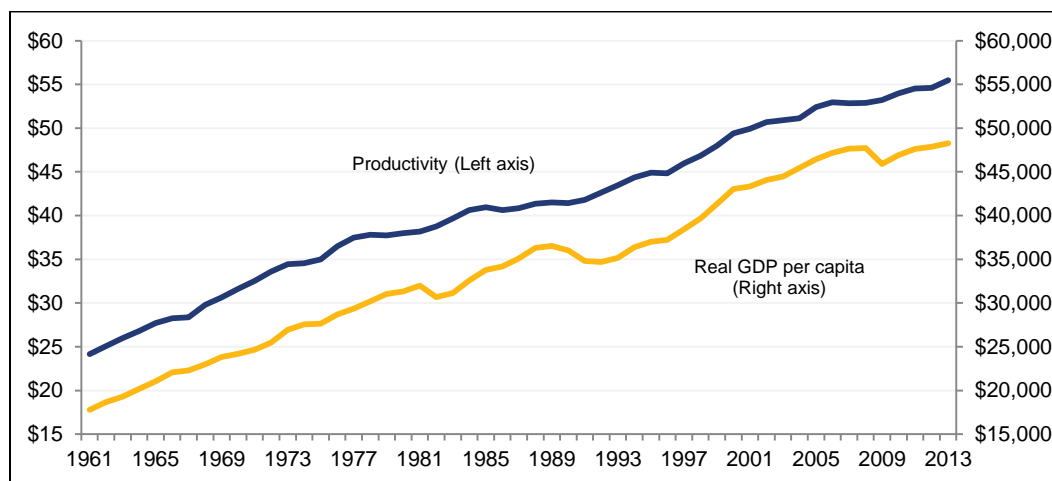
According to a book published in 2010 on the economic impact of an aging population, this demographic shift can lower labour productivity, since older workers are often less productive (for example, because their skills are not as current), although the impact appears to be rather insignificant overall and is somewhat offset by the experience of older workers.¹⁹

4 PRODUCTIVITY CHANGES IN CANADA AND OTHER COUNTRIES

4.1 CANADA'S LABOUR PRODUCTIVITY AND GROSS DOMESTIC PRODUCT

Figure 1 shows that labour productivity and real GDP per capita in Canada have been following similar trends since 1961. It also shows that productivity is less sensitive than real GDP per capita to economic conditions. One reason for this is that when there is a drop in demand, employers can reduce the number of hours of work or lay off the least productive employees, thereby helping to maintain or even boost productivity, despite a drop in output.

Figure 1 – Gross Domestic Product Per Capita (per year) and Labour Productivity (per hour), Economy-Wide, Canada, 1961–2013 (2007 constant dollars)



Source: Figure prepared by the author using data obtained from the Centre for the Study of Living Standards, [Aggregate Income and Productivity Trends, Canada vs. United States](#).

The figures also show that productivity grew at different average annual rates in recent decades: 3% from 1961 to 1972, 1.6% from 1972 to 1984, 0.8% from 1984 to 1996, 1.8% from 1996 to 2005, and 0.7% from 2005 to 2013.

According to an OECD study, part of the reason for the drop in the rate of real GDP growth (and consequently, productivity) is that it is more difficult for countries that already have a high real GDP to maintain high rates of growth than it is for those with a smaller GDP.²⁰ In the early 1970s, countries such as Canada, the United States and France had a higher real GDP than countries such as Ireland and Italy, which did not see a drop in real GDP growth. Variations by sub-period may also be explained by cyclical variations in investment or in commodity prices.

4.2 PRODUCTIVITY IN CANADA: PROVINCIAL PERSPECTIVES

Labour productivity varies by province. In a paper by De Avillez and Ross (2011), the authors discuss how MFP, labour composition (number of hours worked by education level) and physical capital intensity contributed to average annual labour productivity growth between 1997 and 2007.²¹

The results are presented in Table 2, together with the level of labour productivity in 2007.

