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A COMPARISON OF AUSTRALIAN AND CANADIAN PRODUCTIVITY PERFORMANCE: LESSONS FOR CANADA

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A Comparison of Australian and Canadian Productivity Performance: Lessons for Canada

Abstract

The objective of this report is to examine the impact of public policy on Australia's productivity performance and to discuss possible lessons for Canada from this experience. To do this, the report conducts a comprehensive analysis of the productivity performance of both countries, with particular interest in determining which underlying factors can explain Australia's superior productivity growth in recent years. In addition, the report discusses the literature on the effects of public policy on Australian productivity performance since the 1990s.

A Comparison of Australian and Canadian Productivity Performance: Lessons for Canada

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A Comparison of Australian and Canadian Productivity Performance: Lessons for Canada

Executive Summary

Australia and Canada share much in common. Both countries have similar institutions based on their historical ties to the United Kingdom, enjoy high standards of living, have large natural resource sectors, accept large numbers of immigrants, and have experienced similar labour market performance. But one area where the two countries have diverged in recent years is productivity performance, as Australia has outperformed Canada.

The objective of this report is to examine the impact of public policy on Australia's productivity performance and to discuss possible lessons for Canada from this experience. To do this, the report conducts a comprehensive analysis of the productivity performance of both countries, with particular interest in determining which underlying factors can explain Australia's superior productivity growth in recent years. In addition, the report discusses the literature on the effects of public policy on Australian productivity performance since the 1990s.

Productivity Trends

In Australia, business sector labour productivity increased at an annual rate of 2.33 per cent between 1994 and 2013, well above (by 1.02 percentage points) the growth rate exhibited by Canada (1.31 per cent) (Exhibit 1). This higher labour productivity growth in Australia was attributable to both stronger real value added growth and weaker growth in total hours worked. In the two major subperiods examined, Australia also had higher labour productivity growth than Canada (2.95 versus 2.16 per cent or 0.79 percentage points difference between 1994 and 2000, and 2.04 per cent versus 0.92 per cent or 1.12 percentage points difference between 2000 and 2013).

Both countries exhibited a significant slowdown in labour productivity growth between 1994-2000 and 2000-2013. In Australia, business sector labour productivity growth was down 0.91 percentage points between 1994-2000 and 2000-2013. The labour productivity slowdown was somewhat larger in Canada, with a decline of 1.25 percentage points. Labour productivity growth declined in both countries between these two periods because the slowdown in real value added growth was much larger than the decline in hours worked growth.

Due to the higher productivity growth in Australia relative to Canada, Australia's relative labour productivity level increased from 96.1 per cent of that of Canada's labour productivity level in 1995 to 108.6 per cent in 2013.[1]

Exhibit 1: Labour Productivity Growth and Related Measures, Compound Annual Growth Rates, Per Cent, Canada and Australia, 1994-2013

Period	Canada			Australia		
	Labour Productivity	Real Value Added	Hours Worked	Labour Productivity	Real Value Added	Hours Worked
1994-2013	1.31	2.77	1.45	2.33	3.52	1.17
1994-2000	2.16	4.80	2.57	2.95	4.23	1.24
2000-2013	0.92	1.85	0.93	2.04	3.20	1.14

Note: The estimates for Canada are for the business sector. The estimates for Australia are for the market sector.
Source: CSLS calculations based on Statistics Canada and ABS data. ABS: 5260.0.55.002. Statistics Canada: 383-0021.

Productivity Drivers

The report focuses on investigating the possible reasons behind the gap in labour productivity growth between Australia and Canada in 1994-2013. This report suggests that the gap in labour productivity growth between Australia and Canada reflects gaps between these countries in many of the drivers of labour productivity growth.

With respect to the supply-side drivers of labour productivity growth, Australia outperformed Canada in terms of capital intensity growth, growth in business expenditures on research and development (BERD) intensity, product market regulation, and barriers to trade and investment. A simple growth accounting exercise shows that capital deepening accounted for 71 per cent of the gap in labour productivity growth between the two countries in this period. The remainder is accounted for by multifactor productivity growth (MFP). Australia surpassed Canada in terms of investment intensity and investment growth for structures, M&E and ICT.

Australia also exhibited more rapid growth in BERD, although its BERD intensity was still lower than Canada's over much of the observed period. More notably, Australia has significantly less product market regulation than Canada according to the OECD, as well as fewer barriers to trade and investment. This may, in part, explain the stronger labour productivity growth of Australia. Many economists attribute Australia's rapid productivity growth in the late-1990s to deregulation and the reduction of barriers to trade and investment.

In contrast, we found no evidence that differences in human capital accumulation contributed to the labour productivity growth gap. The growth accounting exercise demonstrates that the contribution of changes in labour composition to labour productivity growth was the same in both countries in 1994-2013, at 0.29 per cent per year.

[1] These level values are for all industries in both Canada and Australia.

It is unclear whether differences in labour market regulation contributed to the gap in labour productivity growth. While the intensity of union membership was quite steady in Canada over the observed period, it steadily declined in Australia. Although unionization has been on the decline in Australia, the share of the population covered by collective agreements has increased, and industry- and occupation-specific minimum wages and terms of employment are determined in Australia's unique "awards" system. Furthermore, according to the OECD Canada has slightly less labour market regulation (overall) than Australia.

Inter-industry shifts explain a significant portion of the gap in labour productivity growth between Canada and Australia (32 per cent of the gap in 1994-2013). Most importantly, Australia reallocated more labour to mining (including oil and gas) relative to Canada, which alone accounted for 17 per cent of the gap. This occurred because the mining sector's share of total hours worked increased much more in Australia than in Canada (by 2.5 percentage points versus 0.6 percentage points).

The labour productivity growth gap between Australia and Canada over the 1994-2013 period is linked to the macroeconomic environment, which has been considerably more favourable in Australia than in Canada. Output growth in Australia has been stronger than in Canada in the 1994-2013 period (3.52 per cent per years versus 2.77 per cent), due to much faster growth in the 2000-2013 sub-period (3.20 per cent versus 1.85 per cent). Australia's superior output growth since 2000 was due to the country's better investment and export performance. Investment growth in Australia between 2000 and 2013 was 5.96 per cent per year, compared to 3.70 per cent in Canada, while exports grew 2.94 per cent per year in Australia, compared to 0.24 per cent per year in Canada. A better macroeconomic environment associated with solid investment growth and export growth improves labour productivity growth *à la* Verdoorn's law.

Lower unemployment rates, as well as other changes that point to an increase in labour market tightness, can have a positive impact on labour productivity growth. This can spur additional investment in labour-saving capital. It is unclear whether this factor has contributed to the gap in labour productivity growth. Despite the lower unemployment rate experienced by Australia, alternative indicators (*e.g.*, the incidence of discouraged searchers and involuntary part-time workers) suggest that Australia's labour market was actually looser than Canada's during this period. There is also a possibility that methodological differences between Statistics Canada and the Australian Bureau of Statistics (ABS) limit comparisons of these indicators.

Theoretically, an increase in the minimum wage should have a similar effect on labour productivity growth as an increase in labour market tightness. Australia's minimum wage was higher than Canada's throughout the observed period. However, the minimum wage has fallen

relative to mean and median wages over time in Australia, while it has increased relative to mean and median wages in Canada. It is therefore unlikely that Australia's higher minimum wage contributed to their superior labour productivity performance.

Exhibit 2: Summary of Drivers and their Potential Impact on the Gap in Labour Productivity Growth Between Canada and Australia, 1994-2013

Driver	Impact	Reasoning
Capital Intensity	Significant	Capital intensity grew 1.66 per cent per year in Australia in 1994-2013 compared to 0.94 per cent per year in Canada, accounting for 71 per cent of the gap in labour productivity growth. Australia had stronger investment growth in structures, M&E and ICT. This likely increased productivity through supply-side channels and reflected the better macroeconomic environment in Australia.
Human Capital	Insignificant	In 1994-2013, the contribution of changes in labour composition to labour productivity growth was the same in both countries, at 0.29 percentage points per year. Therefore, it is unlikely that differences in human capital accumulation contributed to the gap.
Inter-industry Shifts	Significant	Inter-industry shifts explain a significant portion of the gap in labour productivity growth (32 per cent of the gap in 1994-2013). Most importantly, Australia reallocated more labour to mining (and oil and gas), which alone accounted for 17 per cent of the gap. Australia's share of hours worked in mining (and oil and gas) increased 2.5 percentage points, while Canada's share increased only 0.6 percentage points.
Quality of the Stock of Natural Resources	Small	Both countries exhibited negative labour productivity growth in mining. This likely reflected increased difficulty in extracting natural resources in both countries. The within-industry effect captures this decline in labour productivity and shows that the negative contribution from this factor was slightly less in Australian than Canada (-0.13 percentage points versus -0.16 percentage points). This within-industry effect explains only 2.9 per cent of the gap.
Innovation	Small, but positive	While BERD intensity was higher in Canada than in Australia over much of the period, growth in BERD intensity has been much more rapid in Australia than in Canada, particularly since 2000. Hence, BERD may have contributed more in Australia to productivity growth than in Canada.
Macroeconomic Environment	Likely	Stronger output growth, especially since 2000 (3.20 per cent per year versus 1.85 per cent per year in 2000-2013) explains part of Australia's stronger labour productivity performance between 1994 and 2013. In 2000-2013, stronger output growth in Australia was driven by investment and exports. Investment growth in Australia between 2000 and 2013 was 5.96 per cent, while investment growth in Canada was only 3.70 per cent. Furthermore, exports grew 2.94 per cent per year in Australia in 2000-2013, compared to 0.24 per cent per year in Canada. A better macroeconomic environment associated with solid export growth and investment growth improves labour productivity growth *à la* Verdoorn's law.
Microeconomic Environment	Likely	According to the OECD, Australia has lower product market regulation and fewer barriers to trade and investment than Canada. This may, in part, explain the stronger labour productivity growth of Australia. However, Canada has slightly less labour market regulation (overall) than Australia.

Note: Since many factors explaining labour productivity growth are interrelated this chart overaccounts for labour productivity growth.

The Impact of Public Policy on Australian Productivity Growth

Australia exhibited weak productivity growth before the 1990s, especially compared to Japan, the United States and other advanced economies in Europe. In response, successive Australian governments implemented a series of reforms to rectify the situation from the mid-1980s to the late-1990s. A great deal of research has been conducted on the impact of these reforms on productivity growth in Australia. In particular, it has been widely shown that these reforms explain the surge in productivity in the mid- to late-1990s. According to the standard narrative, which is frequently put forward by the Productivity Commission and other researchers, much of the improved productivity performance came from an unlocking of the supply-side potential of the Australian economy related to these reforms.

The series of reforms were wide-ranging and ambitious. They have had both macro and micro dimensions, although the focus of the literature is largely on the role of microeconomic reforms. More specifically, these reforms included the introduction of financial deregulation, privatisation of government enterprises, the introduction of enterprise-level wage bargaining and individual employment contracts, reduced tariffs, tax reform, a dramatic shift in macroeconomic policy, and a new competition policy.

The analysis of the impact of reforms on Australia's 1990s productivity surge generally does not distinguish between separate policies but looks at the effect of reforms as a whole. Thus, it is difficult to draw lessons for Canada, as we simply do not know which specific policies had the largest impact on productivity growth in Australia. In theory, it is possible that a few of the policy changes had a large, positive effect on productivity, while others had a negligible (or maybe even negative) effect on productivity.

Nevertheless, the analysis in this report does give rise to a few potential lessons for Canada. These are as follows:

- Australia has greatly benefited from impressive export growth to the huge and fast growing Chinese market. Canada's main market, on the other hand, is the slow growing United States. Given the importance of demand growth for both output and productivity advance, Canada should focus greater attention on emerging markets where there is significant potential for growth in exports.

- Australia has been very successful in increasing its BERD intensity, Canada much less so. Given the great similarities between the two countries, Canada should closely examine the specific public policies that Australia has implemented to boost BERD intensity to determine if any could be adopted in this country.

- Australia has been aggressive in reducing product market regulation, Canada less so. Canada is in the middle of the pack among OECD countries in terms of product regulation, and therefore has room to move to a less restrictive policy regime. The greatest potential for productivity gains in the product market regulation area for Canada is the gradual phasing out of marketing boards, especially for dairy products. The Australian experience offers much insight in this regard.

- Canada lacks a governmental organization that focuses on productivity issues, the role played by the Productivity Commission in Australia. Given the positive implications for government revenues of even small increases in productivity, the costs of such as organization would be very small relative to the benefits. The federal government should establish an organization that would play a similar role to the Australian Productivity Commission in championing the productivity issue.

A Comparison of Australian and Canadian Productivity Performance: Lessons for Canada[2]

I. Introduction

Australia and Canada share much in common. The countries have similar institutions based on their historical ties to the United Kingdom, enjoy high standards of living, have large natural resource sectors, accept large numbers of immigrants, and have experienced similar labour market performance. But one area where the two countries have diverged in recent years is productivity performance, as Australia has outperformed Canada in this area. For example, labour productivity has advanced at a 2.33 per cent average annual rate in Australia since 1994, compared to only 1.31 per cent in Canada.[3]

The objective of this report is to examine the impact of public policy on Australia's productivity performance and to discuss possible lessons for Canada from this experience. To do this, we will conduct a comprehensive analysis of the productivity performance of both countries, with particular interest in determining which underlying factors can explain Australia's superior productivity growth in recent years. To this end, we present the key findings of the available literature as well as original analyses with official statistics from Statistics Canada, the Australian Bureau of Statistics (ABS) and the Organisation for Economic Co-operation and Development (OECD).

The report is divided into eight sections. The current section introduces the report. The second section presents data on productivity growth in Australia and compares these data with the situation in Canada. Comparisons are made for labour, capital, and multifactor productivity at the aggregate and industry level. The third section examines the sources of labour productivity growth in Australia and Canada from a growth accounting perspective. The impact of other factors not captured in a growth accounting analysis that have been identified in the literature as contributing to productivity growth will also be discussed. The fourth section decomposes aggregate labour productivity growth by industry. The fifth section examines the drivers of labour productivity growth in Australia and Canada. The sixth section analyzes the impact of public policies on productivity growth in Australia. The seventh section discusses the role of the

[2] This report was written by Evan Capeluck under the supervision of Andrew Sharpe, Executive Director of the CSLS for Industry Canada. An abridged version is available at http://www.csls.ca/ipm/30/capeluck.pdf. The author would like to thank Alexander Murray from the CSLS, Bert Waslander, Jianmin Tang, and Shiji Zhao from the Australian Productivity Commission for their comments and contributions. The author would also like to thank Matthew Calver, Jasmin Thomas, Erika Rodrigues, and Nico Palesch and Alexander Benjamin Rand for their contributions to the report. Finally, the author would like to thank Jim Stanford for comments received in his role as discussant on the paper at the 49th Canadian Economics Association Annual Meeting, May 29-May 31, 2015 at Ryerson University in Toronto, Ontario.

[3] It should be noted that labour productivity refers to real valued added per hour worked throughout the report.

Productivity Commission in the genesis, development and application of these policies. The eighth section concludes. In particular, it summarizes the main findings and discusses the relevance and implications of the public policies adopted in Australia for Canada.

II. A Comparison of Productivity Trends in Canada and Australia[4]

This section presents data on productivity growth in Australia and compares these data with the situation in Canada. It is divided into two sub-sections. The first sub-section deals with productivity level and growth rate comparisons at the aggregate level for both the business sector and the total economy. Both measures of the economy are discussed because there is a large difference between the productivity levels and growth rates of the total economy and the business sector for both Canada and Australia. The second sub-section presents comparisons at the industry level. Comparisons are made for labour, capital, and multifactor productivity and related indicators.

A. Aggregate Level

i. Labour Productivity

a. Labour Productivity Growth

Both real value added and total hours worked grew more quickly in Australia than in Canada throughout the entire 1981-2013 period (Table 1, Panel A).[5] In Australia, annual growth in total economy real valued added was 3.29 per cent in 1981-2013, 0.87 percentage points above Canada's growth rate (2.42 per cent). With respect to total hours worked, Australia's total economy exhibited annual growth of 1.61 per cent between 1981 and 2013 compared to 1.23 per cent for its Canadian counterpart. The difference between real value added growth and hours worked growth was significantly larger in Australia, which indicates more rapid growth in total economy labour productivity in Australia.

In Canada, total economy labour productivity increased at an annual rate of 1.18 per cent between 1981 and 2013, well below the growth rate exhibited by Australia (1.65 per cent). Australia exhibited stronger growth in total economy labour productivity than Canada in every sub-period between 1981 and 2013. For example, total economy labour productivity was 0.43 percentage points stronger in 1981-2000 and 0.54 percentage points stronger in 2000-2013.

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[4] Consult Appendix A for a primer on concepts related to productivity and for a discussion of data sources. It should be noted that labour productivity refers to real valued added per hour worked throughout the report.

[5] Most ABS statistics are based on the financial year (i.e. July 1st to June 30th of the following year). Since Statistics Canada's figures are not based on the financial year, this could cause a slight, likely inconsequential, mismatch.

Table 1: Labour Productivity Growth and Related Measures, Compound Annual Growth Rates, Per Cent, Canada and Australia, 1981-2013 and 1994-2013

Panel A: All Industries

Period	Canada				Australia			
	Labour Productivity	Real Value Added	Hours Worked	Productivity Elasticity	Labour Productivity	Real Value Added	Hours Worked	Productivity Elasticity
81-13	1.18	2.42	1.23	0.49	1.65	3.29	1.61	0.50
94-13	1.19	2.57	1.36	0.46	1.62	3.42	1.77	0.47
81-00	1.37	2.72	1.33	0.50	1.80	3.45	1.63	0.52
81-94	1.16	2.21	1.04	0.52	1.70	3.11	1.39	0.55
94-00	1.82	3.81	1.96	0.48	2.00	4.20	2.15	0.48
00-13	0.91	1.99	1.08	0.46	1.45	3.06	1.59	0.47
00-08	0.84	2.31	1.46	0.36	1.50	3.40	1.87	0.44
08-13	1.01	1.49	0.47	0.68	1.37	2.52	1.13	0.54

Panel B: Business/Market Sector

Period	Canada				Australia			
	Labour Productivity	Real Value Added	Hours Worked	Productivity Elasticity	Labour Productivity	Real Value Added	Hours Worked	Productivity Elasticity
94-13	1.31	2.77	1.45	0.47	2.33	3.52	1.17	0.66
94-00	2.16	4.80	2.57	0.45	2.95	4.23	1.24	0.70
00-13	0.92	1.85	0.93	0.50	2.04	3.20	1.14	0.64
00-08	0.88	2.19	1.30	0.40	1.79	3.47	1.65	0.52
08-13	0.97	1.32	0.34	0.73	2.44	2.78	0.33	0.88

The estimates for Australia are for the market sector. The estimates of productivity elasticity are calculated as labour productivity growth divided by real value added growth.

Source: CSLS calculations based on Statistics Canada and ABS data. ABS: 5204.015 and 5260.0.55.002. Statistics Canada: 383-0012 and 383-0021.

Canada's relative performance was even worse in terms of labour productivity growth in the business sector (Table 1, Panel B).[6,7] Between 1994 and 2013, the gap between Australia and Canada's business sector labour productivity growth rates was 1.02 percentage points, compared to a gap of 0.43 percentage points in terms of total economy labour productivity growth over the same period. In particular, Canada exhibited annual growth in business sector labour productivity of 1.31 per cent in 1994-2013 compared to 2.33 per cent in Australia. The higher growth in business sector labour productivity in Australia reflects stronger real value added growth and weaker growth in total hours worked.[8]

[6] In this report, we focus on labour productivity in the business sector because we feel that it is the most appropriate measure of the economy for productivity analysis as there tends to be a number of measurement problems for non-business sector output.

[7] The term 'market sector' in Australia has been used by the ABS to represent different compositions of industries. In past instances, it has referred to 12 industries, while more recently it has referred to 16 industries (as it does in this report).

[8] It is interesting to note that the non-business sector in Canada performed much more strongly than the non-business sector in Australia in most of the period. For example, in 2008 to 2013, business sector labour productivity growth was 0.97 per cent in Canada, while total economy labour productivity growth was 1.01 per cent. This suggests that labour productivity growth in Canada in the non-business sector was slightly above that of the business sector. In contrast, labour productivity growth in Australia in the business sector was 2.44 per cent over the 2008-2013 period, while it was 1.37 per cent in the total economy.

Both countries exhibited a significant slowdown in labour productivity growth between 1994-2000 and 2000-2013 (Table 2).[9] In Australia, total economy labour productivity growth declined 0.55 percentage points from 1994-2000 to 2000-2013, while business sector labour productivity growth fell 0.91 percentage points.[10] The labour productivity slowdown was much starker in Canada, with declines of 0.91 percentage points in the total economy and 1.25 percentage points in the business sector.

Labour productivity declined in both countries between these two periods because the decline in real value added growth was much larger than the decline in hours worked growth. The productivity elasticity, which measures the sensitivity of labour productivity growth to real value added growth, was quite similar in Canada and Australia both in 1994-2000 and 2000-2013 for all industries (but not for the business/market sector). This indicates change in labour productivity growth between these two periods was closely related to the decline in real value added growth. It follows that the larger decline in labour productivity growth in Canada compared to Australia was attributable to the larger decline in real valued added growth in Canada between 1994-2000 and 2000-2013.

This indicates that the non-business sector saw relatively slow growth in labour productivity over this period.

[9] This report focuses on the 1994-2013 period. This is because 1994 was the first year of available data for both countries, while 2013 was the last year of available data for both countries. We examined growth rates between 1994 and 2000 and between 2000 and 2013 because the year 2000 was a peak year. The Productivity Commission (and many others in Australia) has conducted analysis of Australia's productivity based on the 'productivity cycles' defined by the ABS. Since 1993-94, the ABS has had two completed cycles (1998-99 to 2003-04 and 2003-04 to 2007-08) and the current uncompleted cycle from 2007-08. Since we chose different starting and ending points, average productivity may differ (sometimes significantly). Hence, the choice to break the period at the year 2000 (a peak year) may mask some differences in the behaviour of Australia's productivity in different cycles over this period.

[10] Australia's measured productivity has declined since 2000. There is no doubt that this is, to a large extent, reflected the deteriorating performance. However, measured productivity was also affected by measurement issues, particularly in the mining and utility industries (Topp and Kulys, 2012 and Topp et al., 2008). Specifically, there is a flawed measure of capital in both the mining and water supply industries (where large lumpy investments are immediately counted in the measure of productive capital). Furthermore, measurement of productivity and capital fails to account for the impact of tightening environmental regulations (such as raising the standards of water treatment of subsoil (in mining), etc. The investments in mining came as a response to the surge of China's demand for minerals and some issues (in the utility industries) were caused by inappropriate decisions with regard to investments in infrastructure. Hence, these measurement issues may play a part in explaining some of the downturn in productivity in utilities and mining in Australia since 2000, although they certainly do not explain the entirety of the decline.

Table 2: Labour Productivity Growth, Real Value Added Growth and Productivity Elasticity, Per Cent, Canada and Australia, 1994-2013

Panel A: All Industries

Period	Labour Productivity (A)		Real Value Added (B)		Productivity Elasticity (A / B)	
	Canada	Australia	Canada	Australia	Canada	Australia
1994-2000	1.82	2.00	3.81	4.20	0.48	0.48
2000-2013	0.91	1.45	1.99	3.06	0.45	0.47
Absolute Change	-0.91	-0.55	-1.82	-1.14	-0.02	0.00

Panel B: Business/Market Sector

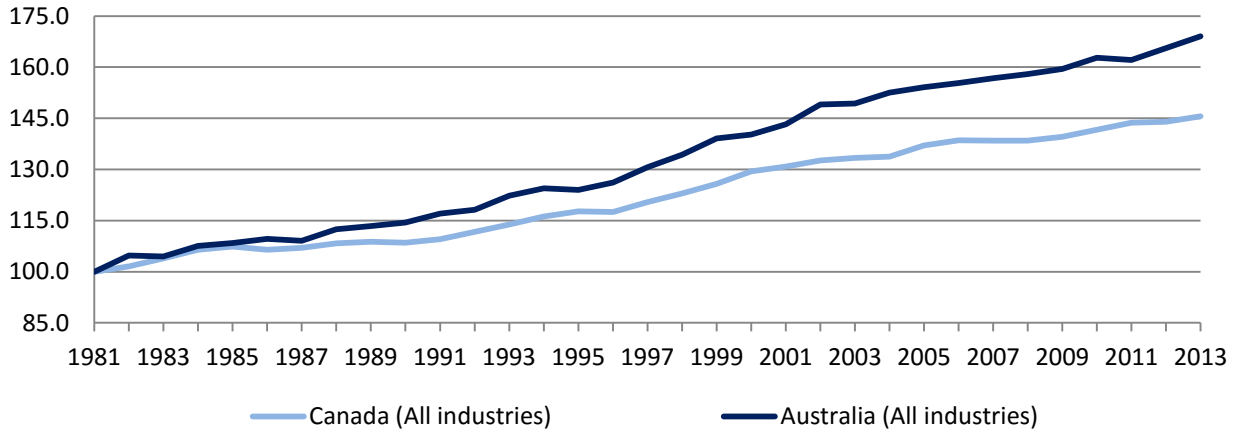
Period	Labour Productivity (A)		Real Value Added (B)		Productivity Elasticity (A / B)	
	Canada	Australia	Canada	Australia	Canada	Australia
1994-2000	2.16	2.95	4.80	4.23	0.45	0.70
2000-2013	0.92	2.04	1.85	3.20	0.49	0.64
Absolute Change	-1.25	-0.91	-2.94	-1.03	0.04	-0.06

Note: The estimates for Canada are for the business sector. The estimates for Australia are for the market sector.
Source: CSLS calculations based on Statistics Canada and ABS data. ABS: 5204.015 and 5260.0.55.002. Statistics Canada: 383-0012 and 383-0021.

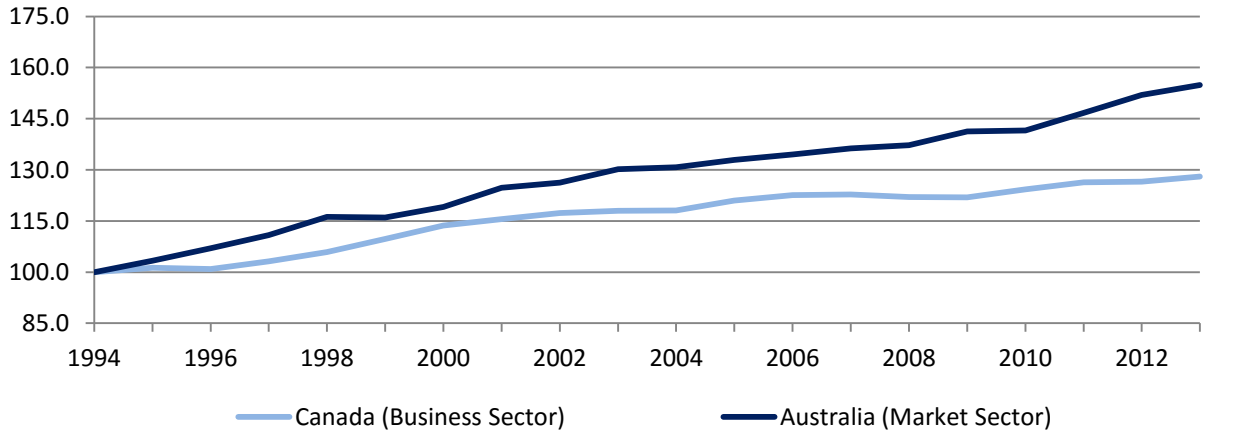
Chart 1compares trends in labour productivity growth in Canada and Australia in 1981-2013 (for the total economy) and 1994-2013 (for the business sector). Total economy labour productivity growth was quite similar in both countries from 1981 to 1988, after which Australia began to grow more quickly than Canada. Both countries exhibited strong labor productivity growth in the late-1990s and markedly slower labour productivity growth post-2000. In 2013, total economy labour productivity was 69.0 per cent above its 1981 level in Australia, while total economy labour productivity was only 45.6 per cent above its 1981 level in Canada. Similarly, Australia outperformed Canada over the entire 1994-2013 period in terms of business sector labour productivity growth. In 2013, business sector labour productivity was 54.9 per cent above its 1994 level in Australia and 28.0 per cent above its 1994 level in Canada.[11]

[11] It is interesting to note that adding the year 2014 to the compound average annual growth rate calculation for Canada increases Canada's average annual growth rate from 0.9 per cent per year over the 2000-2013 period to 1.0 per cent per year over the 2000-2014 period due to strong growth in labour productivity in 2014 (2.25 per cent).