Table 2 – Labour Productivity Level in 2007 (1997 constant dollars) and Contribution of Various Inputs to Average Annual Labour Productivity Growth (%), 1997–2007, by Province

	Labour Productivity		Contribution to Productivity Growth		
	Level (\$)	Growth (%)	Labour Composition	Physical Capital	Multifactor Productivity
Newfoundland and Labrador	39.6	4.82	0.27	0.39	4.14
Prince Edward Island	22.1	1.59	0.35	1.42	-0.18
Nova Scotia	27.1	1.92	0.15	0.64	1.12
New Brunswick	28.2	1.78	0.26	1.13	0.37
Quebec	35.6	1.76	0.27	0.54	0.94
Ontario	37.3	1.71	0.32	0.56	0.82
Manitoba	31.4	2.10	0.35	1.12	0.62
Saskatchewan	35.4	2.09	0.37	1.60	0.11
Alberta	39.4	1.04	0.23	2.43	-1.58
British Columbia	32.5	1.18	0.08	0.62	0.48
Canada	36.1	1.71	0.30	0.97	0.44

Note: The total of the three components of productivity growth (three columns on the right) do not always equal total growth due to rounding.

Source: Ricardo de Avillez and Chris Ross, "[A Portrait of the Productivity Performance of the Canadian Provinces, 1997-2007](#)," *International Productivity Monitor*, No. 21, Spring 2011, tables 5 and 12.

Productivity levels can vary based on the proportion of a province's economic activity taken up by industrial sectors where productivity is higher or lower. For example, in 2007, the mining, oil and gas industry – which tends to make greater use of physical capital per employee, resulting in a higher level of productivity – represented in Alberta (8.5%), Saskatchewan (5.9%) and Newfoundland and Labrador (5.3%) a much higher proportion of total hours worked than the Canadian average, which was around 2%.

Newfoundland and Labrador is the province that had the strongest growth between 1997 and 2007, mainly due to offshore oil investment that resulted in a steep increase in production. On the opposite end is Alberta, which shifted from conventional oil and gas extraction to oil sands exploitation, an activity that requires significant investment over several years without necessarily resulting in significant output, making it the province that saw the slowest productivity growth during that period.

Lastly, Table 2 shows that between 1997 and 2007, physical capital (0.97) contributed more to productivity growth than MFP (0.44) and labour composition (0.30).²²

4.3 INTERNATIONAL COMPARISONS

Growth in labour productivity has slowed since the early 1970s for most OECD countries. Table 3 shows that this slowdown was greater in certain countries (Norway, Italy, France, Japan, Germany and the United Kingdom) than in Canada. However, growth was faster in countries such as Sweden and the United States.

**Table 3 – Average Annual Growth Rate of Labour Productivity
(Gross Domestic Product per hour worked), Selected Countries, 1970–2013 (%)**