Chart 1: Index of Labour Productivity, Canada and Australia, 1981-2013 and 1994-2013
Panel A: All Industries (1981=100)



Panel B: Business/Market Sector (1994=100)



Source: CSLS calculations based on StatCan and ABS data. ABS: 5260.0.55.002 and 5204.015. StatCan: 383-0021.

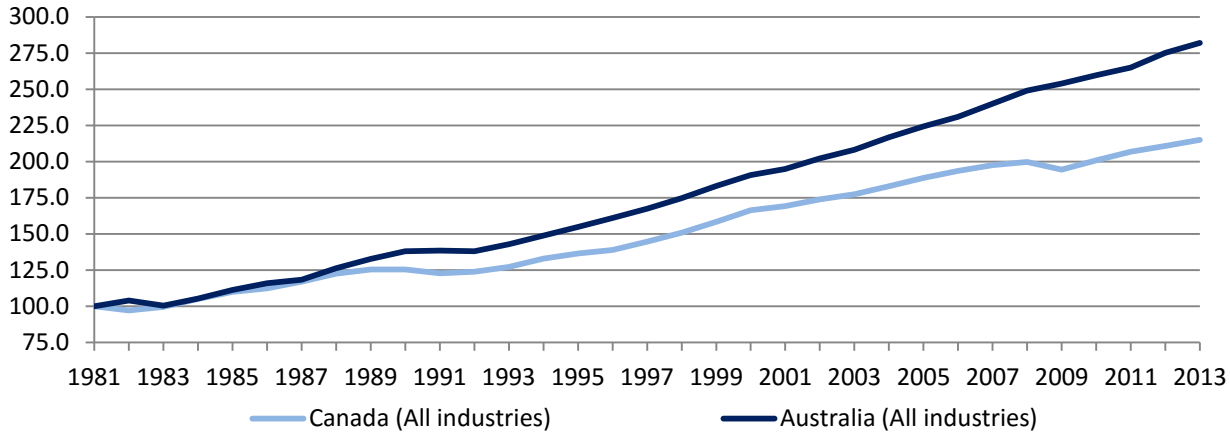
Similar to Chart 1, Chart 2 and Chart 3 compare Canada and Australia's performance in terms of real value added growth and total hours worked growth, respectively, in both the total economy and the business sector.

With respect to the total economy, Australia and Canada exhibited similar growth in real value added and total hours worked from 1981 to 1988, and thus similar labour productivity trends in both countries. Between 1988 and 2013, real value added and total hours worked began to grow more quickly in Australia's total economy compared to its Canadian counterpart. However, Canada fell further behind Australia in terms of real value added growth than it did in terms of hours worked growth over this period. As a result, Australia exhibited higher total economy labour productivity growth than Canada after 1988.

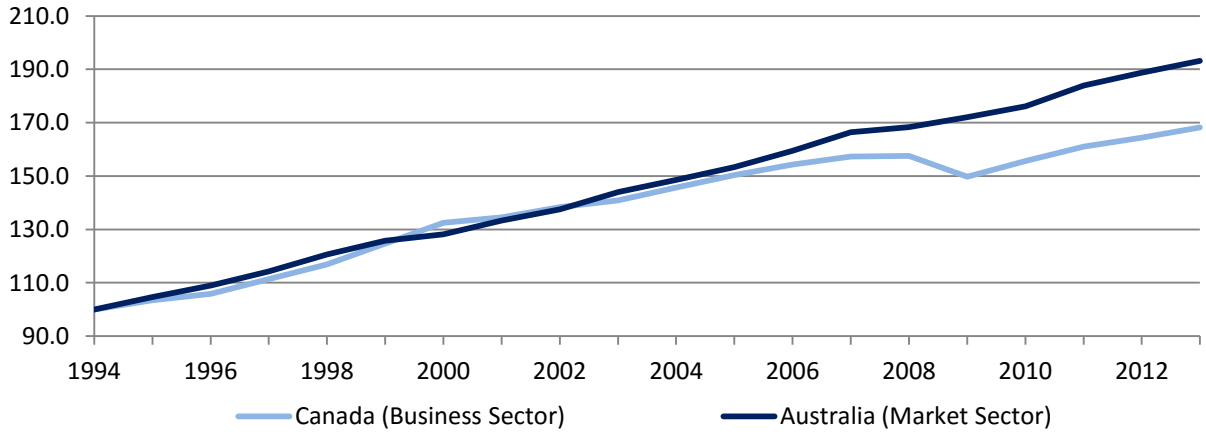
The story for the business sector is somewhat different. The weaker business sector labour productivity growth exhibited by Canada over much of the 1994-2013 period was driven by higher hours worked growth as opposed to lower real value added growth. Canada's business

sector kept pace with its Australian counterpart in terms of real value added growth from 1994 to 2006, while it surpassed its Australian counterpart in terms of growth in total hours worked. Following 2006, growth in real value added and total hours worked slowed significantly in Canada relative to Australia, largely because of the 2008-09 recession.

Chart 2: Index of Real Value Added, Canada and Australia, 1981-2013 and 1994-2013
Panel A: All Industries (1981=100)

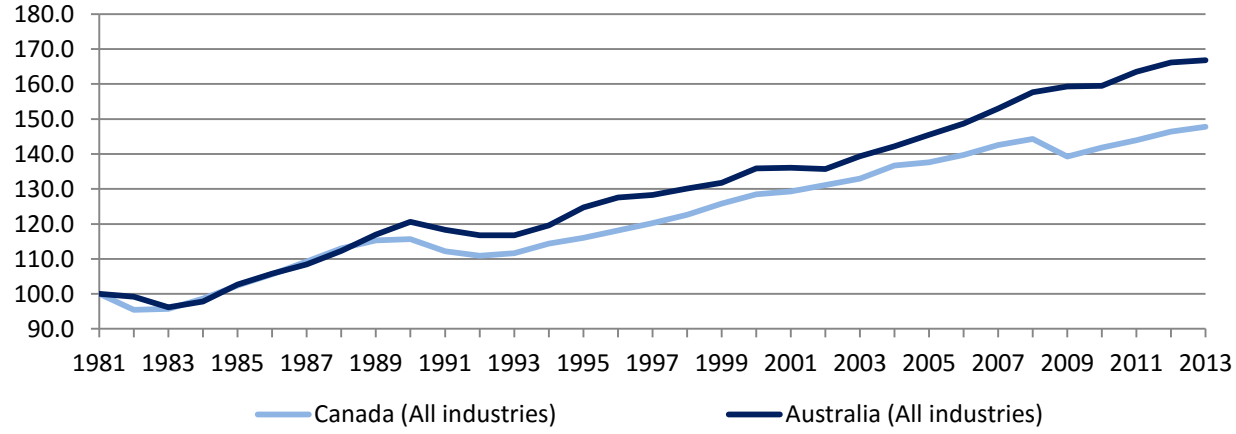


Panel B: Business/Market Sector (1994=100)

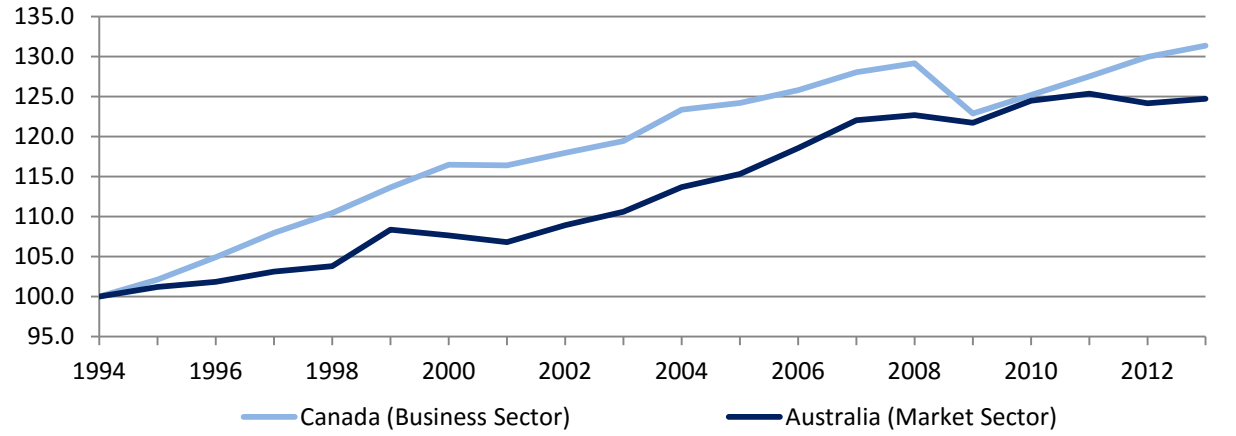


Source: CSLS calculations based on StatCan and ABS data. ABS: 5260.0.55.002 and 5204.015. StatCan: 383-0021.

Chart 3: Index of Hours Worked, Canada and Australia, 1981-2013 and 1994-2013
Panel A: All Industries (1981=100)



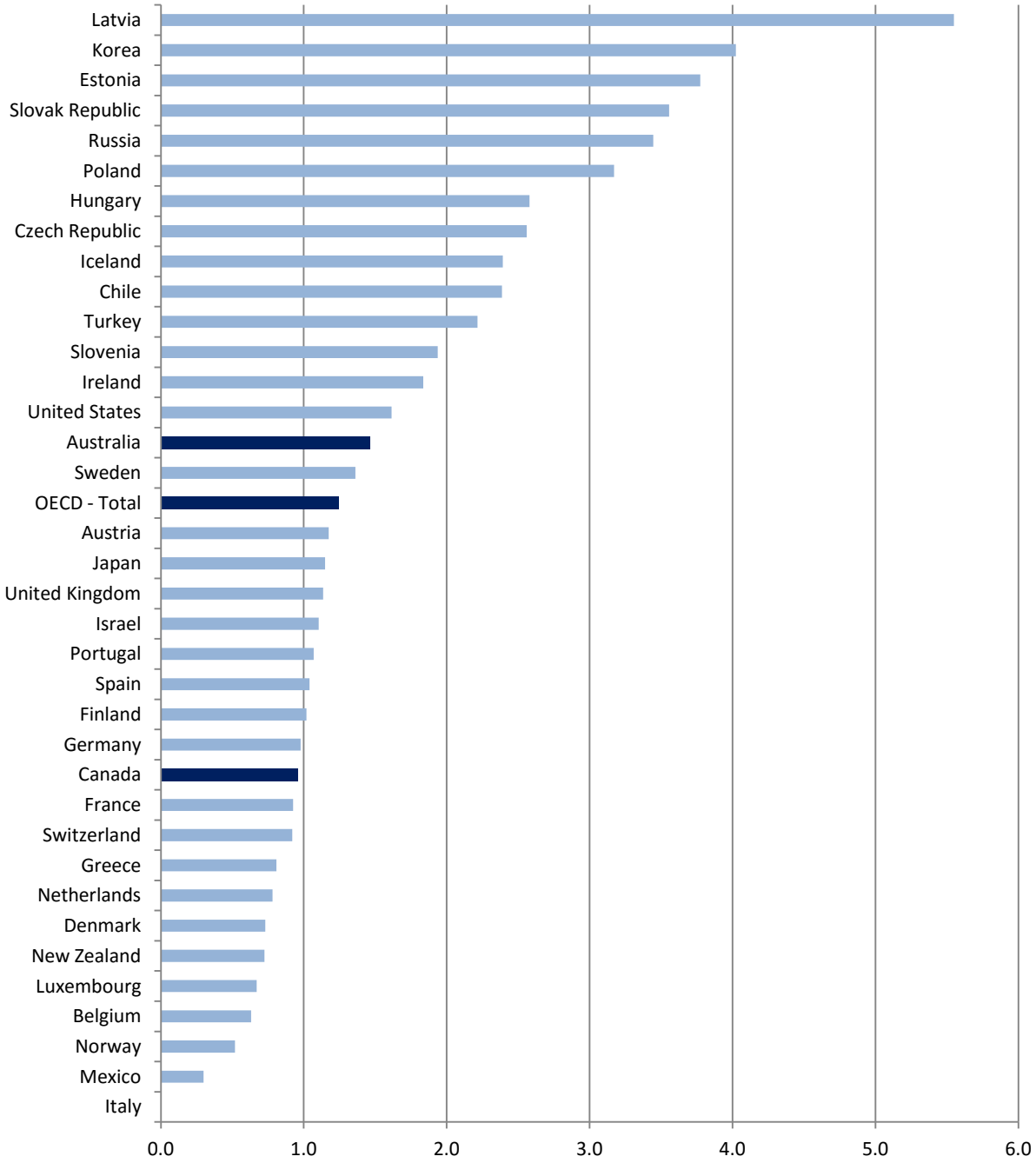
Panel B: Business/Market Sector (1994=100)



Source: CSLS calculations based on StatCan and ABS data. ABS: 5260.0.55.002 and 5204.015. StatCan: 383-0021.

Chart 4 provides an international comparison of labour productivity growth rates in 2000-2014 across OECD countries. In 2000-2014, Australia exhibited labour productivity growth of 1.46 per cent per year, 0.22 percentage points above the OECD average (1.24 per cent per year). Australia ranked 15th among the 37 countries included in the comparison. In contrast, labour productivity increased at an annual rate of 0.96 per cent in Canada, 0.29 percentage points below the OECD average. Canada ranked 26th among the 37 countries included in the comparison.

Chart 4: International Comparison of Labour Productivity Growth, All Industries, Compound Annual Growth Rate, Per Cent, OECD Countries, 2000-2014



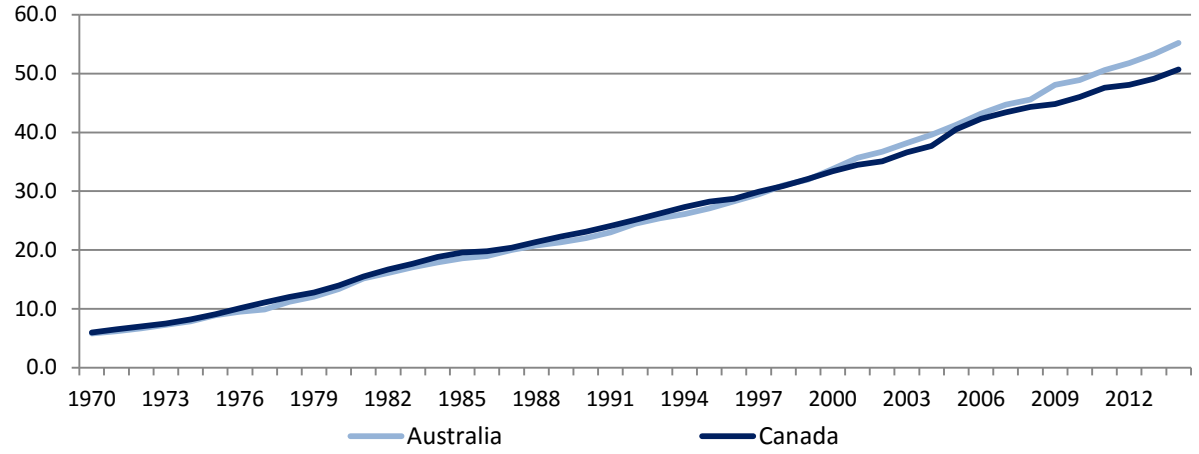
Source: CSLS calculations based on OECD data.

b. Labour Productivity Levels

We will now turn our attention to productivity level comparisons. According to Chart 5, Canada and Australia have very similar labour productivity levels (measured in PPP-adjusted U.S. dollars) over much of the 1970-2013 period, and significant changes in the relative

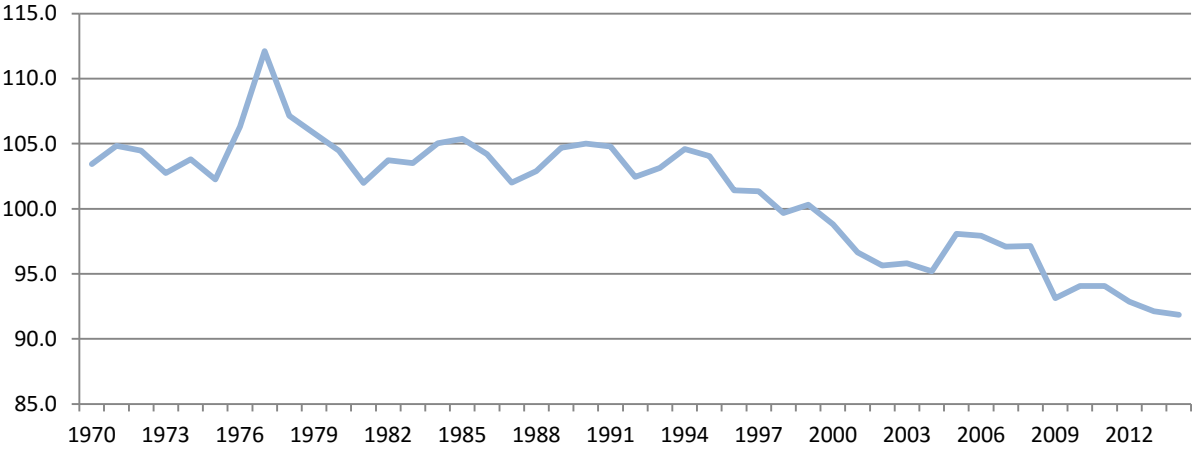
performance of the two countries did not occur until about 2000. As shown in Chart 6, labour productivity levels in Canada were roughly 0-5 per cent above those in Australia between 1970 and 1995. After 1995, labour productivity levels in Canada deteriorated significantly relative to Australia, falling from 104.1 per cent in 1995 to 91.9 per cent in 2014, reflecting relative growth rates.

Chart 5: Labour Productivity Levels, All Industries, Current PPP-adjusted U.S. Dollars, Canada and Australia, 1970-2014



Source: CSLS calculations based on OECD data.

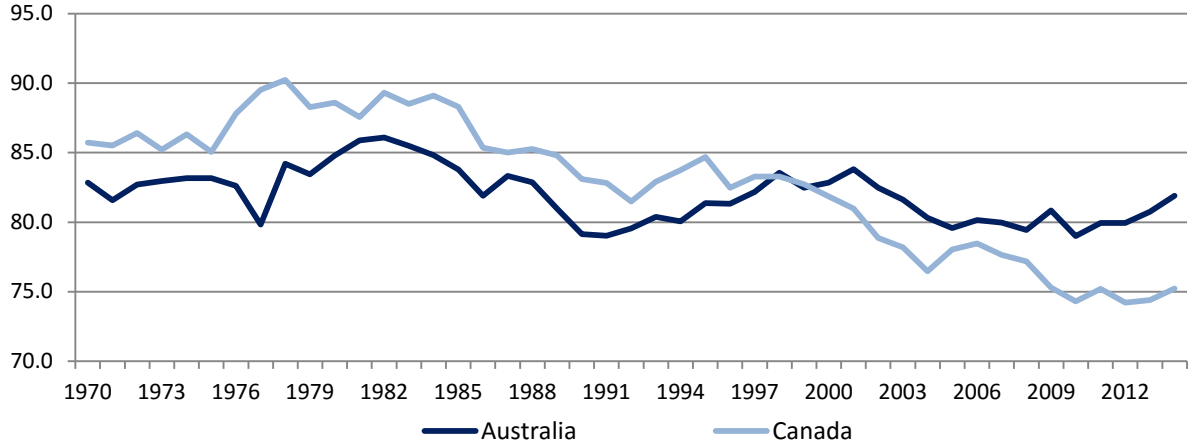
Chart 6: Labour Productivity in Canada Relative to Australia, Current PPP-adjusted U.S. Dollars, All Industries, Per Cent, 1970-2014



Source: CSLS calculations based on OECD data.

Chart 7 compares the labour productivity levels of Canada and Australia relative to those of the United States. Both countries have had lower labour productivity levels than the United States over the entire 1970-2014 period. However, while Canada's performance relative to the United States has deteriorated significantly from around 90 per cent of the U.S. level in the late-1970s and early 1980s to 75.2 per cent of the U.S. level in 2014, Australia has successfully maintained its relative labour productivity throughout the 1970-2014 period at roughly 80-85 per cent of the U.S. level.

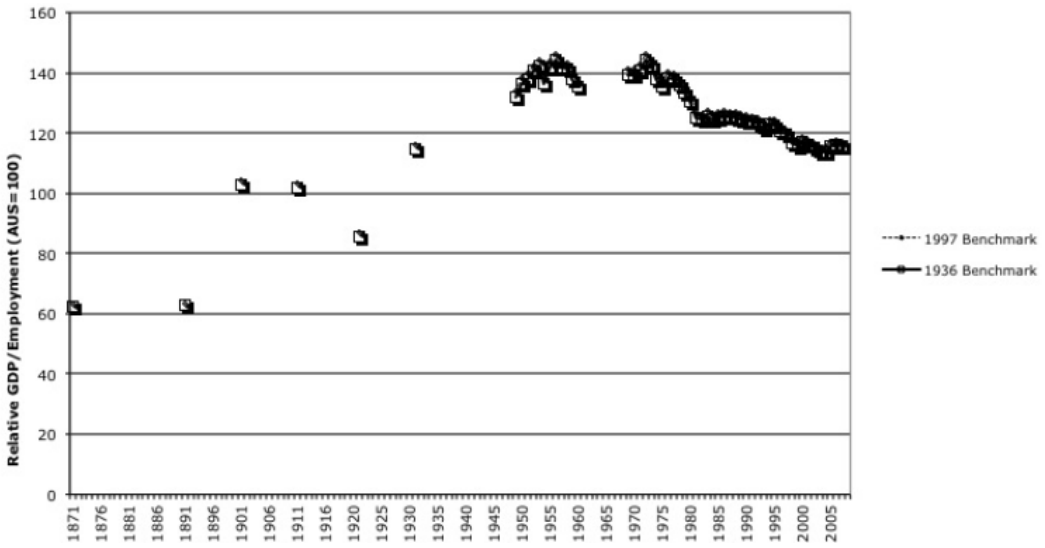
Chart 7: Labour Productivity in Canada and Australia Relative to the United States, Current PPP-adjusted U.S. Dollars, All Industries, Per Cent, 1970-2014



Source: CSLS calculations based on OECD data.

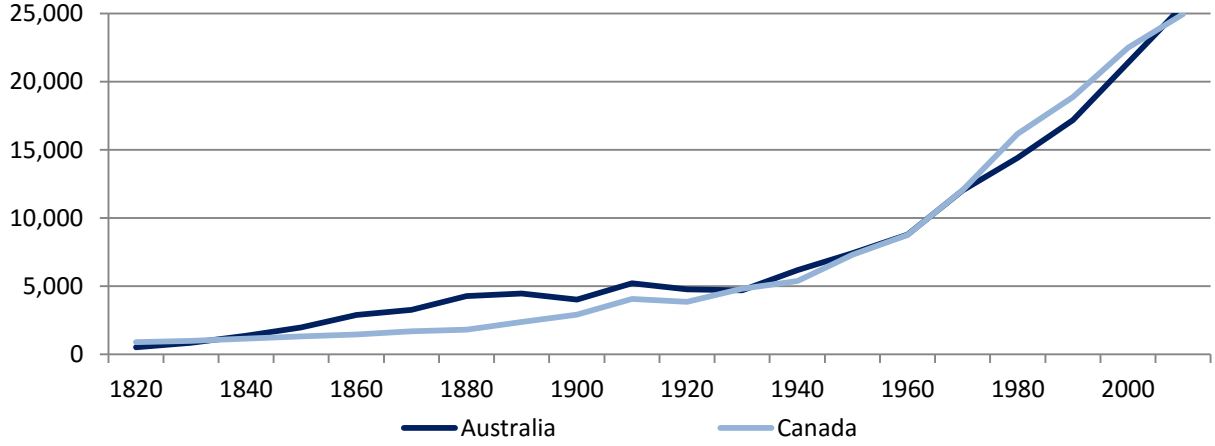
Zammit (2012) provides a longer time series comparing labour productivity levels in Canada and Australia (Chart 8). Canada had a significantly lower labour productivity level than Australia in the 19th century. However, Canada surpassed Australia in terms of its labour productivity by the turn of the century. By the end of World War II, labour productivity in Canada was about 40 per cent above that of in Australia. Following the mid-1970s, Australia began to catch up with Canada in terms of labour productivity, leading to a significant decline in the gap between the two countries, with a relative of 118 per cent by 2005.

Chart 8: Productivity in Canada Relative to Australia, PPP-adjusted All Industries, Per Cent, 1871-2009



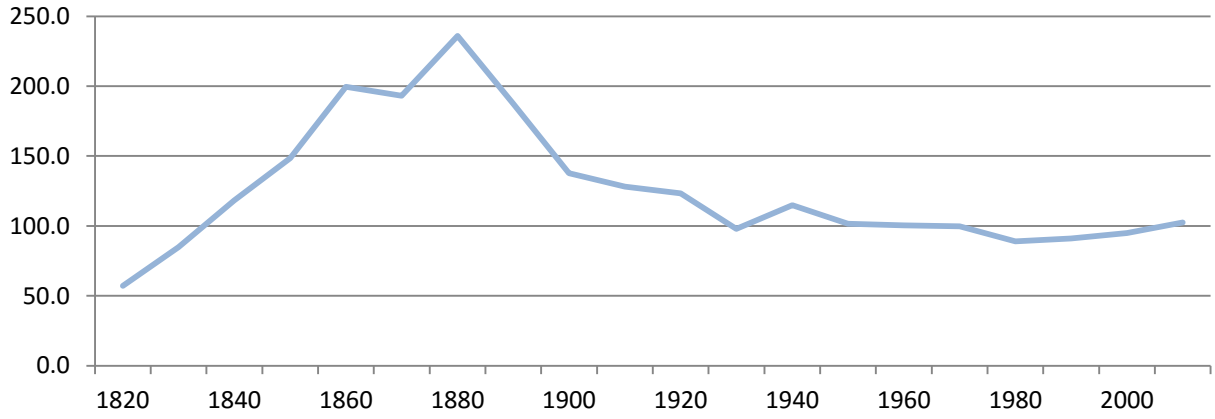
Source: Zammit (2012:35), Figure 7.

Chart 9: GDP per Capita, 1990 GK Dollars, Canada and Australia, 1820-2010



Source: New Maddison Project Database

Chart 10: GDP per Capita in Australia Relative to Canada, Per Cent, 1820-2010

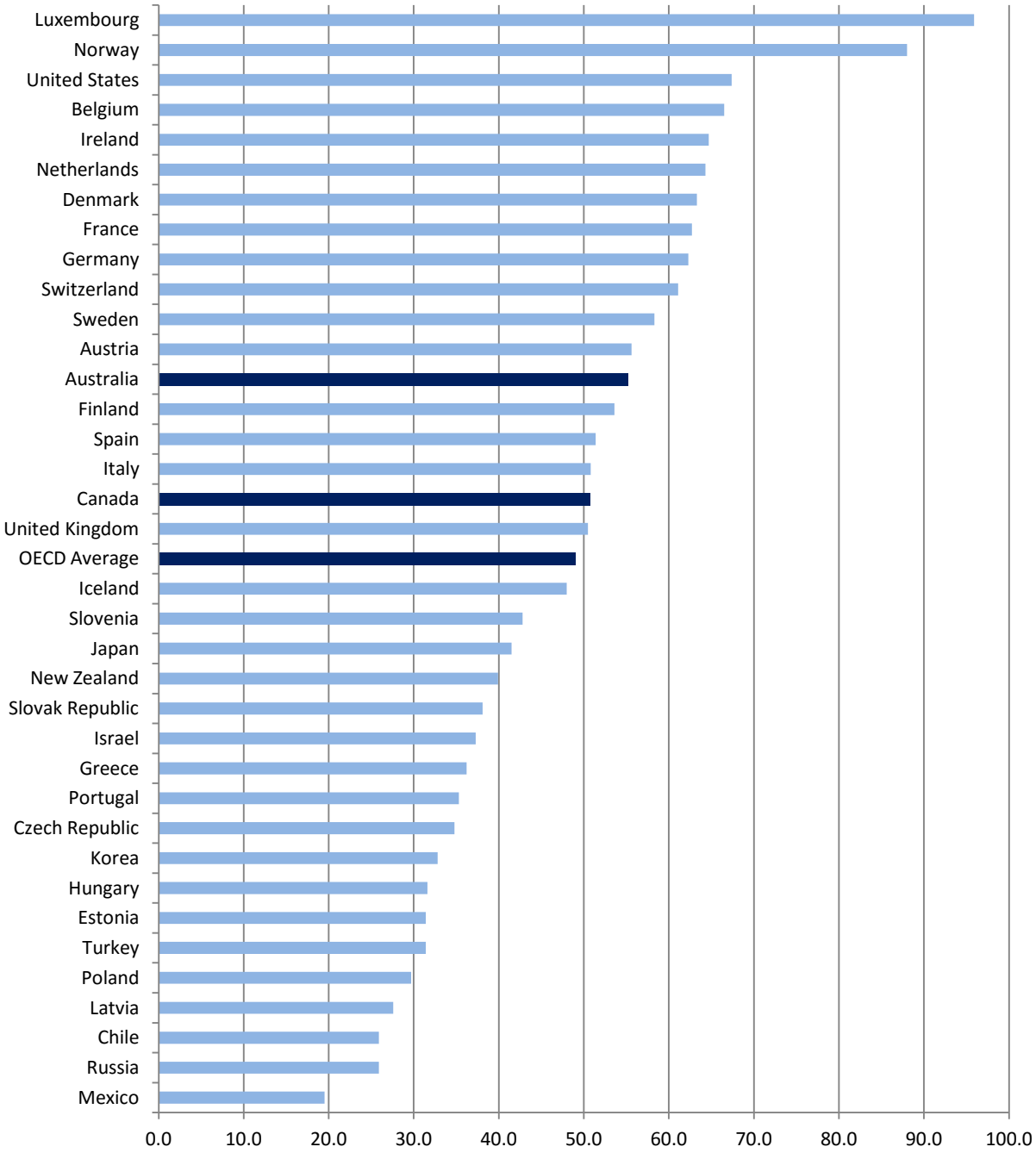


Source: New Maddison Project Database

Given the positive relationship between GDP per capita and labour productivity, it is possible to glean a historical perspective on labour productivity in Canada and Australia by examining historical trends in GDP per capita. Hence, Chart 9 and Chart 10 provide GDP per capita in Canada and Australia based on data from the New Maddison Project Database. In 2010, GDP per capita was identical in Canada and Australia. This was not always the case. Between 1830 and 1930, Australia had higher GDP per capita. Between 1860 and 1890, GDP per capita in Australia was between two and two-and-a-half times higher than GDP per capita in Canada. This enormous difference in GDP per capita between the two countries suggests that productivity was roughly twice as high. Compared to the rest of the world between 1875 and 1884, Australia had the highest GDP per capita. Australia's strong GDP per capita reflects the value of wool exports from Australia in the nineteenth century (Attard, 2006). By the end of World War II, GDP per capita in Canada reached parity with GDP per capita in Australia. Canada's GDP per capita kept pace with its Australian counterpart from 1945 to 1970. Between 1970 and the late-1990s, Canada's GDP per capita pulled ahead of Australia's GDP per capita. Between the late-1990s

and 2008, Canada's GDP per capita was slightly larger than or on par with Australia's GDP per capita. In 2008, the financial crisis pushed Canada's GDP per capita below Australia's GDP per capita.

Chart 11: International Comparison of Labour Productivity Levels (GDP per Hour), All Industries, Current PPP-adjusted U.S. Dollars, OECD Countries, 2014



Source: CSLS calculations based on OECD data.

Chart 11 provides a comparison of labour productivity in 2014 across OECD countries. In 2014, Australia ranked 13th among the 37 countries included in the comparison, while Canada ranked 17th. Australia's productivity level was 12.7 per cent above the OECD average in 2014, while Canada's was just 3.5 per cent higher than the average. Labour productivity was significantly lower in both countries than in many countries in northern Europe as well as the United States.

ii. Capital Productivity

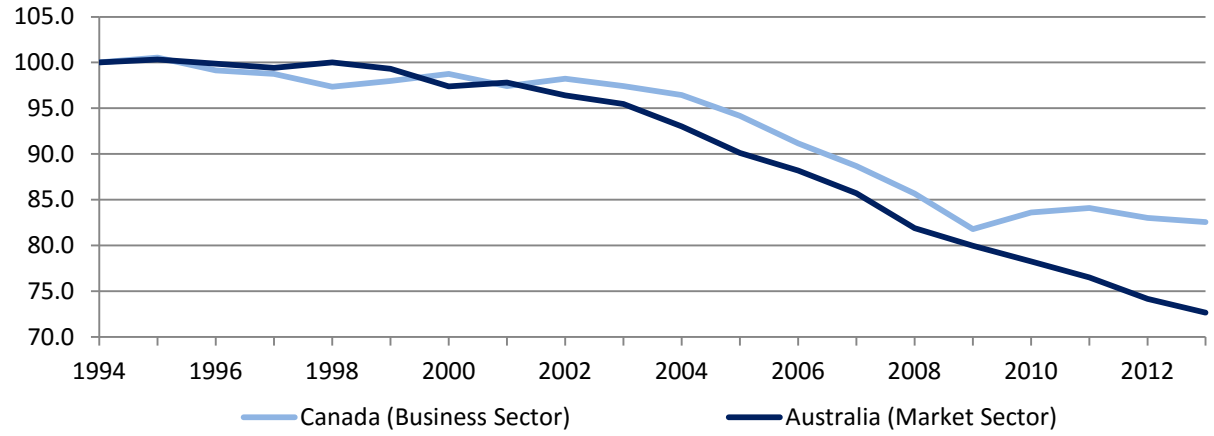
Capital productivity, defined as real value added per unit of capital services, has fallen dramatically in both the Canadian and Australian business sectors over the 1994-2013 period. In particular, capital productivity decreased 1.00 per cent per year between 1994 and 2013 in Canada, while it fell 1.67 per cent per year in Australia (Table 3). However, the declines in capital productivity were not evenly spread over the 1994-2013 period. In fact, capital productivity was stable from 1994 to 2001/2002 in both countries. However, capital productivity began to decrease rapidly in both countries after 2001/2002 (Chart 12). Capital productivity continued to fall until 2009 in Canada, after which it stabilized at 80-85 per cent of its 1994 level. In contrast, in Australia, capital productivity continued to decline throughout the 2009-2013 period and reached 72.7 per cent of its 1994 level in 2013.

Table 3: Capital Productivity Growth and Related Measures, Business/Market Sector, Compound Annual Growth Rates, Per Cent, Canada and Australia, 1994-2013

Period	Canada			Australia		
	Capital Productivity	Real Value Added	Capital Services	Capital Productivity	Real Value Added	Capital Services
1994-2013	-1.00	2.77	3.82	-1.67	3.52	5.28
1994-2000	-0.21	4.80	5.01	-0.44	4.23	4.69
2000-2013	-1.37	1.85	3.27	-2.23	3.20	5.55
2000-2008	-1.76	2.19	4.03	-2.14	3.47	5.73
2008-2013	-0.74	1.32	2.07	-2.36	2.78	5.27

Note: The estimates for Canada are for the business sector. The estimates for Australia are for the market sector.
Source: CSLS calculations based on Statistics Canada and ABS data. ABS: 5260.0.55.002. Statistics Canada: 383-0021.

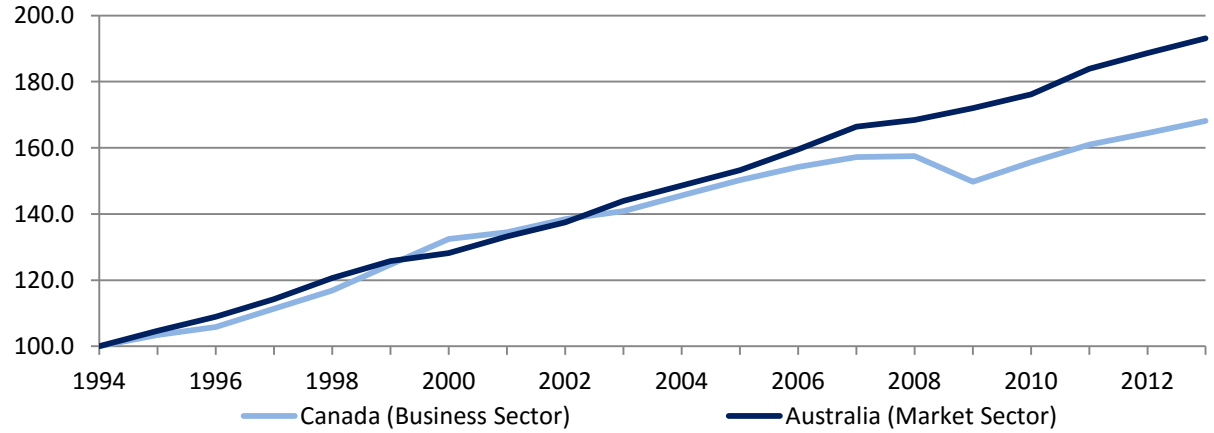
Chart 12: Index of Capital Productivity (1994=100), Business/Market Sector, Canada and Australia, 1994-2013



Source: CSLS calculations based on StatCan and ABS data.

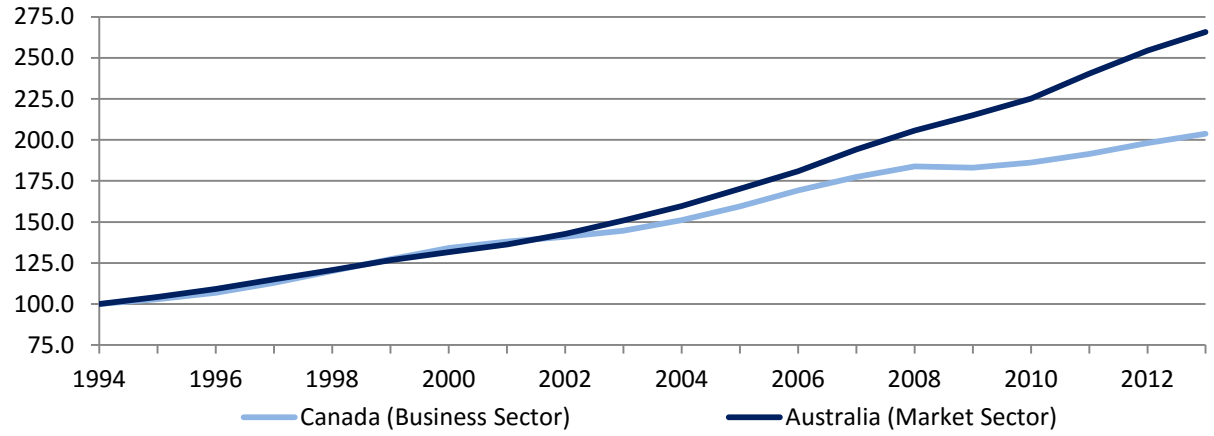
Chart 13 and Chart 14 compare Canada and Australia's performance in terms of real value added growth and capital services growth, respectively, in the business sector. Australia and Canada exhibited comparable growth in real value added and capital services from 1994 to 2002, leading to similar capital productivity trends. Between 2002 and 2009, real value added and capital services began to grow more quickly in Australia compared to Canada. However, Canada fell further behind Australia in terms of capital services growth than it did in terms of real value added growth over this period. As a result, Australia exhibited much steeper declines in business sector capital productivity than Canada from 2002 to 2009. The slower decline in business sector capital productivity growth exhibited by Canada during the 2009-2013 period was driven by a dramatic halving in capital services growth which was much greater than the slowdown in real value added growth. Australia did not experience a slowdown in capital services growth and real value added growth after 2008.

Chart 13: Index of Real Value Added (1994=100), Business/Market Sector, Canada and Australia, 1994-2013



Source: CSLS calculations based on StatCan and ABS data. ABS: 5260.0.55.002. StatCan: 383-0021.

Chart 14: Capital Services (1994=100), Business/Market Sector, Canada and Australia, 1994-2013



Source: CSLS calculations based on StatCan and ABS data. ABS: 5260.0.55.002. StatCan: 383-0021.

iii. Multifactor Productivity

Both Canada and Australia have experienced extremely weak multifactor productivity (MFP) growth over the 1994-2013 period (Table 4 and Chart 15).[12] Over the 1994-2013 period as a whole, MFP in the business/market section increased 0.07 and 0.37 per cent per year in Canada and Australia, respectively. Trends in MFP growth were quite similar in Canada and Australia over this period. Both countries exhibited relatively strong growth in MFP from 1994 to 2002 in Canada and 2003 in Australia after which MFP declined until 2009 in Canada and 2010 in Australia. Following this, MFP was relatively stable, exhibiting slightly positive growth rates in both countries.

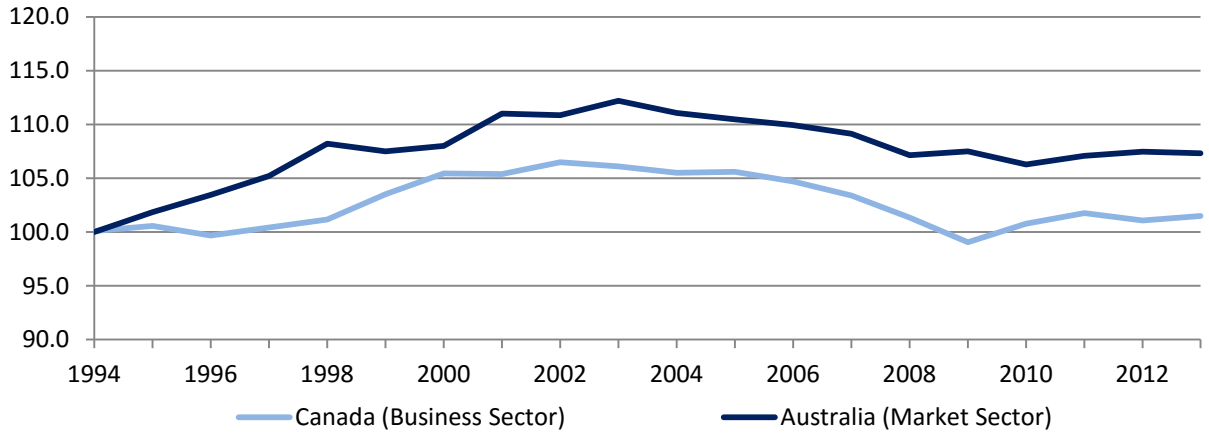
Table 4: Multifactor Productivity Growth, Business/Market Sector, Compound Annual Growth Rates, Per Cent, Canada and Australia, 1994-2013

Period	Canada	Australia
1994-2013	0.07	0.37
1994-2000	0.87	1.28
2000-2013	-0.29	-0.05
2000-2008	-0.50	-0.10
2008-2013	0.03	0.03

Source: CSLS calculations based on Statistics Canada and ABS data. ABS: 5260.0.55.002. Statistics Canada: 383-0021.

[12] MFP is calculated as the ratio of value added to an index of combined labour and capital inputs. Therefore, MFP growth is a residual, reflecting output growth that is not accounted for by measured input growth.

Chart 15: Index of Multifactor Productivity (1994=100), Business/Market Sector, Canada and Australia, 1994-2013



Source: CSLS calculations based on StatCan and ABS data. ABS: 5260.0.55.002. StatCan: 383-0021.

iv. Summary

Table 5 summarizes the key figures presented in this sub-section. In particular, it provides growth rates for labour productivity, capital productivity, MFP, real value added, total hours worked and capital services for the Canadian and Australian business sectors for multiple sub-periods between 1994 and 2013.

Table 5: Productivity Growth and Related Measures, Business/Market Sector, Compound Annual Growth Rates, Per Cent, Canada and Australia, 1994-2013

Period	Canada						Australia					
	LP	CP	MFP	VA	HW	CS	LP	CP	MFP	VA	HW	CS
1994-2013	1.31	-1.00	0.07	2.77	1.45	3.82	2.33	-1.67	0.37	3.52	1.17	5.28
1994-2000	2.16	-0.21	0.87	4.80	2.57	5.01	2.95	-0.44	1.28	4.23	1.24	4.69
2000-2013	0.92	-1.37	-0.29	1.85	0.93	3.27	2.04	-2.23	-0.05	3.20	1.14	5.55
2000-2008	0.88	-1.76	-0.50	2.19	1.30	4.03	1.79	-2.14	-0.10	3.47	1.65	5.73
2008-2013	0.97	-0.74	0.03	1.32	0.34	2.07	2.44	-2.36	0.03	2.78	0.33	5.27

Note: "LP" stands for labour productivity. "CP" stands for capital productivity. "VA" stands for real value added. "HW" stands for hours worked. "CS" stands for capital services. The estimates for Canada are for the business sector. The estimates for Australia are for the market sector.
Source: CSLS calculations based on Statistics Canada and ABS data. ABS: 5260.0.55.002. Statistics Canada: 383-0021.

B. Industry Level

i. Labour Productivity

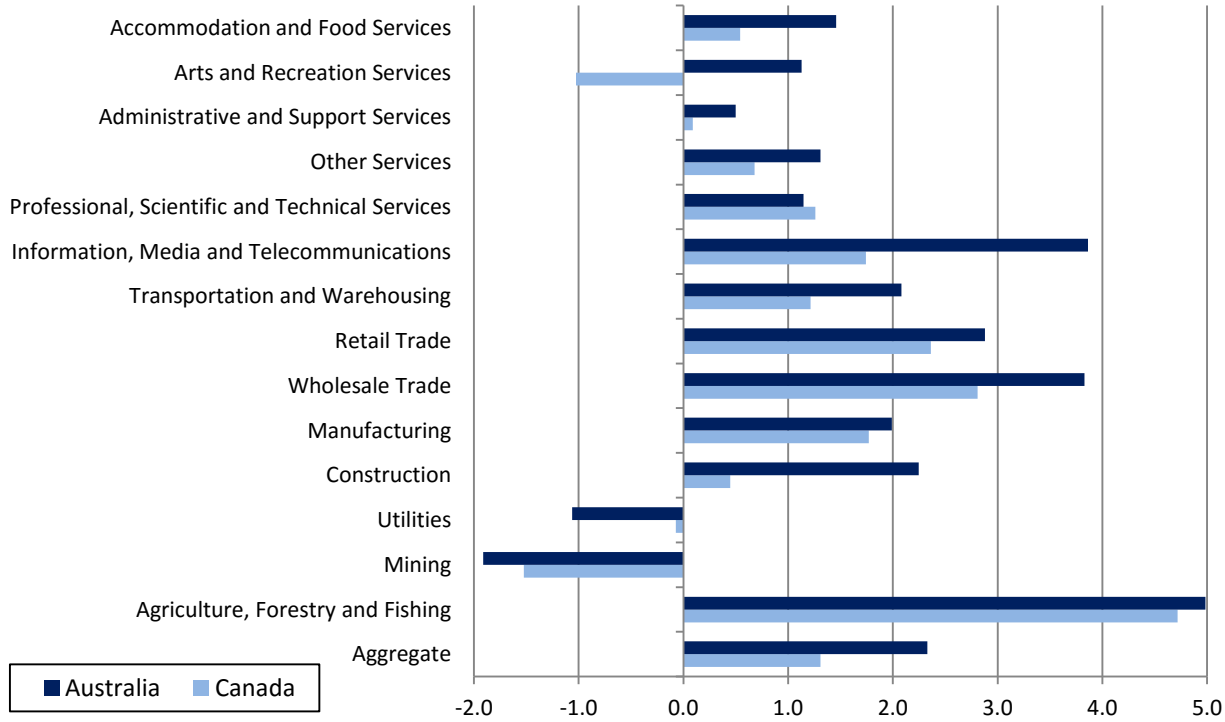
a. Labour Productivity Growth

Between 1994 and 2013, Australia outperformed Canada in terms of labour productivity growth in every industry except for utilities, mining, and professional and technical services

(Chart 16).[13] Some of the most striking cases were: arts and recreation services, where Australia saw labour productivity growth that was 2.15 percentage points higher than Canada; information media and telecommunications (2.12 percentage points); and construction (1.80 percentage points). In the aggregate, Australia exhibited labour productivity growth that was 1.02 percentage points higher than what was seen in Canada (2.33 per cent versus 1.31 per cent).

In both countries, agriculture, forestry and fishing exhibited the strongest labour productivity performance, followed by information media and telecommunications in Australia and wholesale trade and retail trade in Canada. In contrast, labour productivity growth was negative in utilities and mining in both countries and negative in arts and recreation services in Canada.

Chart 16: Labour Productivity Growth, Business/Market Sector Industries, Compound Annual Growth Rates, Per Cent, Canada and Australia, 1994-2013

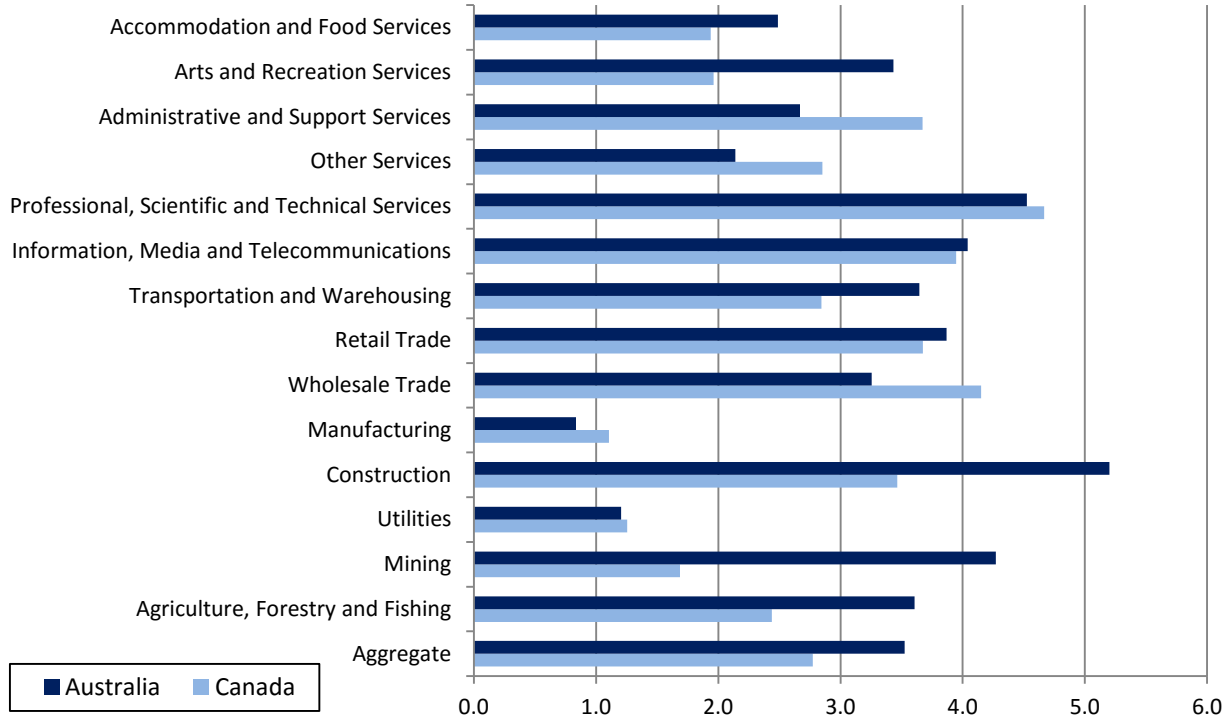


Note: "Aggregate" refers to the business sector for Canada and the market sector for Australia

[13] It is important to note that, while the list of industries is quite similar for both countries, there are two small differences. First, the decomposition for Canada includes "other private services" whereas the decomposition for Australia includes "other services." "Other private services" is somewhat broader: it includes the business sector components of health care and education alongside "other services." Second, "financial and insurance services" and "rental, hiring and real estate services" are separate industries for Australia, while they are aggregated under "finance, insurance, real estate and renting and leasing" for Canada. Furthermore, in Australia, waste management is classified as part of 'utilities,' while in Canada, it is classified as part of 'administrative and support, waste management and remediation services.' In this report, 'agriculture, fishing, forestry' and 'agriculture, fishing, forestry and hunting' are used interchangeably. In Canada, the 'hunting' sub-industry is always included in this category, whether or not it features in the title.

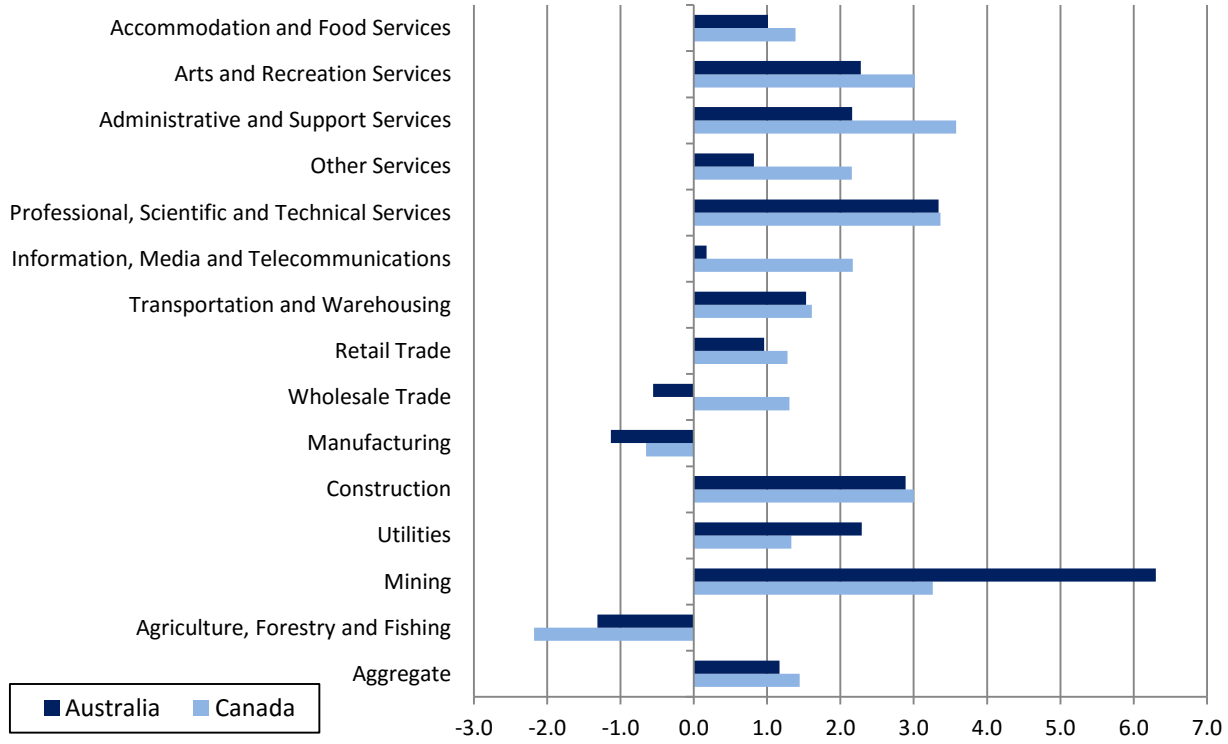
Chart 17 and Chart 18 provide real value added growth and total hours worked growth by industry for the 1994-2013 period. Australia surpassed Canada in terms of real value added growth in eight of fourteen industries, while Australia outperformed Canada in terms of total hours worked growth in only three of fourteen industries. At the aggregate level, 0.75 percentage points (or 73.1 per cent) of the difference in labour productivity growth between Australia and Canada in 1994-2013 was due to higher real value added growth in Australia than Canada (3.52 per cent per year versus 2.77 per cent per year) and 0.28 percentage points (or 26.9 per cent) was due to slower growth in total hours worked in Australia.

Chart 17: Real Value Added Growth, Business/Market Sector Industries, Compound Annual Growth Rates, Per Cent, Canada and Australia, 1994-2013



Note: "Aggregate" refers to the business sector for Canada and the market sector for Australia.
Source: CSLS calculations based on Statistics Canada and ABS data. ABS: 5260.0.55.002. Statistics Canada: 383-0021.