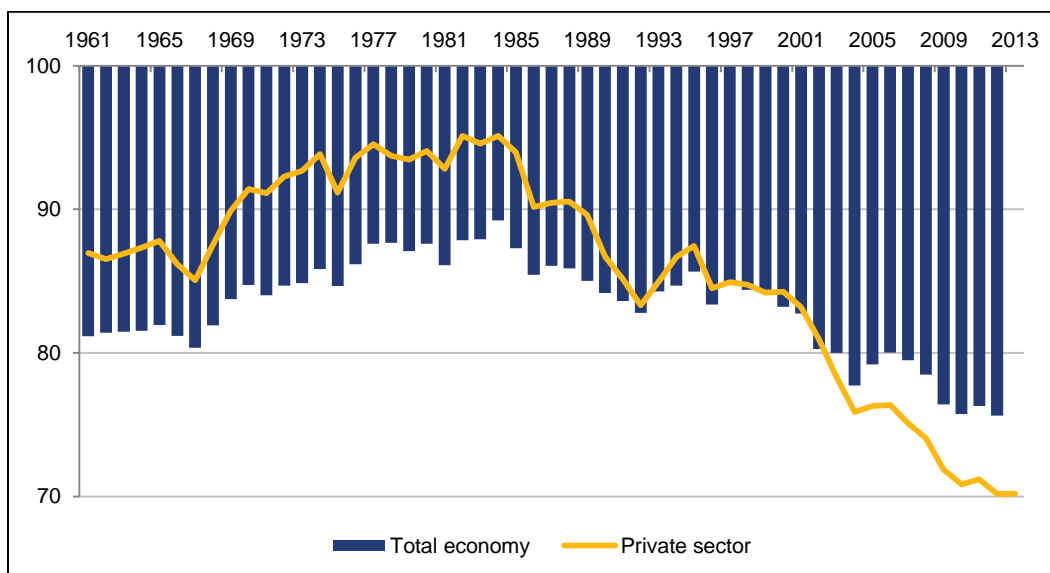
Country	1970–1984 (1)	1984–1998 (2)	1998–2013 (3)	(3) – (1)
Norway	4.0	2.6	0.8	-3.2
Italy	3.2	1.8	0.2	-3.0
France	3.9	2.1	1.1	-2.8
Japan	3.9	3.2	1.4	-2.5
Germany	3.3	2.3	1.2	-2.1
United Kingdom	2.9	2.4	1.2	-1.6
Canada	1.9	1.0	1.1	-0.8
Australia	1.8	1.6	1.4	-0.4
Sweden	1.5	1.7	1.7	0.2
United States	1.6	1.5	1.9	0.3

Source: Organisation for Economic Co-operation and Development, "[Productivity, Level of GDP Per Capita and Productivity](#)," *OECD.Stat Extracts* (database), accessed 21 August 2014.

4.4 PRODUCTIVITY GAP BETWEEN CANADA AND THE UNITED STATES

Figure 2 compares the Canadian level of productivity with that of the United States, which is set at 100. Until 1984, Canadian productivity was closing in on levels in the United States, but it has declined ever since, with few exceptions. In 2012, the productivity level of the Canadian economy, including the private and public sectors, was 24% lower than that of the U.S. economy. For the private sector, this gap was 30%, since the Canadian public sector had slightly higher productivity than the U.S. public sector.

**Figure 2 – Labour Productivity in Canada Compared to the United States (= 100),
Private Sector and Total Economy, 1961–2013**



Note: Data on the total economy is not available for 2013.

Source: Figure prepared by the author using data obtained from the Centre for the Study of Living Standards, [Aggregate Income and Productivity Trends, Canada vs. United States](#).

This gap could be explained by the differences in the level of determinants presented in the preceding section. For example, according to the study by Baldwin, Leung and Rispoli (2014), the proportion of hours worked within small businesses is higher in Canada than in the United States (67% in Canada versus 56% in the U.S.). However, labour productivity is lower in small businesses, particularly in Canada; as mentioned previously, productivity in Canada's small businesses was 47% of that of large businesses, whereas in the United States, this figure was 67%. These two factors would explain about two thirds of the labour productivity gap between both countries.²³

It is conceivable that given its smaller population, it would make sense for businesses in Canada to be smaller than those in the United States. However, the free trade agreement with the United States has been in place since 1989, and the North American Free Trade Agreement (which also includes Mexico) since 1994. These agreements gave Canadian businesses access to the American and Mexican markets. One could then expect that Canadian businesses could end up growing to the same size as American businesses. However, perhaps certain services are better sourced locally, or perhaps consumers prefer to buy locally produced goods.

The segment of the population aged 25 and over with at least one university degree (including those with a master's degree or a Ph.D.) in 2013 was 25.7%²⁴ in Canada compared with 31.6% in the United States.²⁵ As well, domestic expenditure on R&D in 2012 as a percentage of GDP was 1.7% in Canada, compared with 2.8% in the United States.²⁶ Both of these facts could help explain the gaps observed.