Chart 18: Hours Worked Growth, Business/Market Sector Industries, Compound Annual Growth Rates, Per Cent, Canada and Australia, 1994-2013

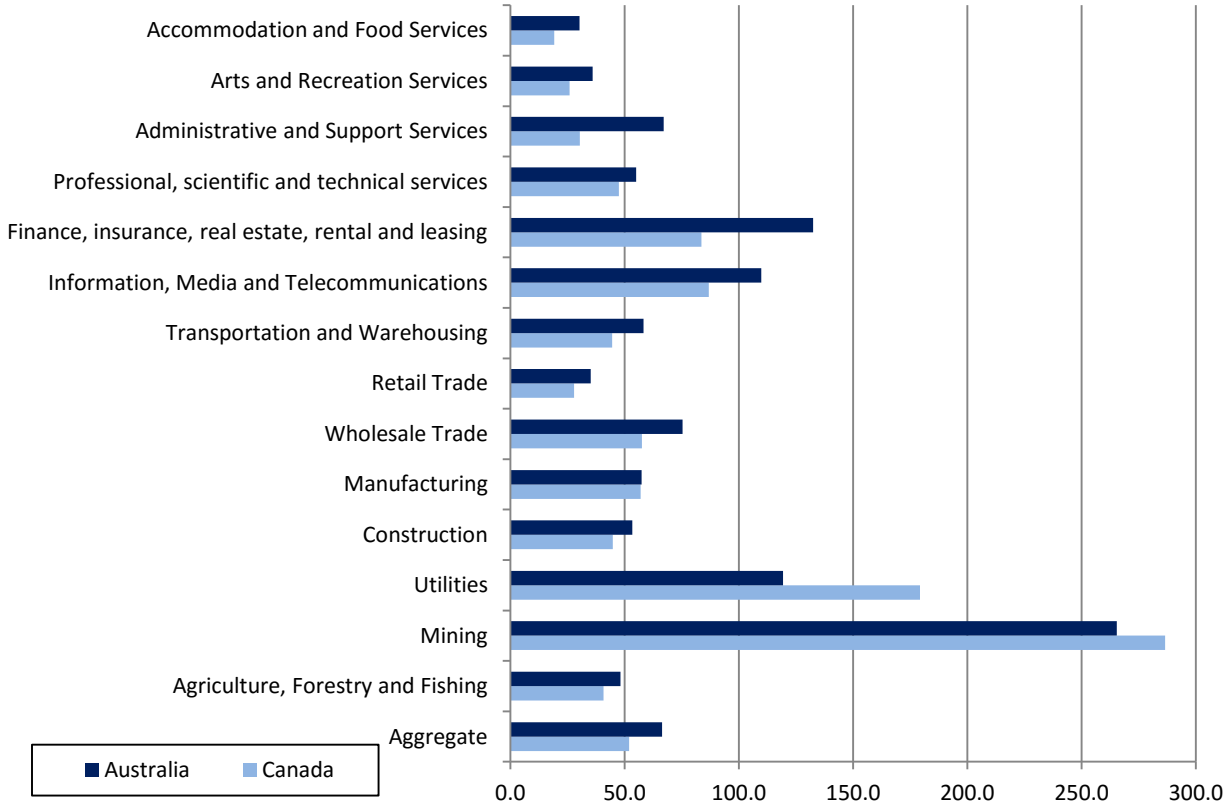


Note: "Aggregate" refers to the business sector for Canada and the market sector for Australia.
Source: CSLS calculations based on Statistics Canada and ABS data. ABS: 5260.0.55.002. Statistics Canada: 383-0021.

b. Labour Productivity Levels

Chart 19 compares labour productivity levels in Canada and Australia for fourteen industries and at the business sector level. In 2011, labour productivity levels were higher in Australia than in Canada in twelve of fourteen industries. This is unsurprising given the higher labour productivity growth rates exhibited by Australia in most of these industries in 1994-2013. In fact, the only two industries for which Canada had higher labour productivity levels than Australia – utilities and mining – were also the two industries for which Canada outperformed Australia in terms of labour productivity growth, excluding professional and technical services.

Chart 19: Labour Productivity Levels by Industry, PPP-Adjusted Canadian Dollars, Canada and Australia, 2011



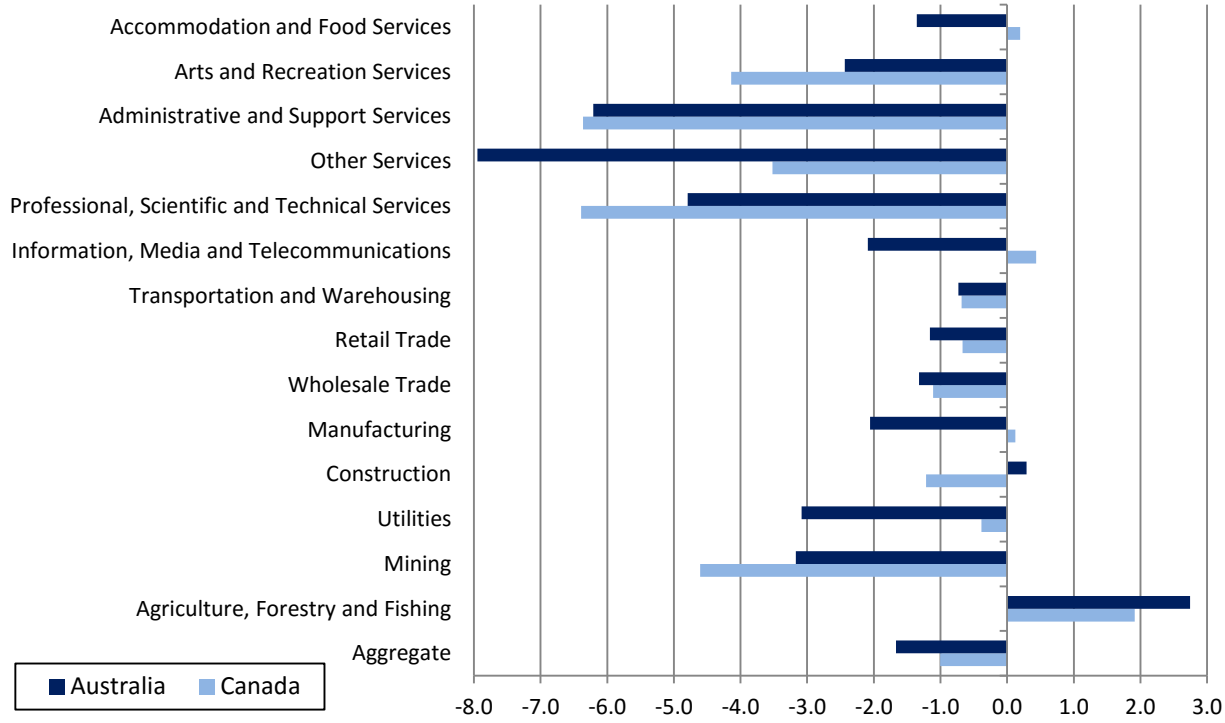
Note: "Aggregate" refers to the business sector for Canada and the market sector for Australia.
Source: CSLS calculations based on Statistics Canada and ABS data. ABS: 5204.0005 and 6291.0.55.003. Statistics Canada: 383-0029 and 380-0037.

ii. Capital Productivity

Although Australia exhibited stronger real value added growth than Canada in almost every industry and at the aggregate level (0.75 percentage points), the difference between Australia and Canada in terms of capital services growth was even larger (1.46 percentage points) (Chart 21). As a result, Australia exhibited a more rapid decrease in capital productivity than Canada in most industries and at the aggregate level.

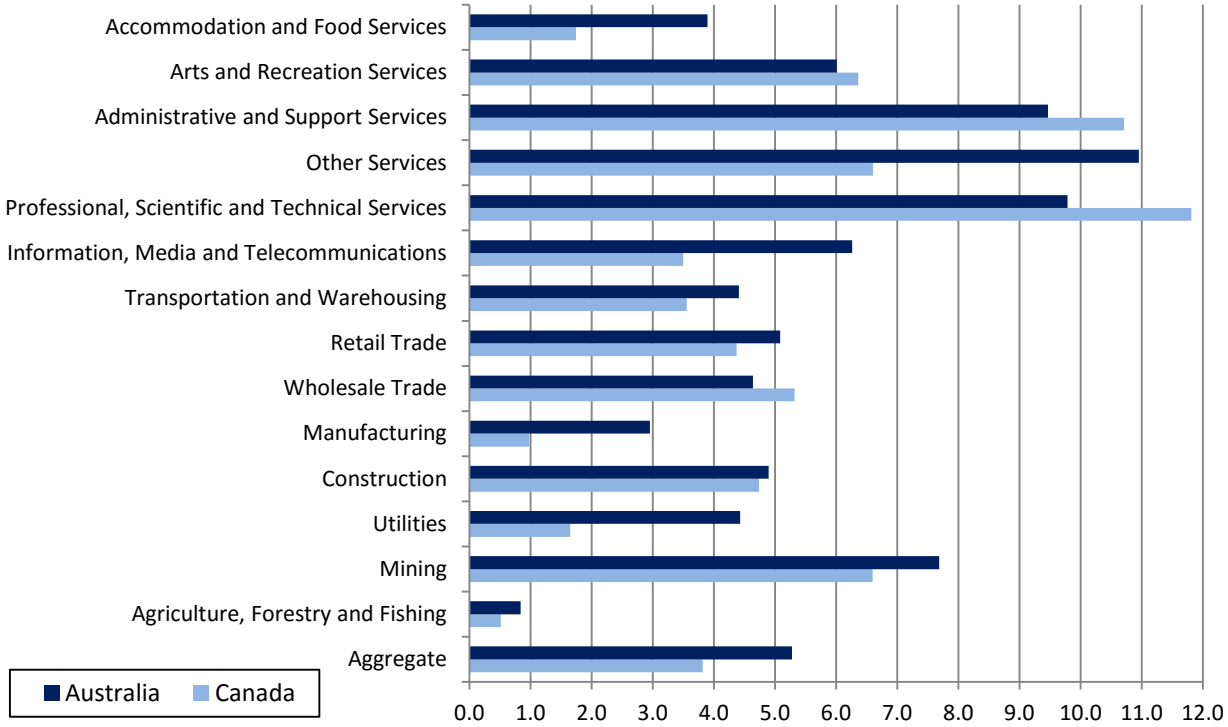
Between 1994 and 2013, Canada achieved higher capital productivity growth (which often simply means smaller declines in capital productivity) than Australia in eight of fourteen industries and at the aggregate level (Chart 20). Capital productivity growth was positive in only two of fourteen industries in Australia compared to four of fourteen industries in Canada. At the aggregate level, Canada experienced a decline of 1.00 per cent per year in capital productivity, 0.67 percentage points above the decline of 1.67 per cent per year in Australia.

Chart 20: Capital Productivity Growth, Business/Market Sector Industries, Compound Annual Growth Rates, Per Cent, Canada and Australia, 1994-2013



Source: CSLS calculations based on Statistics Canada and ABS data. ABS: 5260.0.55.002. Statistics Canada: 383-0021.

Chart 21: Capital Services Growth, Business/Market Sector Industries, Compound Annual Growth Rates, Per Cent, Canada and Australia, 1994-2013



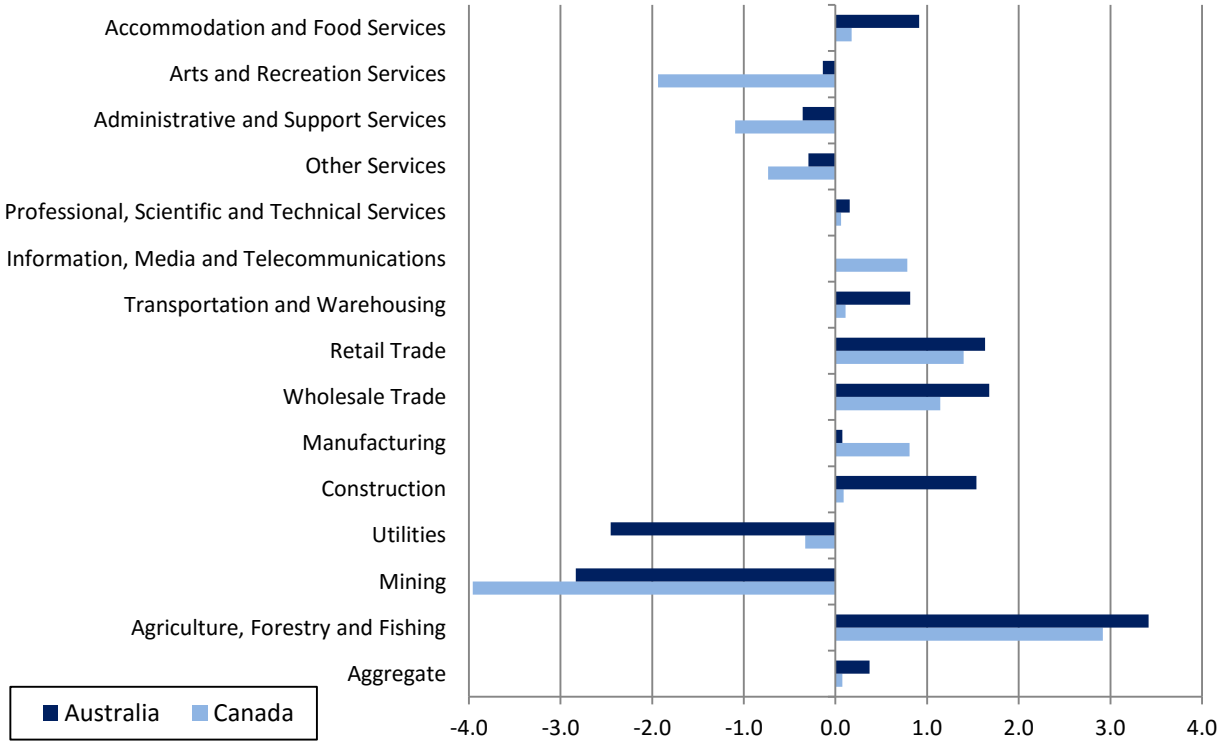
Note: "Aggregate" refers to the business sector for Canada and the market sector for Australia.
Source: CSLS calculations based on Statistics Canada and ABS data. ABS: 5260.0.55.002. Statistics Canada: 383-0021.

iii. Multifactor Productivity

Between 1994 and 2013, Australia outperformed Canada in terms of MFP growth in eleven of fourteen industries and at the aggregate level (Chart 22). The gap in MFP growth between the two countries was particularly large for arts and recreation (1.80 percentage points), construction (1.45 percentage points), and mining (1.13 percentage points).

In both countries, agriculture, forestry and fishing exhibited the strongest MFP growth, followed by wholesale and retail trade. In contrast, MFP growth was negative in utilities, mining, arts and recreation services, administrative and support services, and other services in both countries.

Chart 22: Multifactor Productivity Growth, Business/Market Sector Industries, Compound Annual Growth Rates, Per Cent, Canada and Australia, 1994-2013



Note: "Aggregate" refers to the business sector for Canada and the market sector for Australia.
Source: CSLS calculations based on Statistics Canada and ABS data. ABS: 5260.0.55.002. Statistics Canada: 383-0021.

iv. Summary

Table 6 highlights the key figures presented throughout this sub-section. It provides industry growth rates for labour productivity, capital productivity, MFP, real value added, total hours worked and capital services for Canada and Australia for the 1994-2013 period. It is important to point out that there are different industry classifications in Australia and Canada,

which this table accommodates appropriately. For example, ‘finance and insurance, real estate and rental and leasing’ is one industry in Canada, while it is two separate industries in Australia: ‘financial and insurance services’ and ‘rental, hiring and real estate services.’

Table 6: Productivity Growth and Related Measures, Business/Market Sector Industries, Compound Annual Growth Rates, Per Cent, Canada and Australia, 1994-2013

Canada							Australia						
Industry	LP	CP	MFP	Y	HW	CS	LP	CP	MFP	Y	HW	CS	Industry
Business sector	1.31	-1.00	0.07	2.77	1.45	3.82	2.33	-1.67	0.37	3.52	1.17	5.28	Market sector industries
Agriculture, forestry, fishing and hunting	4.72	1.92	2.92	2.44	-2.18	0.51	4.99	2.75	3.42	3.61	-1.31	0.84	Agriculture, forestry and fishing
Mining and oil and gas extraction	-1.52	-4.61	-3.96	1.69	3.26	6.60	-1.91	-3.17	-2.83	4.27	6.30	7.69	Mining
Utilities	-0.07	-0.39	-0.33	1.25	1.33	1.65	-1.06	-3.09	-2.45	1.21	2.29	4.43	Electricity, gas, water and waste services
Construction	0.45	-1.22	0.09	3.47	3.00	4.74	2.25	0.29	1.54	5.20	2.89	4.90	Construction
Manufacturing	1.77	0.12	0.81	1.11	-0.65	0.98	1.99	-2.05	0.08	0.84	-1.13	2.95	Manufacturing
Wholesale trade	2.81	-1.11	1.15	4.15	1.31	5.32	3.83	-1.32	1.68	3.25	-0.55	4.64	Wholesale trade
Retail trade	2.36	-0.67	1.40	3.67	1.28	4.37	2.88	-1.16	1.63	3.87	0.96	5.08	Retail trade
Transportation and warehousing	1.21	-0.68	0.11	2.84	1.61	3.55	2.08	-0.73	0.82	3.65	1.53	4.41	Transport, postal and warehousing
Information and cultural industries	1.74	0.43	0.78	3.95	2.17	3.50	3.86	-2.09	-0.01	4.04	0.17	6.26	Information, media and telecommunications
Finance, insurance, real estate and renting and leasing	1.49	-0.09	0.39	3.20	1.69	3.30	3.55	1.17	1.81	5.07	1.47	3.85	Financial and insurance services
							0.58	-5.27	-2.89	2.86	2.26	8.58	Rental, hiring and real estate services
Professional, scientific and technical services	1.26	-6.39	0.06	4.67	3.36	11.81	1.15	-4.79	0.15	4.52	3.34	9.79	Professional, scientific and technical services
Other services	0.68	-3.52	-0.74	2.85	2.16	6.61	1.31	-7.95	-0.30	2.14	0.82	10.96	Other services
Administrative and support, waste management and remediation services	0.09	-6.36	-1.10	3.67	3.58	10.71	0.50	-6.21	-0.36	2.67	2.16	9.47	Administrative and support services
Arts, entertainment and recreation	-1.02	-4.14	-1.94	1.96	3.02	6.36	1.13	-2.43	-0.14	3.43	2.28	6.01	Arts and recreation services
Accommodation and food services	0.54	0.19	0.18	1.94	1.39	1.74	1.46	-1.35	0.92	2.49	1.01	3.89	Accommodation and food services
Other private services	0.72	-2.80	-0.07	2.41	1.68	5.36	...	...	...	...	...	...	No corresponding industry

Note: "LP" stands for labour productivity. "CP" stands for capital productivity. "VA" stands for real value added. "HW" stands for hours worked. "CS" stands for capital services. The estimates for Canada are for the business sector. The estimates for Australia are for the market sector.
Source: CSLS calculations based on Statistics Canada and ABS data. ABS: 5260.0.55.002. Statistics Canada: 383-0021.

III. Sources of Labour Productivity Growth

This section seeks to understand the reasons behind the superior productivity performance of Australia. In particular, we will examine the sources of labour productivity growth in Australia and Canada from a growth accounting perspective. The impact of other factors not captured in a growth accounting analysis that have been identified in the literature as contributing to productivity growth will also be discussed.

A. Growth Accounting Framework

A good starting point for any analysis of productivity growth is the standard neo-classical growth accounting model, which is formally derived in Appendix B. Using the standard growth accounting framework, three factors contribute to labour productivity growth: 1) capital services intensity growth; 2) labour composition growth; and 3) MFP growth. These factors are discussed in more detail below.

The three factors highlighted below are often referred to as the *sources* of labour productivity growth. It is important to keep in mind, however, that they are (in general) only proximate causes of growth, and can be affected by several underlying factors, such as governance.

i. Capital Services Intensity

When used in a production process, capital stock generates a flow of *capital services* (also known as *capital input*). Different capital assets provide services at different rates. As Baldwin, Gu and Yan (2007:24) note:

> Short-lived assets, such as a car or computer, must provide all of their services in just the few years before they completely depreciate. Office buildings provide their services over decades. So, in a year, a dollar's worth of a car provides relatively more services than a dollar's worth of a building.

Thus, capital services *growth* is a function of two components: 1) capital stock growth; and 2) shifts in the composition of capital, caused by more investment in assets that provide relatively more services per dollar of capital stock (*i.e.*, short-lived assets). What is relevant to labour productivity growth, however, is not the growth in capital services *per se*, but the growth in capital services per hour worked. In general, the more capital a worker has at her disposal, the more productive she is. The ratio between capital services and hours worked is called *capital services intensity*.[14]

[14] An additional cause of change in the composition of capital is changes in the assumed service life for a particular asset. If the

ii. Labour Composition

Labour composition captures (albeit very imperfectly) improvements in human capital. Statistics Canada defines labour composition as the ratio between labour input and hours worked. Labour input, in turn, is obtained by aggregating hours worked across different categories of workers using hourly compensation as weights. The variables used to categorize workers are: education (broken down into four levels), experience (proxied by seven age groups), and class of workers (paid employees vs. self-employed workers). Overall, there are 56 different categories of workers. Like capital services, labour input *growth* can be decomposed into two components: 1) hours growth; and 2) labour composition growth.

iii. Multifactor Productivity

Finally, MFP is the ratio between output and combined labour and capital inputs. Therefore, MFP growth is a residual, reflecting output growth that is not accounted for by measured input growth. MFP growth can be explained by a number of very different factors, such as improvements in technology and organization, capacity utilization, returns to scale, etc. It also embeds errors due to the mismeasurement of inputs and outputs.

B. Results: Aggregate Level

Between 1994 and 2013, labour productivity growth in Canada and in Australia was driven by capital intensity,[15] representing over 70 per cent of growth in each country (Table 7 and Chart 23). However, the next largest contributor to labour productivity in Australia was MFP (15.8 per cent or 0.37 percentage points), while it was labour composition in Canada (22.4 per cent or 0.29 percentage points). It is important to note that the disparity in the contribution of capital intensity between Canada and Australia was quite large, at 0.72 percentage points, accounting for 71.1 per cent of the overall gap in labour productivity growth between the two countries. The remaining 28.8 per cent of the overall gap was due to higher MFP growth in Australia compared to Canada, while labour composition growth contributed a negligibly to the overall gap.

When broken down into sub-periods, Australia shows higher values for each component in almost every breakdown. The only exceptions are labour composition in the period 1994-2000 and 2000-2008, as well as MFP growth in 2008-2013. A larger contribution from capital

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service life decreases due to a lower life expectancy for a particular asset, depreciation will increase and there will be capital services growth.

[15] Please note that capital intensity and capital deepening will be used interchangeably, referring to capital input over labour input.

intensity growth was consistently the main driver of the stronger labour productivity growth rate of Australia across the sub-periods.

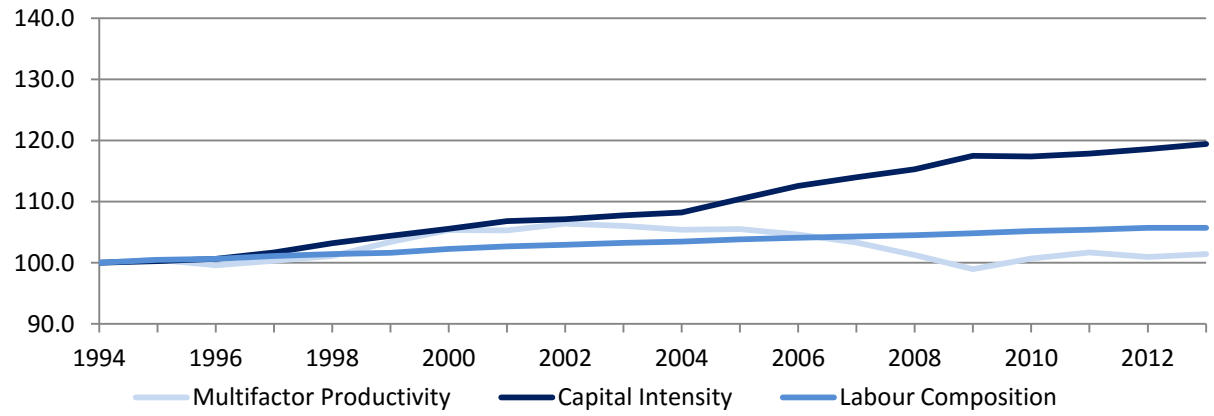
Table 7: Sources of Labour Productivity Growth, Business/Market Sector, Compound Annual Growth Rates, Per Cent or Percentage Points, Canada and Australia, 1994-2013

Period	Canada				Australia			
	LP	MFP	CI	LC	LP	MFP	CI	LC
1994-2013	1.31	0.07	0.94	0.29	2.33	0.37	1.66	0.29
1994-2000	2.16	0.87	0.91	0.37	2.96	1.28	1.34	0.31
2000-2013	0.92	-0.29	0.95	0.26	2.04	-0.05	1.81	0.27
2000-2008	0.88	-0.50	1.11	0.27	1.79	-0.10	1.63	0.26
2008-2013	0.97	0.03	0.71	0.23	2.44	0.03	2.10	0.30

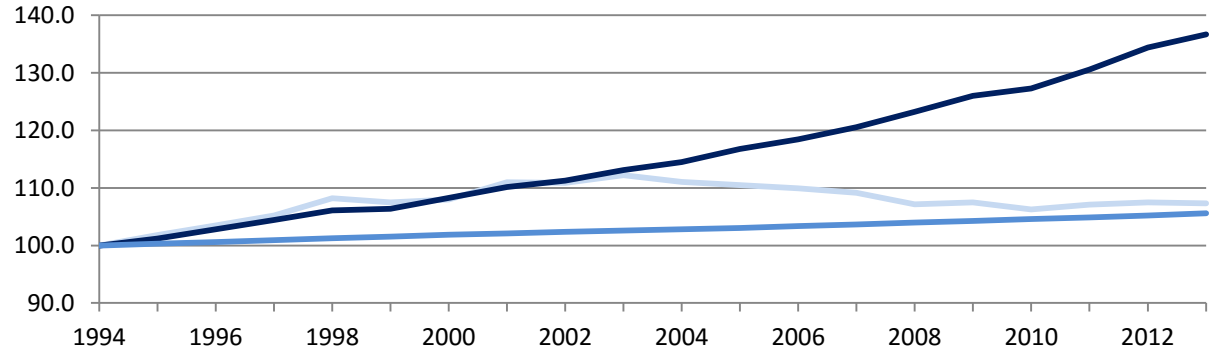
Note: "LP" stands for labour productivity. "CI" stands for capital intensity. "LC" stands for labour composition. The estimates for Canada are for the business sector. The estimates for Australia are for the market sector.
Source: CSLS calculations based on Statistics Canada and ABS data. ABS: 5260.0.55.002. Statistics Canada: 383-0021.

Chart 23: Sources of Labour Productivity Growth (1994=100), Business/Market Sector, Canada and Australia, 1994-2013

Panel A: Canada



Panel B: Australia



Source: CSLS calculations based on StatCan and ABS data. ABS: 5260.0.55.002. StatCan: 383-0021.

C. Results: Industry Level

Table 8 and Table 10 provide a breakdown of labour productivity growth in each industry into MFP growth, capital intensity growth and labour composition growth. The results by industry vary greatly. It is interesting to note that the strong negative labour productivity growth rates in utilities and mining were entirely due to negative MFP growth, while the strong positive labour productivity growth in agriculture, forestry and fishing was due to MFP growth.

Table 8: Sources of Labour Productivity Growth by Industry, Business/Market Sector, Compound Annual Growth Rates, Per Cent or Percentage Points, Canada and Australia, 1994-2013

Australia					Canada				
Industry	LP	MFP	CI	LC	LP	MFP	CI	LC	Industry
Market Sector industries	2.33	0.37	1.66	0.29	1.31	0.07	0.94	0.29	Business sector
Agriculture, Forestry and Fishing	4.99	3.41	1.41	0.11	4.72	2.92	1.38	0.37	Agriculture, forestry, fishing and hunting
Mining	-1.91	-2.83	0.88	0.06	-1.52	-3.96	2.45	0.09	Mining and oil and gas extraction
Electricity, Gas, Water and Waste Services	-1.06	-2.45	1.35	0.07	-0.07	-0.33	0.21	0.04	Utilities
Construction	2.25	1.54	0.55	0.15	0.45	0.09	0.20	0.16	Construction
Manufacturing	1.99	0.08	1.63	0.27	1.77	0.81	0.61	0.35	Manufacturing
Wholesale Trade	3.83	1.68	1.75	0.37	2.81	1.15	1.34	0.30	Wholesale trade
Retail Trade	2.88	1.63	0.98	0.24	2.36	1.40	0.69	0.26	Retail trade
Transport, Postal and Warehousing	2.08	0.81	1.05	0.21	1.21	0.11	0.89	0.21	Transportation and warehousing
Information, Media and Telecommunications	3.86	-0.01	3.67	0.19	1.74	0.78	0.78	0.17	Information and cultural industries
Financial and Insurance Services	3.55	1.80	1.38	0.33	1.49	0.39	0.89	0.21	Finance, insurance, real estate and renting and leasing
Rental, Hiring and Real Estate Services	0.58	-2.88	3.37	0.19					
Professional, Scientific and Technical Services	1.15	0.16	0.60	0.39	1.26	0.06	0.92	0.27	Professional, scientific and technical services
Other Services	1.31	-0.30	1.61	0.01	0.68	-0.74	1.13	0.29	Other services (except public administration)
Administrative and Support Services	0.50	-0.35	0.44	0.41	0.09	-1.10	1.02	0.18	Administrative and support, waste management and remediation services
Arts and Recreation Services	1.13	-0.13	1.11	0.15	-1.02	-1.94	0.87	0.06	Arts, entertainment and recreation
Accommodation and Food Services	1.46	0.91	0.50	0.04	0.54	0.18	0.04	0.32	Accommodation and food services
No corresponding industry	…	…	…	…	0.72	-0.07	0.53	0.25	Other private services

Note: “LP” stands for labour productivity. “CI” stands for capital intensity. “LC” stands for labour composition.
Source: CSLS calculations based on Statistics Canada and ABS data. ABS: 5260.0.55.002. Statistics Canada: 383-0021.

Table 9: Sources of Labour Productivity Growth by Industry, Business/Market Sector, Compound Annual Growth Rates, Per Cent of Industry Total, Canada and Australia, 1994-2013

Australia					Canada				
Industry	LP	MFP	CI	LC	LP	MFP	CI	LC	Industry
Market Sector industries	100.00	15.88	71.24	12.45	100.00	5.34	71.76	22.14	Business sector
Agriculture, Forestry and Fishing	100.00	68.34	28.26	2.20	100.00	61.86	29.24	7.84	Agriculture, forestry, fishing and hunting
Mining	100.00	148.17	-46.07	-3.14	100.00	260.53	-161.18	-5.92	Mining and oil and gas extraction
Electricity, Gas, Water and Waste Services	100.00	231.13	-127.36	-6.60	100.00	471.43	-300.00	-57.14	Utilities
Construction	100.00	68.44	24.44	6.67	100.00	20.00	44.44	35.56	Construction
Manufacturing	100.00	4.02	81.91	13.57	100.00	45.76	34.46	19.77	Manufacturing
Wholesale Trade	100.00	43.86	45.69	9.66	100.00	40.93	47.69	10.68	Wholesale trade
Retail Trade	100.00	56.60	34.03	8.33	100.00	59.32	29.24	11.02	Retail trade
Transport, Postal and Warehousing	100.00	38.94	50.48	10.10	100.00	9.09	73.55	17.36	Transportation and warehousing
Information, Media and Telecommunications	100.00	-0.26	95.08	4.92	100.00	44.83	44.83	9.77	Information and cultural industries
Financial and Insurance Services	100.00	50.70	38.87	9.30	100.00	26.17	59.73	14.09	Finance, insurance, real estate and renting and leasing
Rental, Hiring and Real Estate Services	100.00	-496.55	581.03	32.76					
Professional, Scientific and Technical Services	100.00	13.91	52.17	33.91	100.00	4.76	73.02	21.43	Professional, scientific and technical services
Other Services	100.00	-22.90	122.90	0.76	100.00	-108.82	166.18	42.56	Other services (except public administration)
Administrative and Support Services	100.00	-70.00	88.00	82.00	100.00	-1,222.22	1,133.33	200.00	Administrative and support, waste management and remediation services
Arts and Recreation Services	100.00	-11.50	98.23	13.27	100.00	190.20	-85.29	-5.88	Arts, entertainment and recreation
Accommodation and Food Services	100.00	62.33	34.25	2.74	100.00	33.33	7.41	59.26	Accommodation and food services
No corresponding industry	…	…	…	…	100.00	-9.72	73.61	34.72	Other private services

Note: “LP” stands for labour productivity. “CI” stands for capital intensity. “LC” stands for labour composition.
Source: CSLS calculations based on Statistics Canada and ABS data. ABS: 5260.0.55.002. Statistics Canada: 383-0021.

Table 10: Sources of Labour Productivity Growth by Industry and Sub-Period, Business/Market Sector, Compound Annual Growth Rates, Percentage Points, Canada and Australia, 1994-2013

Panel A: Canada

Industry	1994-2013				1994-2000				2000-2013			
	LP	MFP	CI	LC	LP	MFP	CI	LC	LP	MFP	CI	LC
Business sector	1.31	0.07	0.94	0.29	2.16	0.87	0.91	0.37	0.92	-0.29	0.95	0.26
Agriculture, forestry, fishing and hunting	4.72	2.92	1.38	0.37	5.77	3.45	1.45	0.78	4.24	2.67	1.34	0.18
Mining and oil and gas extraction	-1.52	-3.96	2.45	0.09	0.98	-1.78	2.74	0.08	-2.66	-4.95	2.31	0.09
Utilities	-0.07	-0.33	0.21	0.04	1.86	1.23	0.53	0.10	-0.95	-1.04	0.07	0.01
Construction	0.45	0.09	0.20	0.16	0.90	0.36	0.38	0.16	0.24	-0.03	0.11	0.16
Manufacturing	1.77	0.81	0.61	0.35	3.36	2.51	0.46	0.37	1.04	0.03	0.67	0.34
Wholesale trade	2.81	1.15	1.34	0.30	3.06	1.28	1.29	0.46	2.69	1.08	1.36	0.22
Retail trade	2.36	1.40	0.69	0.26	3.49	2.43	0.76	0.27	1.85	0.93	0.66	0.25
Transportation and warehousing	1.21	0.11	0.89	0.21	2.04	0.84	1.10	0.09	0.84	-0.23	0.80	0.27
Information and cultural industries	1.74	0.78	0.78	0.17	1.58	0.22	1.14	0.22	1.82	1.04	0.62	0.14
Finance, insurance, real estate and renting and leasing	1.49	0.39	0.89	0.21	2.00	-0.04	1.76	0.28	1.25	0.59	0.48	0.17
Professional, scientific and technical services	1.26	0.06	0.92	0.27	1.72	0.69	0.80	0.22	1.05	-0.23	0.98	0.30
Other services (except public administration)	0.68	-0.74	1.13	0.29	0.67	-0.76	1.15	0.29	0.68	-0.72	1.12	0.30
Administrative and support, waste management and remediation services	0.09	-1.10	1.02	0.18	-0.51	-1.65	1.00	0.16	0.37	-0.84	1.03	0.18
Arts, entertainment and recreation	-1.02	-1.94	0.87	0.06	-2.53	-3.62	0.89	0.23	-0.32	-1.15	0.85	-0.01
Accommodation and food services	0.54	0.18	0.04	0.32	0.60	-0.52	0.76	0.36	0.51	0.50	-0.29	0.31
Other private services	0.72	-0.07	0.53	0.25	0.58	-0.81	1.03	0.36	0.78	0.28	0.30	0.20

Note: “LP” stands for labour productivity. “CI” stands for capital intensity. “LC” stands for labour composition.

Source: CSLS calculations based on Statistics Canada and ABS data. ABS: 5260.0.55.002. Statistics Canada: 383-0021.

Panel B: Australia

Industry	1994-2013				1994-2000				2000-2013			
	LP	MFP	CI	LC	LP	MFP	CI	LC	LP	MFP	CI	LC
Market Sector industries	2.33	0.37	1.66	0.29	2.96	1.28	1.34	0.31	2.04	-0.05	1.81	0.27
Agriculture, Forestry and Fishing	4.99	3.41	1.41	0.11	7.05	7.29	-0.38	0.15	4.05	1.67	2.24	0.09
Mining	-1.91	-2.83	0.88	0.06	4.77	1.27	3.28	0.17	-4.85	-4.67	-0.21	0.02
Electricity, Gas, Water and Waste Services	-1.06	-2.45	1.35	0.07	5.11	0.74	4.05	0.28	-3.79	-3.89	0.13	-0.02
Construction	2.25	1.54	0.55	0.15	0.44	-0.04	0.28	0.20	3.09	2.28	0.67	0.12
Manufacturing	1.99	0.08	1.63	0.27	2.67	0.74	1.54	0.37	1.68	-0.23	1.68	0.23
Wholesale Trade	3.83	1.68	1.75	0.37	6.87	4.29	2.25	0.23	2.45	0.49	1.51	0.43
Retail Trade	2.88	1.63	0.98	0.24	3.37	2.05	1.11	0.18	2.66	1.44	0.92	0.27
Transport, Postal and Warehousing	2.08	0.81	1.05	0.21	2.13	1.67	0.18	0.28	2.06	0.42	1.45	0.18
Information, Media and Telecommunications	3.86	-0.01	3.67	0.19	2.62	-0.48	2.93	0.18	4.44	0.21	4.02	0.20
Financial and Insurance Services	3.55	1.80	1.38	0.33	4.77	2.02	2.32	0.37	2.99	1.71	0.96	0.30
Rental, Hiring and Real Estate Services	0.58	-2.88	3.37	0.19	0.56	-3.94	4.50	0.18	0.59	-2.39	2.85	0.20
Professional, Scientific and Technical Services	1.15	0.16	0.60	0.39	1.36	0.41	0.55	0.40	1.05	0.04	0.63	0.38
Other Services	1.31	-0.30	1.61	0.01	3.92	1.60	1.98	0.30	0.13	-1.17	1.43	-0.12
Administrative and Support Services	0.50	-0.35	0.44	0.41	-0.23	-1.20	0.58	0.40	0.83	0.04	0.38	0.41
Arts and Recreation Services	1.13	-0.13	1.11	0.15	1.90	-0.36	1.98	0.27	0.78	-0.03	0.72	0.09
Accommodation and Food Services	1.46	0.91	0.50	0.04	2.57	1.99	0.46	0.10	0.95	0.42	0.52	0.01

Note: “LP” stands for labour productivity. “CI” stands for capital intensity. “LC” stands for labour composition.
Source: CSLS calculations based on Statistics Canada and ABS data. ABS: 5260.0.55.002. Statistics Canada: 383-0021.

D. Business Cycle, Returns to Scale, and Other Factors[16]

The standard theoretical framework used to calculate MFP growth relies on some important assumptions, three of which are particularly relevant to us:

- Efficiency: Production is assumed to be efficient. Thus, in order to produce one unit of output, profit-maximizing firms use the least amount of inputs possible. It is assumed that firms do not have excess labour or excess capital at their disposal; they have only as much labour or as much capital as they need.

- Constant returns to scale (CRS): Firms can double output produced simply by doubling inputs used. In other words, CRS implies that an increase in the amount of inputs used will lead to a proportional increase in the amount of output.

- Perfect competition: Firms do not have market power, i.e. they are price takers. Under perfect competition, the compensation of the factors of production (labour and capital) is equal to their marginal products.

Needless to say, these can be strong assumptions. In situations where they do not hold, MFP growth – and, as a consequence, labour productivity growth – will be affected. If, for instance, firms operate below capacity (*i.e.*, they do not use all their capital in the production process), there will be a negative impact on productivity. Thus, the neoclassical growth framework has limitations in its ability to explain observed trends in labour productivity growth.

In this subsection, we point to the possibility that part of the MFP growth experienced by Canada and Australia is linked to the factors listed above. First, we mention factors related to the business cycle, such as capacity utilization and labour hoarding. Second, we mention returns to scale. Finally, we list other factors that can potentially influence MFP growth and are not captured in the growth accounting framework.

i. Business Cycle

In general, productivity exhibits *procyclical* behaviour, that is, it increases during economic booms and decreases during recessions (Basu and Fernald, 2001). This relationship over long periods is known as Verdoorn's law. There are many potential reasons for this, but three stand out:

[16] This section borrows from De Avillez (2014).

- Capacity utilization: During recessions, a significant part of firms' capital stock is idle, causing productivity to fall; inversely, during booms, capital can be over-utilized, causing productivity to rise.

- Labour hoarding: During recessions, firms have a tendency to keep more workers, especially skilled workers, than they require given their depressed levels of production, driving down productivity.

- Labour market tightness: Lower unemployment rates, as well as other indicators that point to an increase in labour market tightness, imply that it is more difficult for firms to hire workers. This can spur additional investment in labour-saving capital.

ii. Returns to Scale and Firm Size

The standard theoretical framework used to compute MFP growth assumes constant returns to scale (CRS), that is, a doubling of inputs used leads to a doubling of output. Whenever this assumption is violated, productivity changes created by either increasing or decreasing returns to scale (IRS) appear as part of MFP growth.[17] When a firm with IRS doubles its use of labour and capital inputs, it *more than doubles* its output. The existing literature highlights the importance of returns to scale in the forest products sector, but does not provide actual estimates of its impact on productivity. Although the econometric estimation of returns to scale is beyond the scope of this report, such estimates can be constructed using the methodology delineated in Diewert and Fox (2005).

iii. Other Factors

Other factors have influenced productivity growth in Canada and Australia. Below, we highlight three of them: 1) profits; 2) changes in the composition of the economy; and 3) the quality and size of Canada's natural resource base. The latter two factors are analyzed in the following section of the report.

Profits can influence productivity growth through three main channels:

- Composition Effect: Low (or negative) profit levels can force low-productivity establishments out of business, raising the average productivity of the sector.

[17] It is interesting to note that the benefits associated with IRS are also linked to the business cycle. In the presence of IRS, economic booms can yield significant productivity gains, since production has to increase to meet the strong demand; conversely, economic downturns lead to productivity losses.

- Survival Effect: Falling profits may serve as incentive for firms to innovate, as they look for ways to cut costs and improve the overall efficiency of their production processes.

- Investment Effect: Conversely, falling profits can make it harder for firms to invest in R&D or new capital, slowing down productivity growth.

IV. Industry Contributions to Aggregate Labour Productivity Growth[18]

A. Overview

Aggregate labour productivity growth reflects the productivity performance of each constituent part as well as changes in the composition of the economy. It is important for policymakers to understand whether and to what extent aggregate labour productivity growth – the principal determinant of living standards in the long-run – is driven by pure productivity growth within each part of the economy and whether and to what extent it is driven by changes in the composition of the economy – that is, how important each part is relative to the total. A shift toward higher-productivity parts causes aggregate labour productivity to increase, while a shift toward lower-productivity parts has the opposite effect.

Generally speaking, the vast majority of productivity analysis has treated sectors or industries, at varying levels of aggregation, as the relevant "parts" of the economy. Several decomposition formulas have been developed to estimate industry contributions to aggregate labour productivity growth. These formulas divide aggregate labour productivity growth into the contribution due solely to productivity increases experienced by individual industries (the within-sector effect) and the contribution due to reallocation of labour shares across industries (the reallocation effect). These formulas allow researchers to measure the extent to which aggregate labour productivity growth is due to changes in the industrial structure as opposed to the labour productivity growth experienced by each industry.

This section presents industry contributions to aggregate labour productivity growth in Canada and Australia in 1994-2013. The aggregate labour productivity level is (approximately) the weighted average of sectoral labour productivity levels, with the weights being equal to each sector's labour input share. Using the framework developed by Sharpe and Thomson (2010), we can determine the industry contributions to aggregate labour productivity growth in Canada and Australia. This framework is known as the CSLS formula.

The CSLS formula is mathematically represented by the following:

[18] For a detailed discussion on labour productivity decompositions, see Reinsdorf (2015), Tang and Wang (2004), Diewert (2008), Sharpe and Thomson (2010), and Almon and Tang (2011).

$$\Delta\bar{P} = \underbrace{\sum \Delta P_i h_i^0}_{\substack{Within-sector \\ Effect}} + \underbrace{\sum (P_i^0 - \bar{P}^0)\Delta h_i}_{\substack{Reallocation\ Level \\ Effect}} + \underbrace{\sum (\Delta P_i - \Delta\bar{P})\Delta h_i}_{\substack{Reallocation\ Growth \\ Effect}}$$

where $\bar{P}^0$ is the aggregate real labour productivity level in period 0, $\Delta\bar{P}$ is the change in the aggregate real labour productivity level between periods 0 and 1, P_i^0 is the real labour productivity level in industry *i* in period 0, ΔP_i is the change in the real labour productivity level in industry *i* between periods 0 and 1, h_i^0 is the share of total hours worked in industry *i* in period 0, and Δh_i is the change in the share of total hours worked in industry *i* between periods 0 and 1.

In the CSLS formula, the absolute change in aggregate real labour productivity between two periods is (approximately) equal to the sum of the three components.[19] We rebased the three components to make them perfectly additive. The three components are briefly described below.

- The within-sector effect (WSE) measures the contribution to aggregate productivity growth due solely to the productivity increase experienced by individual sectors. Theoretically, this component is driven by increased capital intensity, increased labour quality, technical change, economies of scale, etc.

- The reallocation level effect (RLE) captures the contribution to aggregate labour productivity growth from labour movements between sectors with different productivity levels. This effect is positive when labour is moving into industries with above-average labour productivity levels or leaving industries with below-average labour productivity levels. It is negative when labour is moving into industries with below-average labour productivity levels or leaving industries with above-average labour productivity levels.

- The reallocation growth effect (RGE) captures the contribution to aggregate labour productivity growth from labour movements between sectors with different rates of productivity growth. This effect is positive when labour is moving into industries with above-average labour productivity growth or leaving industries with below-average labour productivity growth. It is negative when labour is moving into industries with below-average labour productivity growth or leaving industries with above-average labour productivity growth.

[19] Real GDP can be calculated using fixed-base or chained indexes. In the former, price weights are fixed at a given base period, while in the latter they are updated every period. Real GDP in constant dollars is calculated using fixed indexes, while real GDP in chained dollars is calculated using chained indexes. The three components are perfectly additive only when labour productivity estimates are constructed using constant dollars real GDP, but not when real GDP is measured in chained dollars. Furthermore, constant dollar real GDP must be computed using fixed-base Laspeyres or Paasche indexes for these components to be perfectly additive. These components are not perfectly additive if constant dollar real GDP is computed with a fixed-base Fisher indexes.

We have adjusted the CSLS formula so as to express the three components for each industry in terms of the average annual growth in aggregate labour productivity. Each component is divided by the absolute change in aggregate real labour productivity, $\Delta\bar{P}$. The resulting ratios are then applied to the average annual growth rate of labour productivity.

While this decomposition can provide a deeper understanding of observed trends in aggregate productivity growth, they do not shed light on productivity growth at the industry level. While the above-mentioned decompositions can tell us the contribution of labour productivity experienced by each industry to aggregate productivity growth, we still do not know whether and to what extent changes in the composition of industries is driving labour productivity growth at the industry level. In particular, we do not know whether and to what extent labour productivity growth within each industry is driven by productivity improvements at the firm level (the within-firm effect) and the reallocation of labour shares across firms (the between-firm effect). For example, changes in the composition of firms due to either the decline or failure of lower-productivity firms or the emergence or growth of higher-productivity firms may account for a large share of labour productivity growth at the industry level. As a result, these decompositions may overestimate the pure productivity growth component of aggregate labour productivity growth and underestimate the compositional component.[20]

In order to craft the most effective productivity-enhancing policies, policymakers need to know the extent to which aggregate labour productivity growth is driven by pure productivity improvements and the extent to which it is driven by changes in the composition of the economy. If the pure productivity component is more important, then it may make sense for policymakers to focus more on the promotion of efficiency improvements, investment in new capital and technologies, and employee training and development programs at the firm level. However, if the compositional component is more important, then it may make sense for policymakers to put more weight on the movement of resources from low productivity regions, sectors, and firms to high productivity ones.

B. Results

This section provides a detailed decomposition at the industry level of aggregate labour productivity growth into the above-noted effects in Canada and Australia for 1994-2013. This period is broken down into two sub-periods: 1994-2000 and 2000-2013.

[20] Theoretically, a decomposition of aggregate labour productivity growth into the within-firm and between-firm effects could also overestimate the pure productivity growth component of aggregate labour productivity growth and underestimate the compositional component. For example, if a manufacturing firm decides close a lower-productivity factory but continues to operate a higher-productivity factory, then labour productivity would increase at the firm level. However, the increase in labour productivity exhibited by this firm is not due to pure productivity growth at the firm level associated with efficiency improvements, investments in new capital or an improved workforce; instead, the increase is due to a change in the composition of establishments and activities at the firm level. Therefore, in order to decompose productivity growth into the pure productivity growth and compositional components, the most relevant "parts" of the economy may be at the establishment level or below.

Within-sector effects contributed the most to aggregate labour productivity growth in both countries in 1994-2000 and 2000-2013 (Table 11). In 1994-2000, within-sector effects accounted for all of the aggregate labour productivity growth, contributing 2.33 percentage points (or 107.5 per cent) in Canada and 3.29 percentage points (or 111.2 per cent) in Australia. The reallocation effects negatively contributed to aggregate labour productivity growth in both countries in 1994-2000.

In contrast, in 2000-2013, while within-sector effects remained the main driver of aggregate productivity growth, the contribution of the reallocation effects were quite large. In 2000-2013, the contributions of within-sector effects to the aggregate labour productivity were notably lower, at 0.78 percentage points (or 85.4 per cent) in Canada and 1.46 percentage points (or 71.5 per cent) in Australia. It follows that the reallocation effects contributed 0.13 percentage points (or 14.6 per cent) on a net basis in Canada and 0.58 percentage points (or 28.5 per cent) in Australia. However, this masks the fact that reallocation growth effects negatively contributed to aggregate labour productivity growth in both countries, which was more than compensated for by a strong positive contribution from reallocation level effects.

Table 11: Decomposition of Aggregate Labour Productivity Growth, Canada and Australia, 1994-2013

	Canada				Australia			
	Aggregate	WSE	RLE	RGE	Aggregate	WSE	RLE	RGE
	Percentage Point Contribution to Aggregate Labour Productivity Growth							
1994-2013	1.31	1.25	0.28	-0.22	2.33	1.94	0.76	-0.37
1994-2000	2.16	2.33	-0.10	-0.07	2.95	3.29	-0.10	-0.23
2000-2013	0.92	0.78	0.34	-0.21	2.04	1.46	1.37	-0.78
	Percentage Contribution to Aggregate Labour Productivity Growth							
1994-2013	100.0	95.1	21.5	-16.5	100.0	83.2	32.5	-15.8
1994-2000	100.0	107.5	-4.4	-3.1	100.0	111.2	-3.5	-7.7
2000-2013	100.0	85.4	37.4	-22.8	100.0	71.5	67.0	-38.5

Note: "WSE" stands for "within-sector effect." "RLE" stands for "reallocation level effect." "RGE" stands for "reallocation growth effect." "Aggregate" refers to the business sector for Canada and the market sector for Australia.
Source: CSLS calculations based on Statistics Canada and ABS data. Statistics Canada: 383-0029 and 383-0021. ABS: 5204.005, 6291.0.55.003 and 5260.0.55.002.

Both countries exhibited a dramatic slowdown in aggregate labour productivity growth between 1994-2000 and 2000-2013 (Table 12). In Canada, aggregate labour productivity growth decreased 1.25 percentage points from 2.16 per cent in 1994-2000 to 0.92 per cent in 2000-2013. In Australia, aggregate labour productivity growth fell 0.91 percentage points from 2.95 per cent in 1994-2000 to 2.04 per cent in 2000-2013, well below the decline experienced in Canada.

Declining contributions of the within-sector effects accounted for the slowdown in aggregate labour productivity growth, accounting for -1.54 percentage points (or 123.8 per cent)

of the slowdown in Canada and -1.83 percentage points (or 200.0 per cent) of the slowdown in Australia. The reallocation effects offset the reductions in the within-sector effects, contributing 0.30 percentage points (or -23.8 per cent) to the slowdown in Canada and 0.91 percentage points (or -100.0 per cent) to the slowdown in Australia. It was the reallocation level effect that offset the decline in aggregate labour productivity growth in Canada and Australia, as the reallocation growth effect positively contributed to the slowdown.

It is important to note that the contribution of the within-sector effect to the slowdown in aggregate labour productivity growth was considerably larger in Australia than in Canada. Despite this, the overall fall-off in aggregate labour productivity growth between periods was significantly smaller in Australia compared to Canada because the former exhibited a much larger increase in the contribution of the reallocation level effect than the latter.

Table 12: Decomposition of Change in Aggregate Labour Productivity Growth Between 1994-2000 and 2000-2013

	Canada				Australia			
	Aggregate	WSE	RLE	RGE	Aggregate	WSE	RLE	RGE
	Absolute Change in Growth Rates (Percentage Points)							
94-00 to 00-13	-1.25	-1.54	0.44	-0.14	-0.91	-1.83	1.47	-0.56
	Share of Absolute Change (Per Cent)							
94-00 to 00-13	100.0	123.8	-35.2	11.4	100.0	200.0	-160.9	60.9

Note: "WSE" stands for "within-sector effect." "RLE" stands for "reallocation level effect." "RGE" stands for "reallocation growth effect." "Aggregate" refers to the business sector for Canada and the market sector for Australia.
Source: CSLS calculations based on Statistics Canada and ABS data. Statistics Canada: 383-0029 and 383-0021. ABS: 5204.005, 6291.0.55.003 and 5260.0.55.002.

Table 13 decomposes the absolute difference in aggregate labour productivity growth between Australia and Canada for 1994-2000 and 2000-2013. In 2000-2013, aggregate labour productivity growth in Australia was 0.79 percentage points higher than in Canada. The larger contribution from within-sector effects in Australia compared to Canada accounted for the entire gap in aggregate labour productivity growth between these countries in 1994-2000, at 0.96 percentage points (or 121.2 per cent). The reallocation effects negatively contributed to the gap.

The gap in aggregate labour productivity growth was even higher in 2000-2013, at 1.12 percentage points. The difference in within-sector effects between Australia and Canada only accounted for 0.67 percentage points (or 60.1 per cent) of the gap in aggregate labour productivity growth between these countries in 2000-2013. This implies that the reallocation effects accounted for 0.45 percentage points (or 39.9 per cent) to the overall gap in this period. In particular, Australia experienced a significantly larger contribution from the positive reallocation level effects than Canada in 2000-2013 (with a gap of 1.02 percentage points), which was more than enough to compensate for the fact that the reallocation growth effects were more of a drag on aggregate labour productivity in Australia compared to Canada.

Table 13: Decomposition of Absolute Difference in Aggregate Labour Productivity Growth Between Australia and Canada, 1994-2013

	Aggregate	WSE	RLE	RGE
	Absolute Difference in Growth Rates (Percentage Points)			
1994-2013	1.02	0.69	0.48	-0.15
1994-2000	0.79	0.96	-0.01	-0.16
2000-2013	1.12	0.67	1.02	-0.58
	Share of Absolute Difference (Per Cent)			
1994-2013	100.0	68.0	46.8	-14.8
1994-2000	100.0	121.2	-0.8	-20.4
2000-2013	100.0	60.1	91.2	-51.3

Note: "WSE" stands for "within-sector effect." "RLE" stands for "reallocation level effect." "RGE" stands for "reallocation growth effect." "Aggregate" refers to the business sector for Canada and the market sector for Australia.
Source: CSLS calculations based on Statistics Canada and ABS data. Statistics Canada: 383-0029 and 383-0021. ABS: 5204.005, 6291.0.55.003 and 5260.0.55.002.