According to a paper by Almon and Tang (2012), productivity in certain industries, such as manufacturing, has been slowing more in Canada than in the United States since 2000. However, the mining and construction industries have seen less of a slowdown in productivity in Canada than in the United States during the same period.²⁷

Harper, Nakamura and Zhang (2012) suggest that "one reason for [the MFP gap between Canada and the United States] may be that measurement issues have resulted in officially measured productivity growth underestimating true productivity growth [in Canada]."²⁸ The authors call for greater transparency on the part of Statistics Canada, which they believe should release the full detailed calculations used to produce its MFP estimates.

5 PUBLIC POLICY OPTIONS

A number of solutions have been brought forward in response to slowing productivity growth in Canada and the widening gap with American productivity. Some of these have already been presented.

In a paper by Drummond (2011), the author recommends that greater attention be paid to microeconomic issues involving businesses. For example, why did businesses not take greater advantage of the strong Canadian dollar to invest more heavily in machinery and equipment, which are often imported, and so less expensive when the Canadian dollar is strong?²⁹

Drummond also suggests that public and fiscal policies could be reviewed to see whether they encourage Canadian businesses to remain small by granting them tax rates and exemptions not available to large businesses. The fact that small businesses are on average less productive and invest less in R&D could help explain the poor performance of Canadian productivity compared with American productivity.

A paper by Côté and Miller (2012) is critical of public policy aimed at stimulating innovation, mainly consisting of providing tax credits for R&D conducted in universities and businesses, which the authors say is ineffective. Instead, they urge support for specific projects conducted by businesses to stimulate innovation. This support must also be tied to regional development, which focuses on the development of recent university graduates with the knowledge and skills needed for innovation.³⁰

6 CONCLUSION

Because of the aging population, *labour utilization* is gradually contributing less to Canada's economic growth. According to the C.D. Howe Institute,³¹ the aging population will bring major financial challenges because significant increases in the share of national income will need to go toward expenditures such as those on health care and social programs (for example, old age security), since the segment of the population, mainly workers, that will pay for a great portion of these expenditures is shrinking. This is why it is important to have a good understanding of *labour productivity* – and its determinants – as a driver of economic growth.

This background paper has highlighted the various components that make up productivity and ways to improve Canadian productivity in order to narrow the current gap with American productivity and possibly ensure long-term economic growth.

NOTES

1. Centre for the Study of Living Standards, "[Aggregate Income and Productivity Trends, Canada vs. United States](#)," 26 June 2014.
2. Statistics Canada, Tables 282-0002 (annual), "[Labour force survey estimates \(LFS\), by sex and detailed age group](#)," and 282-0087 (monthly), "[Labour force survey estimates \(LFS\), by sex and age group, seasonally adjusted and unadjusted](#)," CANSIM (database), accessed 9 September 2014.
3. Statistics Canada, Table 282-0002 (annual), "[Labour force survey estimates \(LFS\), by sex and detailed age group](#)," CANSIM (database), accessed 9 September 2014.
4. Statistics Canada, Table 051-0001 (annual), "[Estimates of population, by age group and sex for July 1, Canada, provinces and territories](#)," CANSIM (database), accessed 20 August 2014.
5. Statistics Canada, "[Population Projections for Canada, Provinces and Territories, 2009 to 2036](#)," Statistics Canada catalogue no. 91-520-X, May 2010 (medium-growth scenarios).
6. Statistics Canada, Table 383-0021, "[Multifactor productivity, value-added, capital input and labour input in the aggregate business sector and major sub-sectors, by North American Industry Classification System \(NAICS\), annual \(index, 2007=100\)](#)," CANSIM (database), accessed 21 August 2014.