Table 14 and Table 15 provide a detailed breakdown of industry contributions to aggregate labour productivity in Canada and Australia for the 1994-2013 period. Manufacturing and finance, insurance, real estate and renting and leasing contributed the most to aggregate labour productivity growth in both countries between 1994 and 2013.[21] Manufacturing contributed 0.33 percentage points (or 24.8 per cent) to aggregate labour productivity growth in Canada compared to 0.40 percentage points (or 17.0 per cent) in Australia, while finance, insurance, real estate and renting and leasing accounted for 0.25 percentage points (or 19.2 per cent) of aggregate labour productivity growth in Canada and 0.44 percentage points (or 18.8 per cent) of aggregate labour productivity growth in Australia. Agriculture, forestry, fishing and hunting, wholesale trade, and retail trade were also top contributors in both countries.

Finance, insurance, real estate and renting and leasing contributed 0.19 percentage points (or 23.5 per cent) to the overall 1.02 percentage point gap in labour productivity growth between Australia and Canada in 1994-2013. This was wholly related to a stronger within-sector effect in Australia compared to Canada. Mining and oil and gas extraction ranked second, accounting for 0.17 percentage points (or 16.9 per cent) of this gap. In particular, mining and oil and gas extraction contributed 0.16 percentage points to labour productivity growth in Australia, while it contributed -0.01 percentage points in Canada. This was entirely due to a larger contribution of reallocation effects related to mining in Australia, which accounted for 0.14 percentage points (or 13.6 per cent) of the gap in aggregate labour productivity growth. Construction made the third largest contribution to the overall gap with 0.16 percentage points (or 15.4 per cent).

[21] This result may seem surprising given the public perception in Australia that manufacturing has been a poor performer in terms of productivity (Barnes et al., 2013).

Table 14: Industry Contributions to Aggregate Labour Productivity Growth, Canada, 1994-2013

	Aggregate	WSE	RLE	RGE
	Percentage Point Contribution to Aggregate Labour Productivity Growth			
Business sector	1.31	1.25	0.28	-0.22
Agriculture, forestry, fishing and hunting	0.20	0.17	0.08	-0.04
Mining and oil and gas extraction	-0.01	-0.16	0.23	-0.07
Utilities	-0.01	0.00	0.00	0.00
Construction	0.01	0.04	0.00	-0.03
Manufacturing	0.33	0.37	-0.01	-0.04
Wholesale trade	0.19	0.19	0.00	0.00
Retail trade	0.18	0.17	0.01	0.00
Transportation and warehousing	0.06	0.07	0.00	0.00
Information and cultural industries	0.08	0.06	0.01	0.00
Finance, insurance, real estate and renting and leasing	0.25	0.23	0.01	0.01
Professional, scientific and technical services	0.05	0.07	-0.01	0.00
Administrative and support, waste management and remediation services	-0.05	0.00	-0.03	-0.03
Arts, entertainment and recreation	-0.02	-0.01	-0.01	-0.01
Accommodation and food services	0.02	0.02	0.00	0.00
Other private services	0.03	0.04	-0.01	0.00
	Percentage Contribution to the Business Sector Total			
Business sector	100.0	100.0	100.0	100.0
Agriculture, forestry, fishing and hunting	15.6	13.3	29.1	19.9
Mining and oil and gas extraction	-0.6	-13.2	82.2	34.3
Utilities	-0.4	-0.2	-1.2	-0.1
Construction	0.5	3.0	-1.1	12.9
Manufacturing	24.8	29.8	-2.8	17.3
Wholesale trade	14.6	15.5	0.4	1.2
Retail trade	13.5	13.3	3.9	-0.3
Transportation and warehousing	5.0	5.3	-0.4	0.2
Information and cultural industries	5.9	5.1	3.1	-2.3
Finance, insurance, real estate and renting and leasing	19.2	18.7	4.6	-2.3
Professional, scientific and technical services	3.7	5.3	-4.4	2.2
Administrative and support, waste management and remediation services	-4.0	0.2	-10.2	11.9
Arts, entertainment and recreation	-1.8	-0.7	-2.1	4.1
Accommodation and food services	1.5	1.4	0.8	-0.4
Other private services	2.5	3.2	-1.8	1.4

Note: "WSE" stands for "within-sector effect." "RLE" stands for "reallocation level effect." "RGE" stands for "reallocation growth effect." "Aggregate" refers to the business sector for Canada and the market sector for Australia.
Source: CSLS calculations based on Statistics Canada and ABS data. Statistics Canada: 383-0029 and 383-0021. ABS: 5204.005, 6291.0.55.003 and 5260.0.55.002.

Table 15: Industry Contributions to Aggregate Labour Productivity Growth, Australia, 1994-2013

	Aggregate	WSE	RLE	RGE
	Percentage Point Contribution to Aggregate Labour Productivity Growth			
Market sector	2.33	1.94	0.76	-0.37
Agriculture, forestry and fishing	0.27	0.22	0.07	-0.02
Mining	0.16	-0.13	0.56	-0.26
Electricity, gas, water and waste services	-0.02	-0.05	0.05	-0.02
Construction	0.16	0.20	-0.02	-0.01
Manufacturing	0.40	0.32	0.04	0.04
Wholesale trade	0.25	0.27	0.01	-0.03
Retail trade	0.20	0.19	0.01	0.00
Transport, postal and warehousing	0.14	0.14	0.00	0.00
Information, media and telecommunications	0.15	0.17	-0.01	-0.02
Financial and insurance services	0.40	0.37	0.01	0.01
Rental, hiring and real estate services	0.04	0.02	0.02	-0.01
Professional, scientific and technical services	0.04	0.08	0.00	-0.05
Administrative and support services	0.02	0.02	0.01	-0.01
Arts and recreation services	0.00	0.01	0.00	-0.01
Accommodation and food services	0.06	0.06	0.00	0.00
Other services	0.06	0.04	0.01	0.01
	Percentage Contribution to the Market Sector Total			
Market sector	100.0	100.0	100.0	100.0
Agriculture, forestry and fishing	11.7	11.5	8.8	4.6
Mining	7.1	-6.8	73.8	71.8
Electricity, gas, water and waste services	-1.0	-2.6	6.1	5.7
Construction	7.0	10.1	-2.5	3.7
Manufacturing	17.0	16.4	4.7	-11.6
Wholesale trade	10.7	14.0	1.1	8.5
Retail trade	8.7	9.7	1.3	-1.1
Transport, postal and warehousing	5.9	7.2	0.0	0.4
Information, media and telecommunications	6.5	9.0	-0.8	4.8
Financial and insurance services	17.1	19.3	1.4	-4.0
Rental, hiring and real estate services	1.6	1.2	2.9	1.8
Professional, scientific and technical services	1.6	4.2	0.6	13.1
Administrative and support services	0.9	1.1	1.7	3.2
Arts and recreation services	0.1	0.6	-0.5	1.6
Accommodation and food services	2.8	3.0	0.5	-0.9
Other services	2.4	2.2	0.9	-1.7

Note: “WSE” stands for “within-sector effect.” “RLE” stands for “reallocation level effect.” “RGE” stands for “reallocation growth effect.” “Aggregate” refers to the business sector for Canada and the market sector for Australia.
Source: CSLS calculations based on Statistics Canada and ABS data. Statistics Canada: 383-0029 and 383-0021. ABS: 5204.005, 6291.0.55.003 and 5260.0.55.002.

Table 16 and Table 17 provide the industry contributions to aggregate labour productivity growth in Canada and Australia for the 1994-2000 period. Manufacturing drove aggregate labour productivity growth in Canada over this period, contributing 0.75 percentage points (or 34.8 per cent). Retail trade, agriculture, forestry, fishing and hunting, and finance, insurance, real estate and renting and leasing were also important, contributing 16.6, 14.8 and 14.2 per cent (respectively) to aggregate labour productivity growth in Canada.

Finance, insurance, real estate and renting and leasing was most important for Australia in 1994-2000, accounting for 0.48 percentage points (or 16.3 per cent) of aggregate labour productivity growth. Manufacturing ranked second Australia with a contribution of 0.47 percentage points (or 16.0 per cent). Other large contributors included: wholesale trade (14.4 per cent), mining and oil and gas extraction (11.3 per cent), and agriculture, forestry, fishing and hunting (9.2 per cent).

Mining and oil and gas extraction accounted for 0.34 percentage points (or 42.5 per cent) of the gap in aggregate labour productivity growth between the two countries in 1994-2000, followed by wholesale trade (28.8 per cent), finance, insurance, real estate and renting and leasing (22.1 per cent), utilities (17.2 per cent), administrative and support, waste management and remediation services (15.6 per cent), and arts, entertainment and recreation (10.2 per cent). The contribution of mining and oil and gas extraction was entirely due to a significantly stronger within-sector effect in Australia than in Canada (0.49 percentage points versus 0.14 percentage points). Similarly, the contributions of wholesale trade, finance, insurance, real estate and renting and leasing, and utilities to the gap were principally related to within-sector effects.

In contrast, several industries negatively contributed to the gap in aggregate labour productivity growth between Australia and Canada in 1994-2000. Most importantly, manufacturing contributed -0.28 percentage points (or -35.5 per cent) to the gap, as Canada’s manufacturing sector exhibited significantly stronger labour productivity growth than its Australian counterpart. Retail trade and construction also made significant negative contributions to the overall gap (-16.7 and -10.6 per cent, respectively). The contributions of manufacturing and construction were related to stronger within-sector effects, while the contribution of retail trade was primarily due to stronger reallocation effects.

Table 16: Industry Contributions to Aggregate Labour Productivity Growth, Canada, 1994-2000

	Aggregate	WSE	RLE	RGE
	Percentage Point Contribution to Aggregate Labour Productivity Growth			
Business sector	2.16	2.33	-0.10	-0.07
Agriculture, forestry, fishing and hunting	0.32	0.17	0.15	-0.01
Mining and oil and gas extraction	0.00	0.14	-0.14	-0.01
Utilities	-0.04	0.09	-0.11	-0.01
Construction	0.10	0.09	0.00	0.01
Manufacturing	0.75	0.76	0.00	0.00
Wholesale trade	0.20	0.20	-0.01	0.00
Retail trade	0.36	0.25	0.10	0.01
Transportation and warehousing	0.12	0.12	0.00	0.00
Information and cultural industries	0.09	0.06	0.03	0.00
Finance, insurance, real estate and renting and leasing	0.31	0.33	-0.02	0.00
Professional, scientific and technical services	0.05	0.10	-0.03	-0.01
Administrative and support, waste management and remediation services	-0.09	-0.02	-0.05	-0.03
Arts, entertainment and recreation	-0.06	-0.02	-0.02	-0.02
Accommodation and food services	0.02	0.02	0.00	0.00
Other private services	0.04	0.04	0.00	0.00
	Percentage Contribution to the Business Sector Total			
Business sector	100.0	100.0	100.0	100.0
Agriculture, forestry, fishing and hunting	14.8	7.5	-160.3	12.0
Mining and oil and gas extraction	-0.1	6.2*	146.4*	10.5
Utilities	-1.6	3.7	113.2	18.0
Construction	4.7	3.7	-3.2	-18.4
Manufacturing	34.8	32.5	0.5	2.2
Wholesale trade	9.1	8.7	8.1	-3.2
Retail trade	16.6	10.7	-108.4	-9.7
Transportation and warehousing	5.4	5.3	4.9	1.4
Information and cultural industries	4.4	2.6	-35.0	-1.6
Finance, insurance, real estate and renting and leasing	14.2	14.4	25.3	3.9
Professional, scientific and technical services	2.4	4.2	33.8	18.4
Administrative and support, waste management and remediation services	-4.3	-0.7	53.5	40.5
Arts, entertainment and recreation	-2.8	-1.0	20.2	25.6
Accommodation and food services	0.9	0.9	1.3	0.4
Other private services	1.7	1.5	-0.2	-0.1

Note: "WSE" stands for "within-sector effect." "RLE" stands for "reallocation level effect." "RGE" stands for "reallocation growth effect." "Aggregate" refers to the business sector for Canada and the market sector for Australia.
* These numbers are surprising because aggregate labour productivity growth in mining and oil and gas extraction is extremely small (and at only two decimals it appears to be zero).
Source: CSLS calculations based on Statistics Canada and ABS data. Statistics Canada: 383-0029 and 383-0021. ABS: 5204.005, 6291.0.55.003 and 5260.0.55.002.

Table 17: Industry Contributions to Aggregate Labour Productivity Growth, Australia, 1994-2000

	Aggregate	WSE	RLE	RGE
	Percentage Point Contribution to Aggregate Labour Productivity Growth			
Market sector	2.95	3.29	-0.10	-0.23
Agriculture, forestry and fishing	0.27	0.26	0.01	0.00
Mining	0.33	0.49	-0.12	-0.04
Electricity, gas, water and waste services	0.10	0.33	-0.17	-0.07
Construction	0.02	0.04	-0.01	-0.01
Manufacturing	0.47	0.43	0.04	0.01
Wholesale trade	0.43	0.45	0.02	-0.05
Retail trade	0.23	0.21	0.02	0.00
Transport, postal and warehousing	0.14	0.14	0.00	0.00
Information, media and telecommunications	0.12	0.10	0.02	0.00
Financial and insurance services	0.44	0.46	-0.01	0.00
Rental, hiring and real estate services	0.04	0.02	0.02	0.00
Professional, scientific and technical services	0.08	0.10	0.01	-0.03
Administrative and support services	0.03	-0.01	0.07	-0.03
Arts and recreation services	0.02	0.02	0.00	0.00
Accommodation and food services	0.07	0.11	-0.03	-0.01
Other services	0.17	0.14	0.03	0.00
	Percentage Contribution to the Market Sector Total			
Market sector	100.0	100.0	100.0	100.0
Agriculture, forestry and fishing	9.2	8.0	-9.6	0.3
Mining	11.3	14.9	113.9	17.7
Electricity, gas, water and waste services	3.4	10.2	162.5	29.4
Construction	0.6	1.1	7.5	4.7
Manufacturing	16.0	13.0	-35.4	-5.2
Wholesale trade	14.4	13.8	-19.2	21.3
Retail trade	7.7	6.3	-17.6	-1.3
Transport, postal and warehousing	4.6	4.2	0.7	1.2
Information, media and telecommunications	3.9	3.0	-15.0	-0.6
Financial and insurance services	15.0	13.9	8.8	1.9
Rental, hiring and real estate services	1.3	0.7	-18.0	0.9
Professional, scientific and technical services	2.7	3.1	-7.5	12.4
Administrative and support services	1.0	-0.3	-72.7	15.3
Arts and recreation services	0.7	0.7	1.7	0.3
Accommodation and food services	2.5	3.2	26.6	2.7
Other services	5.8	4.3	-26.8	-1.1

Note: "WSE" stands for "within-sector effect." "RLE" stands for "reallocation level effect." "RGE" stands for "reallocation growth effect." "Aggregate" refers to the business sector for Canada and the market sector for Australia.
Source: CSLS calculations based on Statistics Canada and ABS data. Statistics Canada: 383-0029 and 383-0021. ABS: 5204.005, 6291.0.55.003 and 5260.0.55.002.

Table 18 and Table 19 present the industry contributions for the 2000-2013 period. In Canada, finance, insurance, real estate and renting and leasing accounted for the largest share of aggregate labour productivity growth (23.0 per cent), followed by wholesale trade (19.4 per cent), manufacturing (16.6 per cent), agriculture, forestry, fishing and hunting (14.9 per cent), and retail trade (10.0 per cent). As was the case for the 1994-2000 period, finance, insurance, real estate and renting and leasing contributed the most to aggregate labour productivity growth in Australia in 2000-2013 (18.2 per cent), followed by manufacturing (15.6 per cent). Agriculture, forestry, fishing and hunting and construction were also important in Australia, contributing 13.0 and 11.0 per cent, respectively.

The contribution of manufacturing and retail trade to aggregate labour productivity growth in Canada fell significantly between 1994-2000 and 2000-2013. The slowdown in manufacturing productivity growth was the most significant, accounting for nearly half (-0.60 percentage points) of the overall slowdown of -1.25 percentage points, while retail trade accounted for -0.27 percentage points (or 21.5 per cent) of the slowdown. Agriculture, forestry, fishing and hunting and construction were also important, accounting for 14.7 and 10.8 per cent (respectively) of the overall slowdown. In contrast, wholesale trade contributed the most to the slowdown in aggregate labour productivity growth in Australia (-0.28 percentage points or 30.3 per cent), followed by mining and oil and gas extraction (26.2 per cent), utilities (19.8 per cent), other services (18.6 per cent), and manufacturing (17.1 per cent).

Finance, insurance, real estate and renting and leasing accounted for 0.20 percentage points (or 25.3 per cent) of the gap in aggregate labour productivity growth between Australia and Canada in 2000-2013, followed by construction (23.0 per cent), manufacturing (14.7 per cent), and agriculture, forestry, fishing and hunting (11.4 per cent). The contributions of finance, insurance, real estate and renting and leasing, construction, and agriculture, forestry, fishing and hunting were primarily due to stronger within-sector effects in Australia than in Canada. However, four-fifths of the contribution of manufacturing to the gap in aggregate labour productivity growth was related to the reallocation effects. In particular, the reallocation effects contributed 0.08 percentage points to aggregate labour productivity growth in Australia, while they contributed -0.06 percentage points in Canada. In other words, the reallocation of workers from manufacturing to other industries boosted aggregate labour productivity growth in Australia, while it weighed down on aggregate labour productivity growth in Canada.

It is also interesting to note that, while mining and oil and gas extraction only contributed 0.10 percentage points (or 9.2 per cent) to the gap in aggregate labour productivity growth in 2000-2013, the reallocation effects linked to mining and oil and gas extraction to other industries accounted for 0.19 percentage points (or 17.3 per cent) of the gap.

Table 18: Industry Contributions to Aggregate Labour Productivity Growth, Canada, 2000-2013

	Aggregate	WSE	RLE	RGE
	Percentage Point Contribution to Aggregate Labour Productivity Growth			
Business sector	0.92	0.78	0.34	-0.21
Agriculture, forestry, fishing and hunting	0.14	0.11	0.05	-0.02
Mining and oil and gas extraction	-0.01	-0.24	0.36	-0.13
Utilities	0.00	-0.03	0.04	-0.01
Construction	-0.03	0.02	-0.02	-0.03
Manufacturing	0.15	0.21	-0.04	-0.01
Wholesale trade	0.18	0.18	0.00	-0.01
Retail trade	0.09	0.11	-0.02	0.00
Transportation and warehousing	0.04	0.04	0.00	0.00
Information and cultural industries	0.07	0.07	0.00	0.00
Finance, insurance, real estate and renting and leasing	0.21	0.18	0.03	0.01
Professional, scientific and technical services	0.06	0.07	-0.01	0.00
Administrative and support, waste management and remediation services	-0.03	0.01	-0.03	-0.01
Arts, entertainment and recreation	0.00	0.00	0.00	0.00
Accommodation and food services	0.02	0.01	0.00	0.00
Other private services	0.03	0.04	-0.01	0.00
	Percentage Contribution to the Business Sector Total			
Business sector	100.0	100.0	100.0	100.0
Agriculture, forestry, fishing and hunting	14.9	14.3	14.1	11.6
Mining and oil and gas extraction	-1.1	-30.9	105.0	61.0
Utilities	0.4	-3.4	10.8	3.3
Construction	-3.8	2.0	-7.1	12.5
Manufacturing	16.6	26.7	-12.6	6.7
Wholesale trade	19.4	23.5	0.9	4.3
Retail trade	10.0	14.7	-6.8	-0.1
Transportation and warehousing	4.8	5.6	0.1	0.0
Information and cultural industries	7.5	8.9	-0.2	0.2
Finance, insurance, real estate and renting and leasing	23.0	22.6	8.0	-3.4
Professional, scientific and technical services	6.4	8.3	-1.9	0.0
Administrative and support, waste management and remediation services	-2.7	1.3	-8.4	3.3
Arts, entertainment and recreation	-0.5	-0.3	-0.4	0.2
Accommodation and food services	2.0	1.8	1.1	-0.3
Other private services	3.1	5.0	-2.6	0.7

Note: “WSE” stands for “within-sector effect.” “RLE” stands for “reallocation level effect.” “RGE” stands for “reallocation growth effect.” “Aggregate” refers to the business sector for Canada and the market sector for Australia.
Source: CSLS calculations based on Statistics Canada and ABS data. Statistics Canada: 383-0029 and 383-0021. ABS: 5204.005, 6291.0.55.003 and 5260.0.55.002.

Table 19: Industry Contributions to Aggregate Labour Productivity Growth, Australia, 2000-2013

	Aggregate	WSE	RLE	RGE
	Percentage Point Contribution to Aggregate Labour Productivity Growth			
Market sector	2.04	1.46	1.37	-0.78
Agriculture, forestry and fishing	0.26	0.20	0.08	-0.02
Mining	0.09	-0.33	1.09	-0.66
Electricity, gas, water and waste services	-0.08	-0.15	0.18	-0.11
Construction	0.22	0.26	-0.06	0.02
Manufacturing	0.32	0.24	0.05	0.03
Wholesale trade	0.15	0.16	-0.01	0.00
Retail trade	0.18	0.17	0.01	0.00
Transport, postal and warehousing	0.14	0.14	0.00	0.00
Information, media and telecommunications	0.17	0.22	-0.02	-0.04
Financial and insurance services	0.37	0.33	0.03	0.02
Rental, hiring and real estate services	0.04	0.02	0.02	0.00
Professional, scientific and technical services	0.06	0.09	-0.01	-0.02
Administrative and support services	0.04	0.04	-0.01	0.00
Arts and recreation services	0.00	0.01	-0.01	-0.01
Accommodation and food services	0.07	0.04	0.02	0.01
Other services	0.00	0.00	0.00	0.00
	Percentage Contribution to the Market Sector Total			
Market sector	100.0	100.0	100.0	100.0
Agriculture, forestry and fishing	13.0	13.7	6.0	2.0
Mining	4.6	-22.8	79.5	84.2
Electricity, gas, water and waste services	-3.9	-10.2	13.0	13.8
Construction	11.0	18.1	-4.0	-2.0
Manufacturing	15.6	16.6	3.3	-3.8
Wholesale trade	7.3	10.9	-0.4	0.6
Retail trade	9.0	12.0	0.6	-0.2
Transport, postal and warehousing	6.9	9.8	-0.1	0.0
Information, media and telecommunications	8.3	15.3	-1.1	5.1
Financial and insurance services	18.2	22.6	1.9	-2.1
Rental, hiring and real estate services	1.9	1.6	1.5	0.5
Professional, scientific and technical services	2.8	6.1	-0.6	2.9
Administrative and support services	2.0	2.9	-0.4	-0.6
Arts and recreation services	-0.2	0.6	-0.5	0.7
Accommodation and food services	3.4	2.7	1.4	-1.3
Other services	0.1	0.3	-0.1	0.1

Note: “WSE” stands for “within-sector effect.” “RLE” stands for “reallocation level effect.” “RGE” stands for “reallocation growth effect.” “Aggregate” refers to the business sector for Canada and the market sector for Australia.
Source: CSLS calculations based on Statistics Canada and ABS data. Statistics Canada: 383-0029 and 383-0021. ABS: 5204.005, 6291.0.55.003 and 5260.0.55.002.

The overall quality of the natural resource base can have an important effect on productivity. *Ceteris paribus*, easily accessible and high-quality natural resources will lead to lower costs and higher productivity than hard-to-reach and low-quality natural resources (Topp and Kulys, 2014; Sharpe and Waslander, 2014).[22] This could explain the negative labour productivity growth exhibited by mining and oil and gas extraction in both economies in 2000-2013. Gordon (2013) provides another possible explanation for weak MFP growth in resource-extraction industries called the "time-to-build" bias. Since there is often a gap of several years between when investment in extraction facility begins and when production commences, there will be a period where investment is increasing with no corresponding increase in output. This would show up as negative MFP growth.[23]

Even though the mining and oil and gas extraction industry exhibited strongly negative labour productivity growth in both countries, its contribution to aggregate labour productivity growth was -0.01 percentage points in Canada and 0.09 percentage points in Australia, as the reallocation level effect was large enough to offset negative values for the within-sector effect and the reallocation growth effect in both economies. The larger contribution of mining and oil and gas extraction to aggregate labour productivity growth in Australia is entirely due to the fact that Australia experienced a much larger increase in the share of mining and oil and gas extraction in total hours worked than Canada (0.6 percentage points increase versus 2.5 percentage points increase.

Table 20: Shares of Real Value Added in Mining by Industry, Canada and Australia, Per Cent, 2000 and 2013

	Canada		Australia	
	2000	2013	2000	2013
Mining, quarrying, and oil and gas extraction	100.0	100.0	100.0	100.0
Oil and gas extraction	70.4	73.3	28.6	21.4
Coal mining	2.1	1.4	22.6	18.6
Iron ore mining	1.7	1.4	14.4	39.7
Other mining	19.5	15.0	26.8	13.0
Exploration and mining support services	6.4	8.8	7.6	7.4

Source: CSLS calculations based on Statistics Canada and ABS data. Statistics Canada: 379-0031. ABS: 5204.005.

Differences in the structure of the mining and oil and gas extraction industry may partially explain why Australia experienced a much larger increase in the industry's share of total hours worked (Table 20). For instance, in 2013, coal and iron mining together accounted for 58.3 of the industry's real output in Australia compared to 2.8 per cent in Canada. In addition, oil and

[22] Gordon (2013) refers to this as the "low-hanging fruit" bias. Firms have an inventive to "start with the high-quality, low-cost plays and, when these are exhausted, move on to deposits that are of lower quality and are more costly." As firms move on to lower quality deposits, firms will need to employ an increasing amount of capital to produce a given level of output. This would show up as negative MFP growth.

[23] This phenomenon is offset by statistical agencies using construction in progress where the value of the project is counted in stages over time.

gas extraction accounted for 73.3 per cent of real output in the industry in Canada, well above the equivalent share in Australia (21.4 per cent).

Table 21: Labour Productivity Levels and Shares of Total Hours Worked, Canada, 1994, 2000 and 2013

	Labour Productivity Levels (2007 CAD)			Shares of Total Hours Worked (Per Cent)		
	1994	2000	2013	1994	2000	2013
Business sector	38.00	43.21	48.66	100.00	100.00	100.00
Agriculture, forestry, fishing and hunting	15.92	22.29	38.23	5.82	4.33	2.91
Mining and oil and gas extraction	333.91	354.09	249.44	1.53	1.43	2.14
Utilities	172.96	193.22	170.57	0.90	0.73	0.88
Construction	37.21	39.27	40.51	8.83	7.99	11.79
Manufacturing	39.01	47.57	54.44	18.83	18.74	12.67
Wholesale trade	33.10	39.67	56.03	6.59	6.92	6.42
Retail trade	17.05	20.95	26.58	13.61	12.55	13.20
Transportation and warehousing	33.36	37.65	41.95	6.07	6.28	6.26
Information and cultural industries	59.51	65.39	82.63	2.16	2.49	2.47
Finance, insurance, real estate and renting and leasing	61.59	69.38	81.55	9.15	8.93	9.58
Professional, scientific and technical services	33.95	37.61	43.07	5.64	7.34	8.05
Administrative and support, waste management and remediation services	26.67	25.86	27.13	4.08	5.05	6.06
Arts, entertainment and recreation	27.72	23.77	22.80	1.32	1.72	1.76
Accommodation and food services	16.47	17.08	18.25	7.44	7.45	7.36
Other private services	27.01	27.96	30.93	8.05	8.04	8.40

Source: CSLS calculations based on Statistics Canada data. CANSIM tables 383-0029 and 383-0021.

Table 22: Labour Productivity Levels and Shares of Total Hours Worked, Australia, 1994, 2000 and 2013

	Labour Productivity Levels (2012 AUD)			Shares of Total Hours Worked (Per Cent)		
	1994	2000	2013	1994	2000	2013
Market sector	57.57	68.56	89.15	100.00	100.00	100.00
Agriculture, forestry and fishing	26.01	39.14	65.55	7.45	7.34	4.65
Mining	357.23	472.44	247.52	1.58	1.44	4.05
Electricity, gas, water and waste services	214.17	288.71	174.80	1.67	1.27	2.06
Construction	50.75	52.11	77.40	9.72	10.13	13.39
Manufacturing	50.40	59.03	73.29	18.38	16.50	11.87
Wholesale trade	51.78	77.18	105.74	6.67	5.41	4.81
Retail trade	28.72	35.04	49.25	12.17	11.94	11.70
Transport, postal and warehousing	56.72	64.38	83.91	6.77	7.08	7.25
Information, media and telecommunications	73.09	85.38	150.16	2.99	3.36	2.48
Financial and insurance services	105.50	139.55	204.72	4.99	4.92	5.28
Rental, hiring and real estate services	117.56	121.58	131.33	2.15	2.27	2.64
Professional, scientific and technical services	59.18	64.19	73.50	7.45	9.22	11.16
Administrative and support services	83.32	82.21	91.60	3.33	4.41	4.01
Arts and recreation services	42.92	48.05	53.14	1.59	1.63	1.96
Accommodation and food services	32.92	38.33	43.34	7.28	7.69	7.07
Other services	33.78	42.54	43.25	6.04	5.62	5.66

Source: CSLS calculations based on ABS data. Catalogue no. 5204.005, 6291.0.55.003 and 5260.0.55.002.

Table 23: Relative Labour Productivity Levels and Shares of Total Hours Worked, Canada and Australia, 1994, 2000 and 2013

	Canada			Australia			
	1994	2000	2013	1994	2000	2013	
Business sector	100.00	100.00	100.00	100.00	100.00	100.00	Market sector
Agriculture, forestry, fishing and hunting	41.89	51.59	78.57	45.18	57.09	73.53	Agriculture, forestry and fishing
Mining and oil and gas extraction	878.71	819.46	512.62	620.51	689.09	277.64	Mining
Utilities	455.16	447.17	350.53	372.02	421.11	196.07	Electricity, gas, water and waste service
Construction	97.92	90.88	83.25	88.15	76.01	86.82	Construction
Manufacturing	102.66	110.09	111.88	87.55	86.10	82.21	Manufacturing
Wholesale trade	87.11	91.81	115.15	89.94	112.57	118.61	Wholesale trade
Retail trade	44.87	48.48	54.62	49.89	51.11	55.24	Retail trade
Transportation and warehousing	87.79	87.13	86.21	98.52	93.90	94.12	Transport, postal and warehousing
Information and cultural industries	156.61	151.33	169.81	126.96	124.53	168.44	Information, media and telecommunications
Finance, insurance, real estate and renting and leasing	162.08	160.56	167.59	183.26	203.54	229.64	Financial and insurance services
				204.20	177.33	147.31	Rental, hiring and real estate services
Professional, scientific and technical services	89.34	87.04	88.51	102.80	93.63	82.45	Professional, scientific and technical services
Administrative and support, waste management and remediation services	70.18	59.85	55.75	144.73	119.91	102.75	Administrative and support services
Arts, entertainment and recreation	72.95	55.01	46.86	74.55	70.08	59.61	Arts and recreation services
Accommodation and food services	43.34	39.53	37.51	57.18	55.91	48.61	Accommodation and food services
Other private services	71.08	64.71	63.56	58.68	62.05	48.51	Other services

Note: the numbers in this table reflect each industry's productivity relative to the business sector or market sector in each year. For example, in 1994, transportation and warehousing labour productivity was 87.79 per cent of labour productivity in the business sector.
Source: CSLS calculations based on ABS data. Catalogue no. 5204.005, 6291.0.55.003 and 5260.0.55.002.

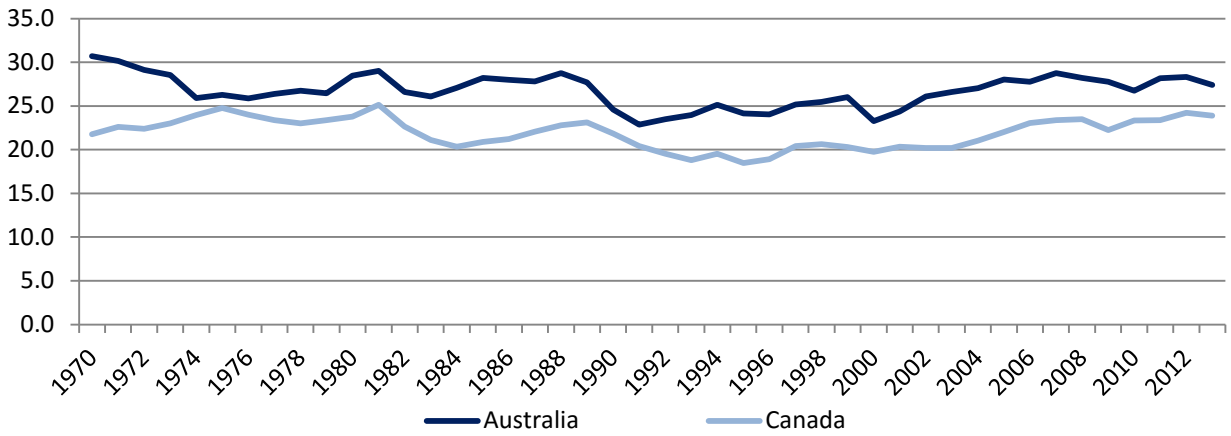
V. Drivers of Labour Productivity Growth

A. Investment

Investment is expenditure on acquiring or maintaining capital goods which will be used for future production. As such, investment is a key component of growth in productivity. Capital deepening (increasing the amount of capital per worker) boosts labour productivity. Many technological improvements which drive labour productivity growth also require investment in new capital.

Australia has outperformed Canada in terms of investment intensity (investment as a share of nominal GDP) for the last 45 years. From 1970 to 2013, total investment's share of nominal GDP has typically been about 5 percentage points above Canada's (Chart 24).[24] In 2013, investment represented 23.9 per cent of Canadian GDP compared to 27.4 per cent in Australia. This consistently higher level of investment likely explains much of Australia's relatively strong labour productivity growth.

Chart 24: Gross Fixed Capital Formation as a Share of GDP, Canada and Australia, Per Cent, 1970-2013



Source: OECD.Stat, National Accounts, Annual National Accounts, Main Aggregates, Gross Domestic Product (GDP)

The higher investment intensity recorded in Australia cannot be explained by investment in the mining sector, as Canada has actually had a higher share of mining and oil and gas extraction investment in total economy GDP than Australia over much of the 1970-2013 period (Chart 25, Panel A).[25] Therefore, higher investment in other industries must explain Australia's superior performance in terms of investment intensity (Chart 25, Panel B). However, the larger increase in mining investment's share of total economy GDP in Australia between 2002 and

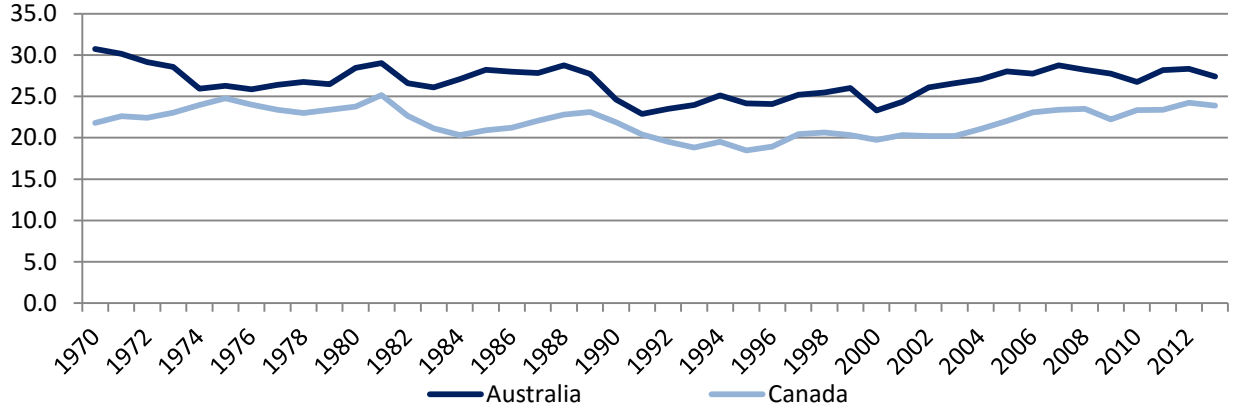
[24] This includes residential investment.

[25] Australia's "mining" industry includes coal mining, oil and gas extraction, metal ore mining, non-metallic mineral mining and quarrying, and exploration and other mining support services, making it comparable with Canada's "mining and oil and gas extraction" industry.

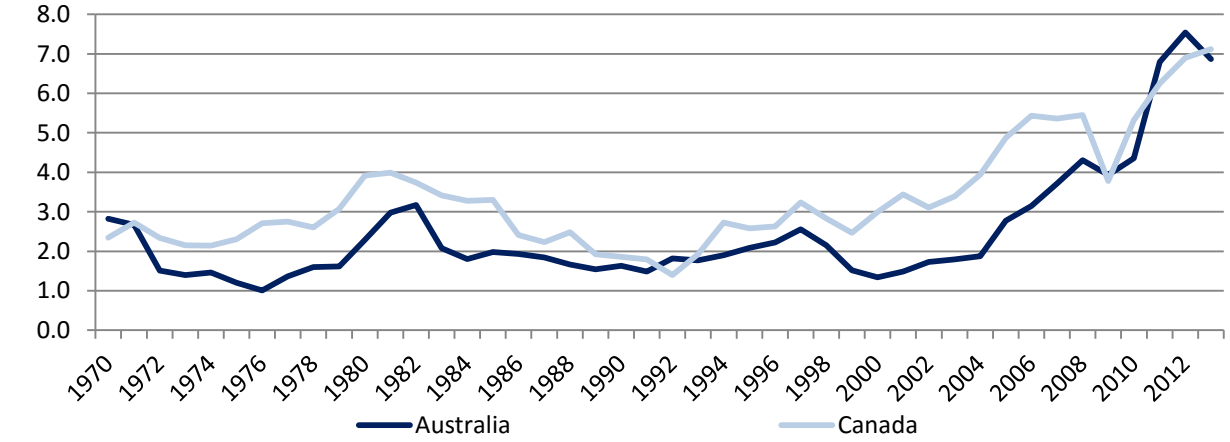
2013 suggests that Australia exhibited more rapid growth in investment in the mining sector than Canada.

Chart 25: Nominal National Currency Unit: Gross Fixed Capital Formation as a Share of GDP by Industry, Canada and Australia, Per Cent, 1970-2013

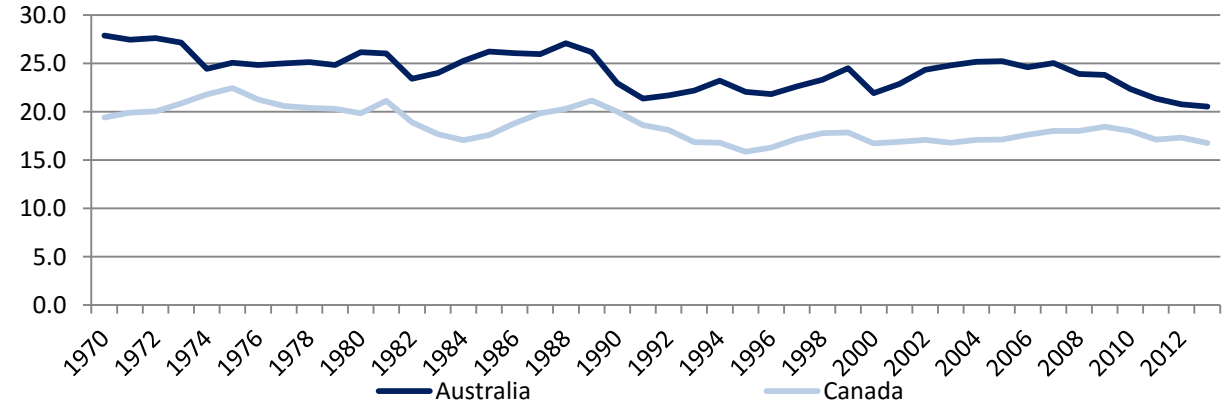
Panel A: All industries



Panel B: Mining



Panel C: All industries (excluding mining and quarrying)



Source: Calculations based on Statistics Canada and OECD data. OECD.Stat, National Accounts, Annual National Accounts, Main Aggregates, Gross Domestic Product (GDP). CANSIM table 031-0006.

Table 24 shows the growth rate of real investment[26] in Canada and Australia between 1981 and 2013. Australian investment grew at an annual rate of 4.34 per cent over this period, 1.35 percentage points higher than the Canadian rate of 2.99 per cent. Australian investment grew faster than Canada's in 1981-1994 and especially in 2000-2013, while Canada outperformed Australia in terms of real investment growth in 1994-2000. From 2000 to 2013, Australian real investment grew at a rate of 6.09 per cent, while Canadian investment only grew at a rate of 3.67 per cent. Notice that investment growth rose considerably for both countries in the 2000s compared to the previous decades. This was likely related to rising natural resource prices, as mining and oil extraction tend to be very capital intensive.

Table 24: Growth Rates of Fixed Investment, Constant 2010 US Dollars (Constant PPP), Australia and Canada

	Australia	Canada
1981-2013	4.34	2.99
1994-2013	5.35	4.04
1981-1994	2.89	1.49
1994-2000	3.78	4.85
2000-2013	6.09	3.67

Note: Fixed investment includes residential investment.
Source: OECD.Stat, National Accounts, Annual National Accounts, Main Aggregates, Gross Domestic Product (GDP)

Table 25 shows real investment growth in the mining sector and all other industries for the 1981-2013 period. In almost every sub-period, Australia surpassed Canada in real investment growth in both mining and all other industries. Therefore, the difference between the two countries cannot be solely attributed to stronger investment in Australia's natural resources sector. However, a large part of the gap in real investment growth between Canada and Australia in 2000-2013 was related to stronger investment in the mining sector, with annual growth of 18.2 per cent in Australia compared to 7.0 per cent in Canada. A notable exception was the 1994-2000 period, when Canada outperformed Australia in both the mining sector and all other industries.

Table 25: Growth Rates of Investment by Industry, Constant/Chained Dollars, Australia and Canada

	Australia				Canada			
	81-13	81-94	94-00	00-13	81-13	81-94	94-00	00-13
All industries	4.34	2.89	3.78	6.09	3.36	1.67	6.14	3.79
All industries (excluding mining and quarrying)	3.85	3.23	4.30	4.26	3.20	2.22	6.09	2.86
Mining and quarrying	6.56	0.11	-2.48	18.16	3.82	-0.38	6.35	7.00

Note: Australian data are in constant 2010 US dollars (constant PPP). Canadian data are in 2007 chained Canadian dollars.
Source: OECD.Stat, National Accounts, Annual National Accounts, Main Aggregates, Gross Domestic Product. Statistics Canada. CANSIM table 031-0006.

While total investment in Canada has been relatively weak when compared to Australia, it should be noted that Australia has the second highest level of investment intensity in the OECD (Table 26). Internationally, Canada also has a relatively high rate of investment – Canada

[26] Measured in constant PPP 2010 US dollars, constant PPP.

ranks fifth in the OECD.

Table 26: Ranking of OECD Countries by Investment as a Share of Nominal GDP, Public and Private, 2013

	Gross Fixed Capital Formation		Private Gross Fixed Capital Formation		Public Gross Fixed Capital Formation	
	% of GDP	Rank	% of GDP	Rank	% of GDP	Rank
Korea	29.3	1	24.6	1	4.68	2
Australia	27.4	2	24.0	2	3.36	17
Estonia	27.3	3	21.8	3	5.48	1
Czech Republic	25.2	4	21.7	5	3.48	15
Canada	23.9	5	20.0	8	3.88	10
Chile	23.8	6	21.7	4	2.08	30
Norway	23.6	7	19.4	9	4.27	6
Switzerland	23.4	8	20.4	6	3.00	19
Belgium	22.3	9	20.1	7	2.22	26
Austria	22.2	10	19.2	10	2.99	20
Sweden	22.1	11	17.6	16	4.54	3
France	22.1	12	18.1	14	4.02	9
New Zealand	22.1	13	18.5	12	3.59	13
Japan	21.7	14	18.3	13	3.46	16
Mexico	21.1	15	19.0	11	2.19	27
Finland	21.1	16	17.0	19	4.16	7
OECD Average	20.5	-	17.4	-	3.28	-
Slovak Republic	20.4	17	17.5	18	2.98	21
Turkey	20.3	18		.		.
Hungary	19.9	19	15.5	22	4.42	4
Germany	19.8	20	17.5	17	2.24	25
Slovenia	19.7	21	15.4	23	4.29	5
Israel	19.5	22	17.8	15	1.70	32
United States	18.9	23	15.6	21	3.34	18
Poland	18.8	24	14.7	25	4.10	8
Spain	18.5	25	16.4	20	2.10	28
Denmark	18.3	26	14.6	27	3.74	11
Netherlands	18.2	27	14.6	26	3.62	12
Italy	17.4	28	15.0	24	2.38	24
Luxembourg	17.1	29	13.5	29	3.53	14
United Kingdom	16.5	30	13.8	28	2.64	23
Iceland	15.4	31		.		.
Ireland	15.2	32	13.4	30	1.77	31
Portugal	14.6	33	12.5	31	2.09	29
Greece	11.2	34	8.5	32	2.73	22

Note: Fixed investment includes dwellings, i.e. residential investment.
Source: OECD.Stat, National Accounts, Annual National Accounts, Main Aggregates, Gross Domestic Product (GDP) and General Government Accounts, Government Deficit/Surplus, Revenue, Expenditure and Main Aggregates

Both the public and private sectors account for significant portions of a country's investment, although the level of private sector investment tends to be much greater. The public sector plays an important role in providing infrastructure (roads, bridges, etc.) which can raise productivity in both the public and private sectors. In 2013, Canada's public sector invested more

than the Australian public sector (as a share of GDP) – 3.88 per cent in Canada compared to 3.36 per cent in Australia. Neither country has an especially high level of public investment when compared internationally. Canada ranks tenth in the OECD while Australia ranks seventeenth.

Australia and Canada both have high rates of investment in the private sector. In 2013, Canadian private sector investment accounted for 20.0 per cent of GDP (eighth in OECD) while Australian private sector investment was 24.0 per cent of its GDP (second in the OECD).

The type of investment matters, as some investments may have greater impacts on productivity than others. We will briefly compare Australia and Canada in terms of a few major types of investment. Specifically, we will look at investments in buildings and structures, machinery and equipment, and intellectual property products.

i. Buildings and Structures

Buildings and structures include both residential dwellings and industrial buildings and structures. The figures we will consider exclude dwelling places, as investment in dwellings is not expected to have much of an impact on our measures of productivity.[27]

Chart 26 shows how investment intensity has evolved in Canada and Australia between 1970 and 2013. In the 1970s, Canada actually had a slightly higher rate of investment in structures and buildings than Australia. This has generally not been the case since about 1983. Canadian investment in buildings and structures (as a share of GDP) declined significantly between 1980 and 2000, from about 9 per cent down to below 6 per cent. Australian investment in this area also fell significantly, although this did not occur until about 1990. The most notable feature of investment rates in buildings and structures is that they surged in both Canada and Australia in the 2000s. This began a few years earlier in Australia, and the growth occurred at a higher rate. Between 2000 and 2013, real investment in structures and buildings grew at an annual rate of 5.08 per cent in Canada and 8.93 per cent in Australia (Table 27).

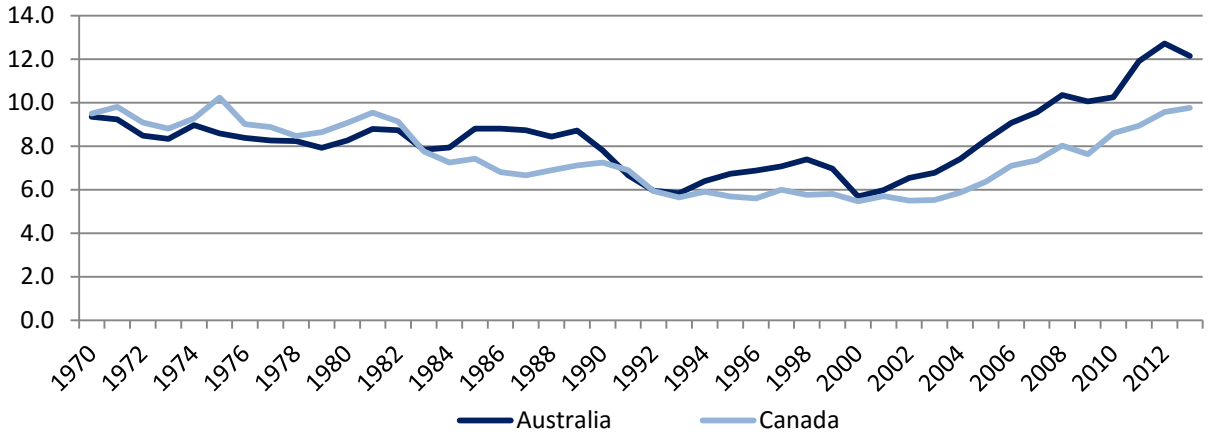
The recent surge in nominal national currency unit investment in buildings and structures largely reflects construction related to mining and oil and gas production (Chart 26). However, Australia also outperformed Canada in terms of real investment in structures and buildings (as a share of GDP) in all other industries during this period.

By 2013, investment in buildings and structures accounted for 9.75 per cent of Canada's GDP (fifth in the OECD) and 12.13 per cent of Australia's (first in the OECD) (Table 28).

[27] Most home production is not captured in GDP.

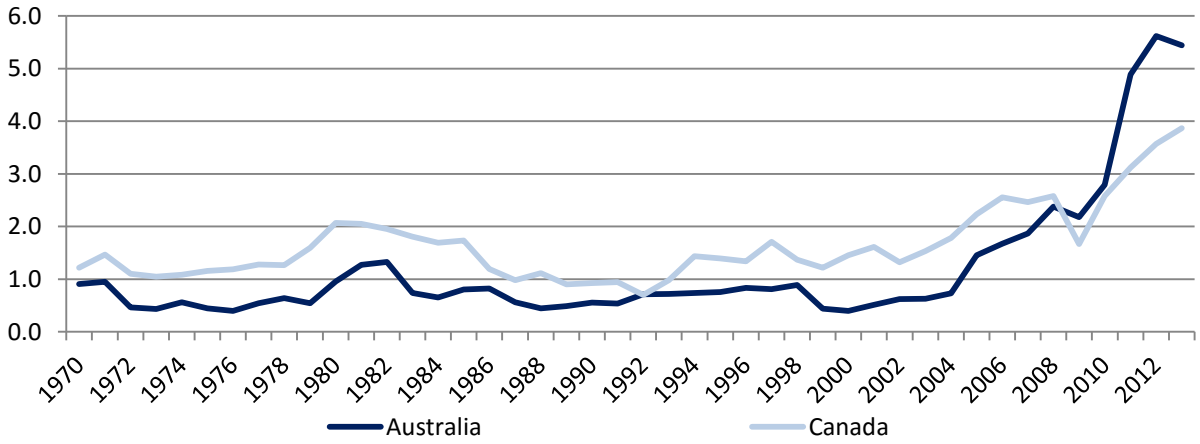
Chart 26: Nominal National Currency Unit: Investment in Non-Residential Buildings and Structures (i.e. Excluding Dwellings) as a Share of Nominal GDP by Industry (%), Canada and Australia, 1970-2013

Panel A: All industries

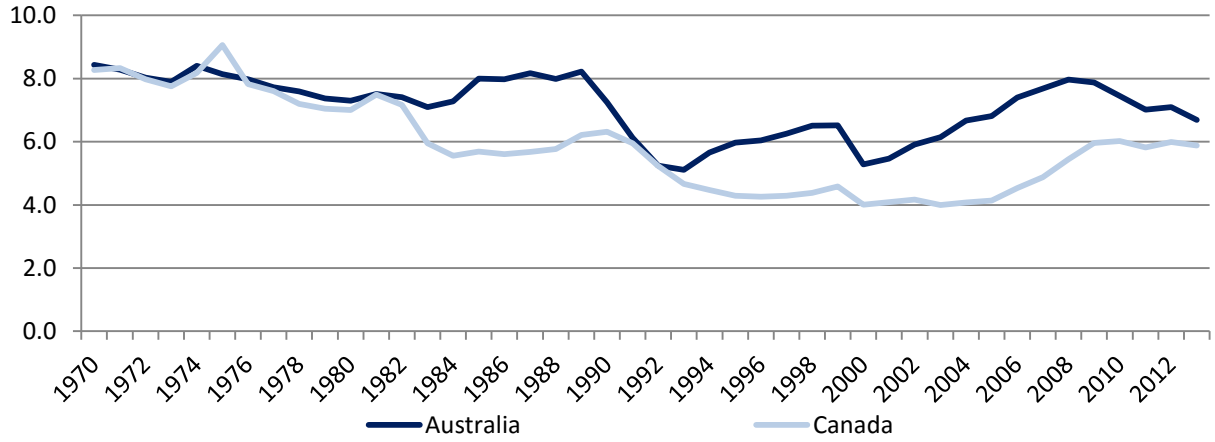


Source: OECD.Stat, National Accounts, Annual National Accounts, Main Aggregates, Gross Domestic Product (GDP)

Panel B: Mining and quarrying



Panel C: All industries (excluding mining and quarrying)



Source: Calculations based on Statistics Canada and OECD data. OECD.Stat, National Accounts, Annual National Accounts, Main Aggregates, Gross Domestic Product (GDP). CANSIM table 031-0006.

Table 27: Growth Rates of Investment by Type, Constant 2010 US Dollars (Constant PPP), Australia and Canada

	Australia				Canada			
	81-13	81-94	94-00	00-13	81-13	81-94	94-00	00-13
Dwellings	1.86	1.83	0.02	2.75	2.24	1.34	0.87	3.80
Other buildings and structures	4.01	0.69	0.95	8.93	2.19	-0.38	1.67	5.08
Machinery and equipment and weapon systems	5.67	4.17	7.67	6.26	3.90	2.37	10.02	2.69
Intellectual property products	8.07	9.22	8.24	6.85	4.57	6.02	6.86	2.12

Source: OECD.Stat, National Accounts, Annual National Accounts, Main Aggregates, Gross Domestic Product

Table 28: Ranking of OECD Countries by Investment as a Share of Nominal GDP, Major Types of Investment, 2013

	Non-dwelling Buildings and Structures		Machinery and Equipment and Weapon Systems		Intellectual Property Products	
	% of GDP	Rank	% of GDP	Rank	% of GDP	Rank
Australia	12.13	1	5.67	21	3.00	18
Korea	11.03	2	8.60	6	5.75	3
Chile	10.11	3	8.52	8	1.79	27
Estonia	10.03	4	11.98	1	1.84	26
Canada	9.75	5	4.43	28	2.91	19
Poland	8.21	6	6.87	16	1.25	31
Mexico	7.68	7	7.37	12	0.42	32
Hungary	7.29	8	8.59	7	2.50	23
Czech Republic	7.19	9	10.99	3	3.60	14
Japan	6.93	10	9.40	5	2.08	24
New Zealand	6.42	11	6.76	17	3.04	17
Slovak Republic	6.31	12	9.91	4	1.47	30
France	6.26	13	4.75	27	4.97	7
Austria	6.24	14	7.17	13	4.42	8
Finland	5.79	15	4.89	26	4.31	9
Slovenia	5.60	16	8.37	9	3.17	16
Spain	5.60	17	5.77	19	2.75	20
Luxembourg	5.47	18	6.90	15	1.59	28
Netherlands	5.36	19	5.35	24	4.18	10
Belgium	5.35	20	6.93	14	4.02	11
United Kingdom	5.25	21	4.02	31	3.75	13
Sweden	5.16	22	7.39	11	5.97	2
Portugal	5.03	23	4.12	30	2.63	21
Iceland	5.01	24	5.48	23	2.05	25
Switzerland	4.34	25	8.25	10	6.10	1
Italy	4.31	26	5.73	20	2.56	22
United States	4.31	27	6.52	18	4.98	6
Ireland	4.29	28	3.89	32	5.01	5
Israel	4.12	29	5.18	25	3.84	12
Germany	4.08	30	.	.	3.51	15
Denmark	4.04	31	5.54	22	5.03	4
Greece	3.15	32	4.35	29	1.51	29
Turkey	.	.	11.27	2	.	.
Norway	.	.	.	.	.	.

Note: Norway does not provide a breakdown of gross fixed capital formation into components.

Source: OECD.Stat, National Accounts, Annual National Accounts, Main Aggregates, Gross Domestic Product (GDP)

ii. Machinery and Equipment

While the gap in terms of structures and buildings explains much of Australia's relatively high investment rate compared to Canada in recent years, Canada has historically underinvested in machinery and equipment (M&E) compared to Australia (Chart 27). Investment as a share of GDP has declined considerably in both countries compared to what it had once been. In 1970, investment in machinery and equipment represented 9.7 per cent of Australian GDP and 7.1 per cent of Canadian GDP.[28] By 2013, these figures had fallen to 5.7 per cent and 4.4 per cent respectively.