7. Andrea Bassanini and Stefano Scarpetta, "[The Driving Forces of Economic Growth: Panel Data Evidence for the OECD Countries](#)," *OECD Economic Studies*, No. 33, 2001.
8. Organisation for Economic Cooperation and Development [OECD], "[Country Note: Canada](#)," *Education at a Glance 2014*.
9. OECD, "Multifactor Productivity," [OECD.Stat Extracts](#) (database), accessed 11 September 2014.
10. OECD, "[Defining innovation](#)," *OECD Innovation Strategy*.
11. Pierre Therrien and Petr Hanel, "[Innovation and Productivity: Summary Results for Canadian Manufacturing Establishments](#)," *International Productivity Monitor*, No. 22, Fall 2011.
12. Wulong Gu, Berook Terefe and Weimin Wang, "[The Impact of R&D Capitalization on GDP and Productivity Growth in Canada](#)," *Economic Insights*, Statistics Canada catalogue no. 11-626-X, No. 016, October 2012.
13. UNESCO Institute for Statistics (UIS), "[Science, technology and innovation](#)" (Domestic expenditure on research and development as a percentage of GDP).
14. Daron Acemoglu and James Robinson, *Why Nations Fail*, New York, Crown Publishing Corporation, 2012.
15. Michelle Alexopoulos and Jon Cohen, "[The Effects of Computer Technologies on the Canadian Economy: Evidence from New Direct Measures](#)," *International Productivity Monitor*, No. 23, Spring 2012.
16. Wulong Gu and Weimin Wang, "[Information Technology and Productivity Growth: Evidence from Canadian Industries](#)," in *Economic Growth in Canada and the United States in the Information Age*, Industry Canada, May 2004.
17. John Baldwin, Danny Leung and Luke Rispoli, "[Canada–United States Labour Productivity Gap Across Firm Size Classes](#)," *The Canadian Productivity Review*, Statistics Canada catalogue no. 15-206-X, No. 33, 2014.
18. Dirk Pilat, "[Canada's Productivity Performance in International Perspective](#)," *International Productivity Monitor*, No. 10, Spring 2005.
19. Pietro Garibaldi, Joaquin Oliveira Martins and Jan van Ours, eds., *Ageing, Health and Productivity: The Economics of Increased Life Expectancy*, New York, Oxford University Press, 2010.
20. Bassanini and Scarpetta (2001), Table 8.
21. Ricardo de Avillez and Chris Ross, "[A Portrait of the Productivity Performance of the Canadian Provinces, 1997–2007](#)," *International Productivity Monitor*, No. 21, Spring 2011.
22. Someshwar Rao and Jiang Li, "[Explaining Slower Productivity Growth: The Role of Weak Demand Growth](#)," *International Productivity Monitor*, 2013, p. 5.
23. Baldwin, Leung and Rispoli (2014), p. 6.
24. Statistics Canada, Table 282-0004 (annual), "[Labour force survey estimates \(LFS\), by educational attainment, sex and age group](#)," CANSIM (database), accessed 27 August 2014.
25. Bureau of Labor Statistics, "[Employment status of the civilian noninstitutional population 25 years and over by educational attainment, sex, race, and Hispanic or Latino ethnicity](#)," *Labor Force Statistics from the Current Population Survey*.
26. OECD, "[Main Science and Technology Indicators](#)," *Directorate for Science, Technology and Innovation*, June 2014.

27. Michael-John Almon and Jianmin Tang, "[Industrial Structural Change and the Post-2000 Output and Productivity Growth Slowdown: A Canada–U.S. Comparison](#)," *International Productivity Monitor*, No. 22, Fall 2011.
28. Michael J. Harper, Alice Nakamura and Lu Zhang, "[Difficulties Assessing Multifactor Productivity for Canada](#)," *International Productivity Monitor*, No. 24, Fall 2012.
29. Don Drummond, "[Confessions of a Serial Productivity Researcher](#)," *International Productivity Monitor*, No. 22, Fall 2011.
30. Marcel Côté and Roger Miller, "[Stimulating Innovation: Is Canada Pursuing the Right Policies?](#)," *International Productivity Monitor*, No. 23, Spring 2012.
31. Christopher Ragan, "[What Now? Addressing the Burden of Canada's Slow-Growth Recovery](#)," Commentary No. 43, C.D. Howe Institute, July 2014.