Canada's chronically poor performance in M&E investment has often been suggested as a major source of Canada's poor productivity growth. Canada ranked 28th out of the 32 countries for which data were available for 2013 (Table 29). Australia certainly outperforms Canada in this area, although it is also well behind internationally, ranking 21st.

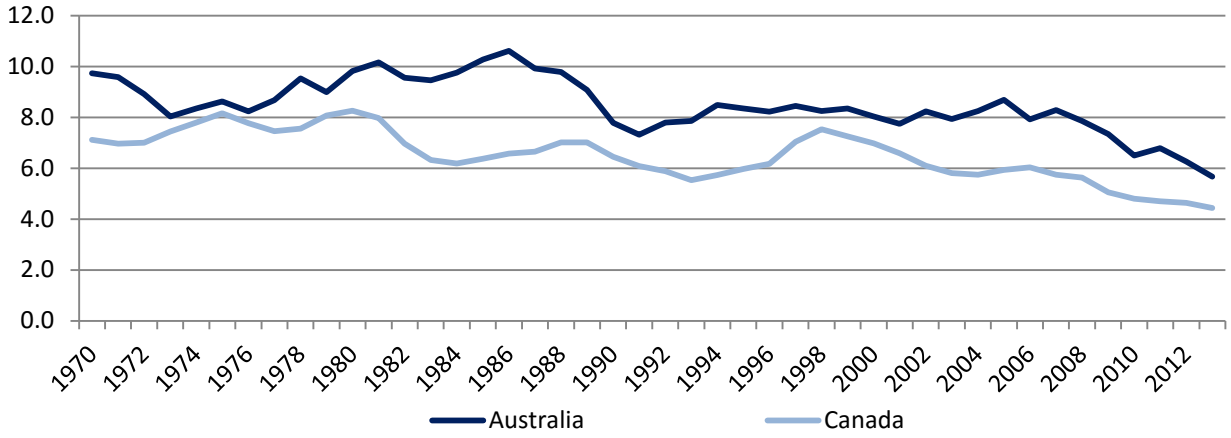
Canada's relatively poor performance in M&E investment intensity was related to lower M&E investment (as a share of GDP) in both mining and in all other industries (Chart 27). M&E investment in the mining sector (as a share of GDP) has actually increased tremendously in both countries between 2000 and 2013, which largely reflects the increase in the sector's share of total economy GDP over this period.

While Australian M&E investment rates are relatively low, it is a strong performer in an important subset of M&E: information and communication technology (ICT). This category of investment includes telecommunications equipment, computers, and software which are expected to embody significant technological improvements. Australia ranks third out of the 19 OECD countries for which data is available on ICT investment (based on 2013 ICT investment relative to nominal GDP). In 2013, Australian investment in ICT accounted for 1.4 per cent of GDP. Unfortunately, data for Canada was unavailable from the OECD, but it has been well documented that Canada's performance is very poor compared to the United States. In particular, Canada's ICT investment rate is about half that of the United States (Thomas, 2015). The United States had the fifth highest rate of investment in ICT (1.2 per cent) in 2013 of the OECD countries for which data was available. Assuming Canada's ICT investment was about 0.6 per cent of GDP, it would have ranked 15th out of 20 OECD countries.

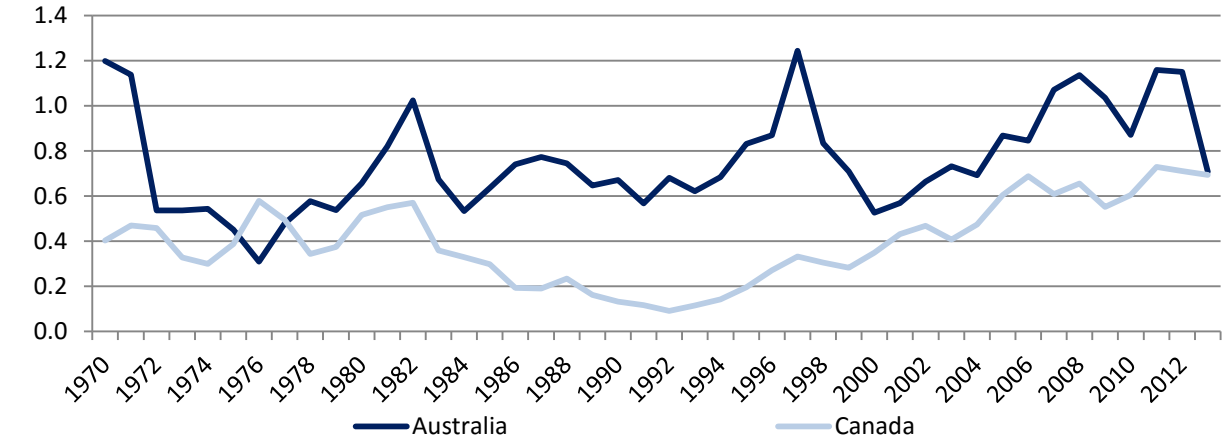
[28] Figures include investments in weapons systems.

Chart 27: Investment in Machinery and Equipment as a Share of Nominal GDP by Industry, Canada and Australia, Per Cent, 1970-2013

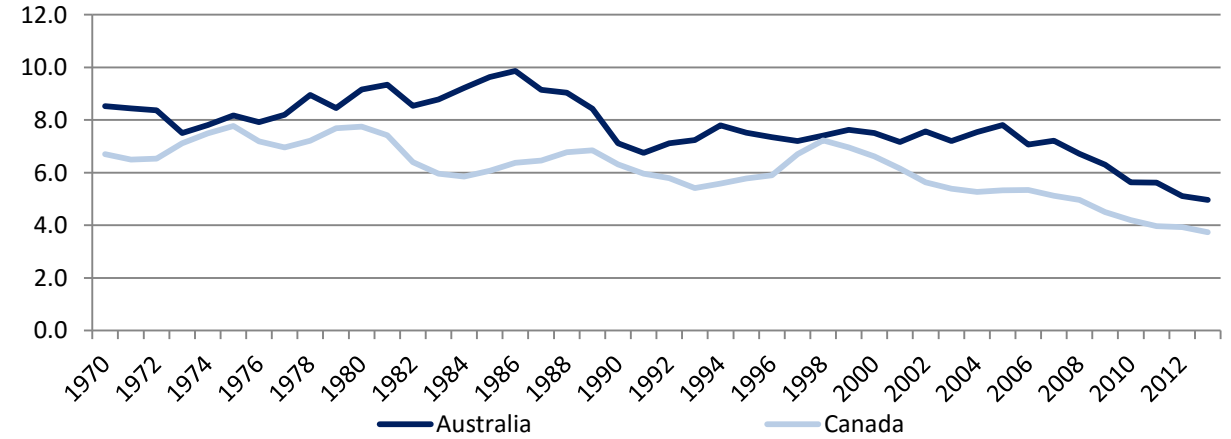
Panel A: All industries



Panel B: Mining and quarrying



Panel C: All industries (excluding mining and quarrying)



OECD.Stat, National Accounts, Annual National Accounts, Main Aggregates, Gross Domestic Product (GDP). CANSIM table 031-0006.

Table 29: Ranking of OECD Countries by ICT Investment as a Share of Nominal GDP, 2013

Country	ICT Investment as a Share of Nominal GDP	Rank
Estonia	2.15	1
Czech Republic	1.78	2
Australia	1.41	3
Belgium	1.23	4
United States	1.20	5
Denmark	1.12	6
Austria	1.11	7
Sweden	1.06	8
Slovenia	0.84	9
Ireland	0.83	10
Mexico	0.77	11
Netherlands	0.72	12
Italy	0.68	13
Slovak Republic	0.64	14
Hungary	0.58	15
Spain	0.56	16
Finland	0.51	17
France	0.43	18
United Kingdom	0.40	19

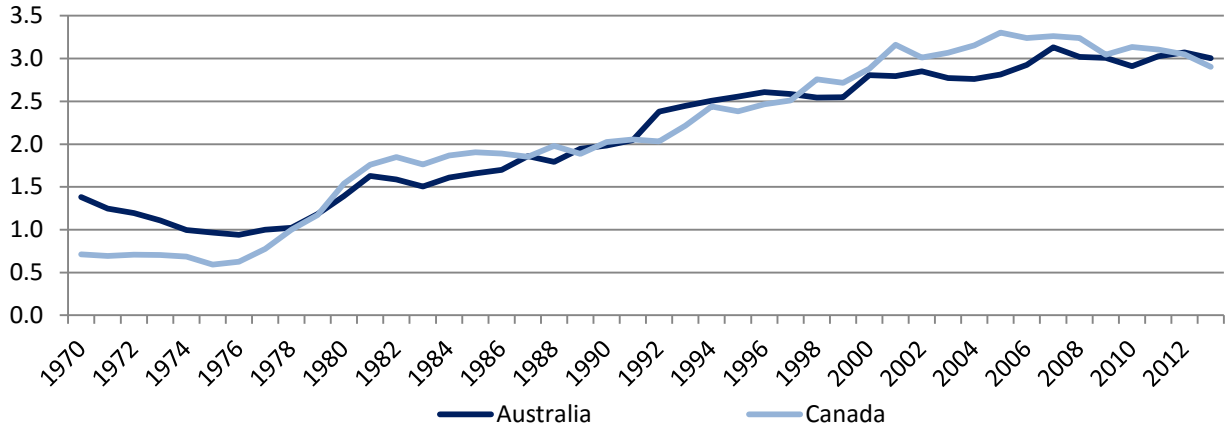
Note: ICT is compiled according to the System of National Accounts 2008. In this manual, ICT equipment consists of devices using electronic controls and also the electronic components forming part of these devices. In practice, this narrows the coverage of ICT equipment mostly to computer hardware and telecommunications equipment.
Source: OECD.Stat, National Accounts, Annual National Accounts, Main Aggregates, Gross Domestic Product (GDP)

iii. Intellectual Property

Intellectual property products (IPP), defined as software, R&D and natural resource exploration, remains a relatively small component of total investment, but it has grown significantly (Chart 28). Given the link between IPP and innovation, investments in this area may be significant for productivity growth. Investment in intellectual property in real terms has grown at a rate of 8.1 per cent annually in Australia and 4.6 per cent in Canada between 1970 and 2013. As of 2013, investments of this type have represented 3.00 per cent and 2.91 per cent of Australian and Canadian GDP respectively. Neither country is especially strong in this area, as they ranked eighteenth and nineteenth among OECD countries in 2013 (Table 28).

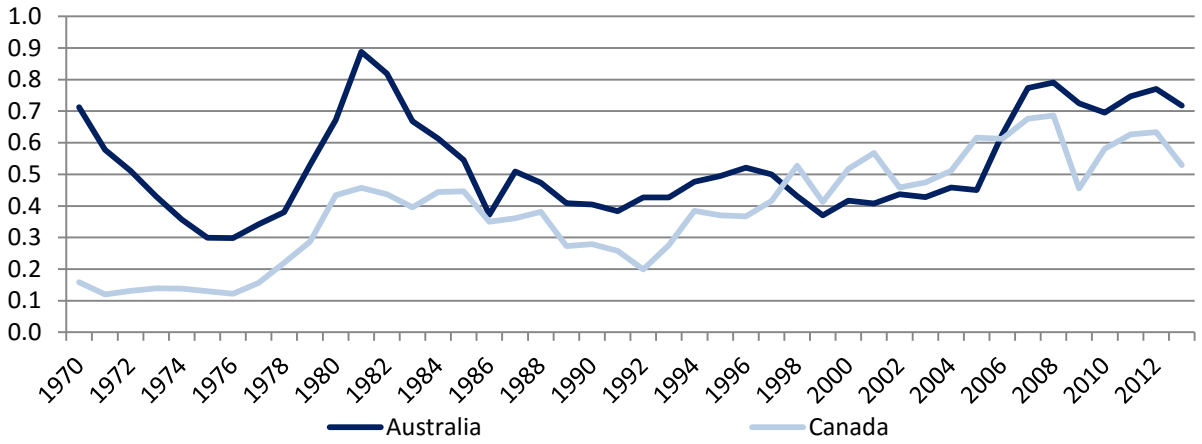
Chart 28: Investment in Intellectual Property as a Share of Nominal GDP by Industry (%), Canada and Australia, 1970-2013

Panel A: All industries

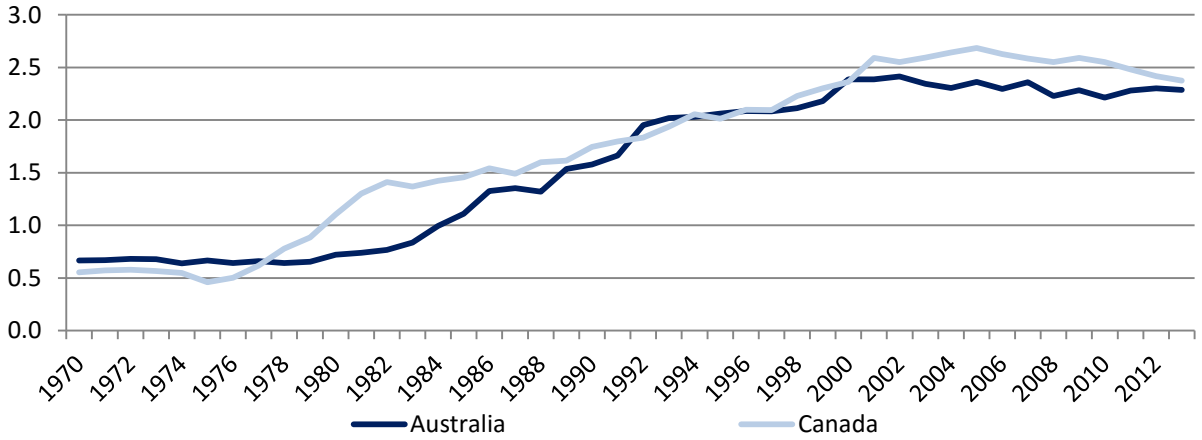


Source: OECD.Stat, National Accounts, Annual National Accounts, Main Aggregates, Gross Domestic Product (GDP)

Panel B: Mining and quarrying



Panel C: All industries (excluding mining and quarrying)

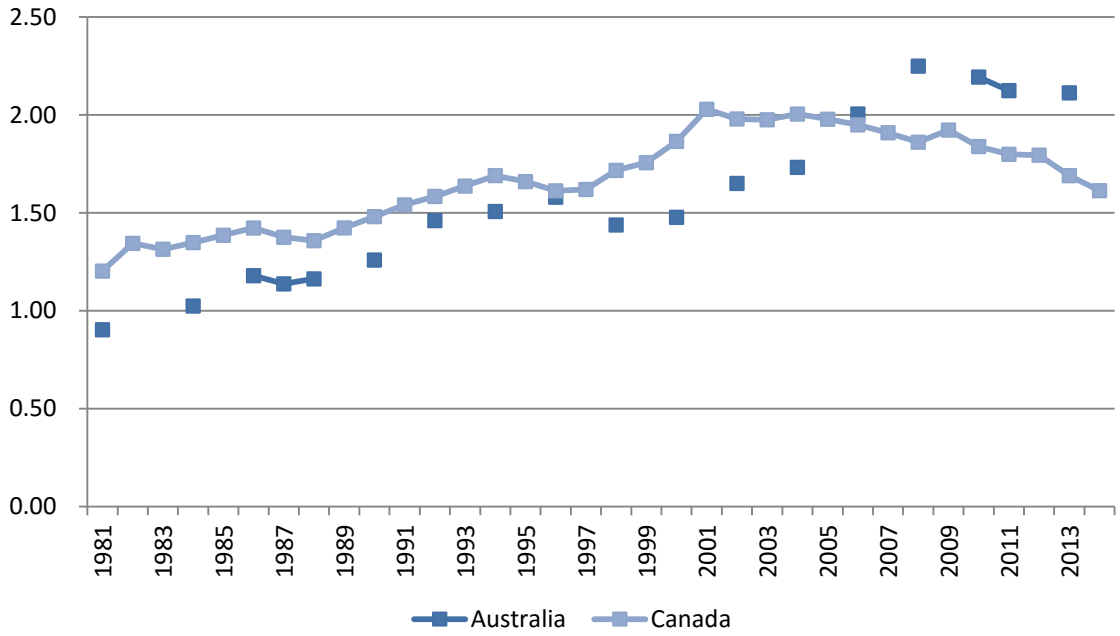


Source: Calculations based on Statistics Canada and OECD data. OECD.Stat, National Accounts, Annual National Accounts, Main Aggregates, Gross Domestic Product (GDP). CANSIM table 031-0006.

B. Innovation

In Canada, general expenditure on R&D (GERD) as a percentage of GDP increased from 1.20 in 1981 to 2.03 in 2001, before dropping to 1.61 in 2014 (Chart 29). Australia's GERD as a per cent of GDP displayed a similar trend to Canada's GERD as a per cent of GDP, increasing from 0.90 to 2.11 between 1981 and 2013, although Australia's GERD began to decrease later than Canada's, in 2008, after reaching a higher peak of 2.25 per cent (Canada peaked in 2001). As a result of Australia's increase, the gap between the two countries was reversed. Relative to other OECD countries' shares of GERD in GDP in 2011, Australia ranked thirteenth out of thirty-three, while Canada ranked eighteenth.

Chart 29: GERD as a Per Cent of GDP, Canada and Australia, 1981-2014

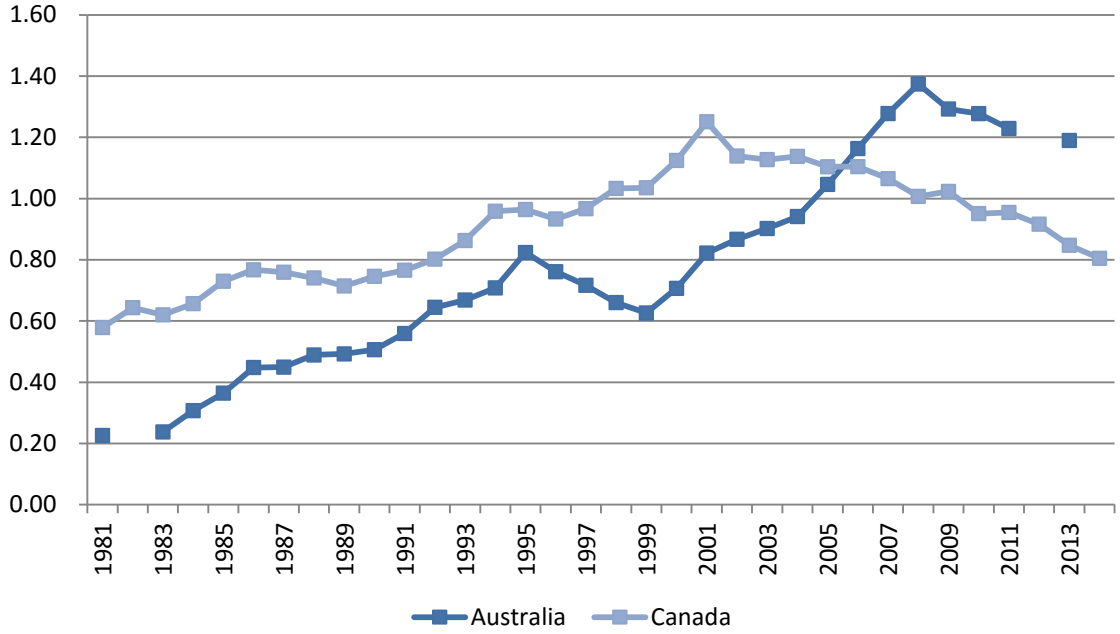


Source: CSLS calculations based on OECD data.

We are particularly interested in business expenditure on R&D (BERD) as a percentage of GDP because BERD is the largest component of GERD and because BERD is more closely linked with productivity in the business sector than other types of R&D expenditures. BERD as a share of GDP was higher in Canada than in Australia between 1981 and 2005 (Chart 30). After 2005, Canada's BERD as a share of GDP continued the decline it began in 2001, while Australia's BERD as a per cent of GDP continued the rise it had begun in 1999. Australia's BERD as a share of GDP only began to trend downward in 2008, seven years after Canada's BERD as a per cent of GDP started its downward movement. Moreover, Australia's share of BERD in GDP increased 426 per cent between 1981 and 2013, compared to a much smaller increase in Canada (46 per cent). Australia's large increase actually pushed its BERD share of GDP higher than that of Canada's in 2006. Relative to other OECD countries in 2013,

Australia's share of BERD in GDP ranked thirteenth out of thirty-two, while Canada's ranked twenty-first.

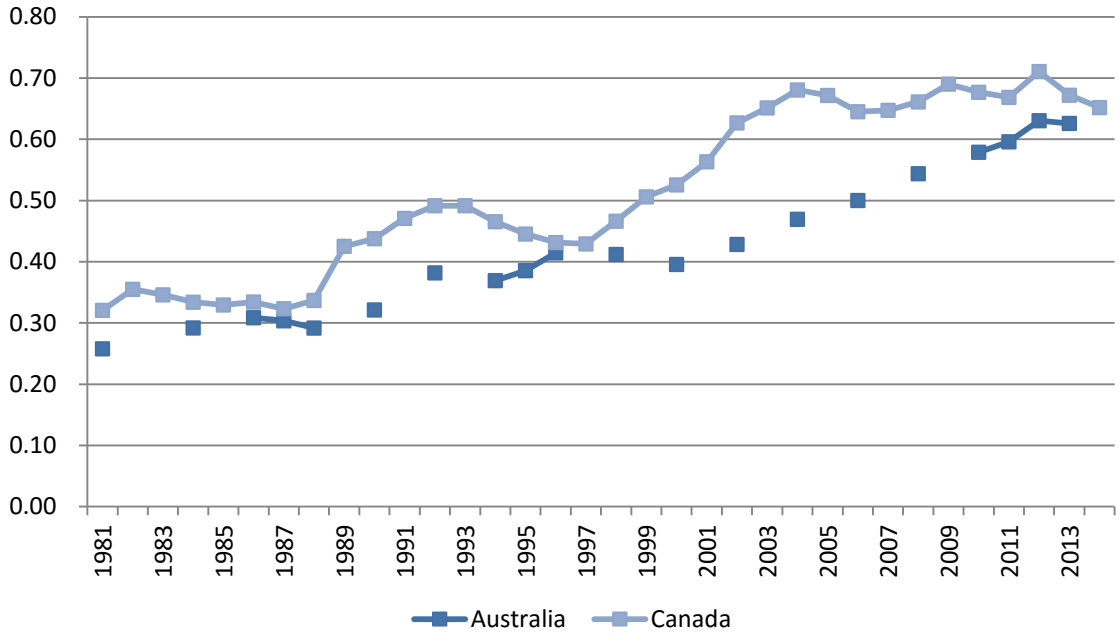
Chart 30: BERD as a Per Cent of GDP, Canada and Australia, 1981-2014



Source: CSLS calculations based on OECD data.

In Australia, higher-education expenditure on R&D (HERD) as a percentage of GDP increased fairly continually between 1981 and 2014 (Chart 31). Starting at 0.26 per cent in 1981, Australia's HERD as a share of GDP increased to 0.63 per cent by 2013 (0.37 percentage points). Canada's share of HERD in GDP increased from 0.32 per cent in 1981 to 0.65 per cent in 2014 (0.33 percentage points).

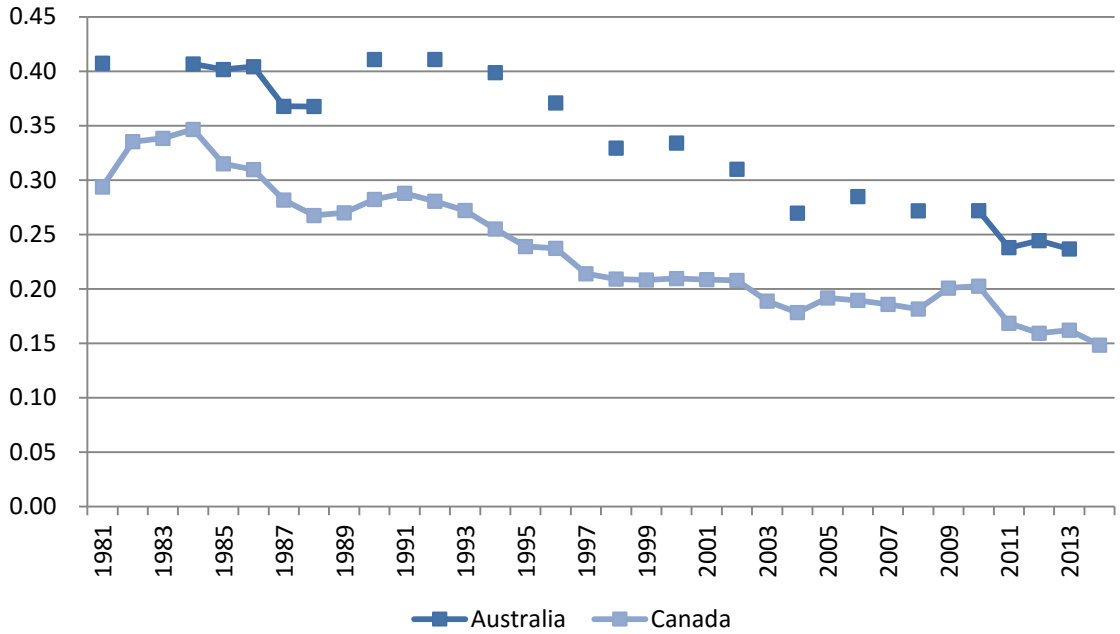
Chart 31: HERD as a Per Cent of GDP, Canada and Australia, 1981-2014



Source: CSLS calculations based on OECD data.

In Canada, government expenditure on R&D (GOVERD) as a percentage of GDP has been declining since 1984 (Chart 32). Australia has shown a similar decline since 1990. However, GOVERD's share of GDP was consistently higher in Australia than in Canada throughout the 1981-2014 period. In fact, the share of GOVERD in GDP was 0.08 percentage points lower in Canada compared to Australia in 2013, the last year of available data for both countries.

Chart 32: GOVERD as a Per Cent of GDP, Canada and Australia, 1981-2014



Source: CSLS calculations based on OECD data.

C. Human Capital

i. Adult Education Levels

Education is well established as a key driver of productivity, with higher levels of education corresponding to a more able and productive workforce.[29] In 2013, 53.2 per cent of adults aged 25-64 had tertiary education in Canada, compared to 39.5 per cent in Australia. Canada had 36.4 per cent of the population with upper secondary and non-tertiary post secondary degrees, while Australia had 36.1 per cent. For the per cent of 25-64 year olds with below upper

[29] Upper secondary includes stronger subject specialization than at lower secondary level, with teachers usually more qualified. Students typically are expected to complete 9 years of education or lower secondary schooling before entry and are generally 15 and 16 years old. Post-secondary non-tertiary education internationally straddles the boundary between upper secondary and post-secondary education, even though it might be considered upper secondary or post-secondary in the national context. Programme content may not be significantly more advanced than upper secondary, but is not as advanced as that in tertiary programmes. The duration is usually the equivalent of between 6 months and 2 years of full-time study. Students tend to be older than those enrolled in upper secondary education. Tertiary education consists of three types (A, B and C). Tertiary type A education is largely composed of theory-based programmes designed to provide sufficient qualifications for entry to advanced research programmes and professions with high skill requirements. The duration is at least 3 years full-time, though usually 4 years or more. These programmes are not exclusively offered at universities; and not all programmes nationally recognized as university programmes fulfill the criteria to be classified as tertiary type A. Tertiary type A programmes include second degree programmes, such as the American master's degree. Tertiary type B education programmes are typically shorter than type A and focus on practical, technical, or occupational skills for direct entry into the labour market, although some theoretical foundations may be covered in the respective programmes. They have a minimum duration of two years full-time equivalent. The tertiary type C or advanced research programmes lead directly to the award of an advanced research qualification, e.g. PhD. The theoretical duration of these programs is 3 years full time in most countries, although the actual enrolment time is typically longer (OECD Education at a Glance 2014: OECD Indicators, pg. 23).

secondary, Australia had a larger per cent than Canada (24.3 versus 10.3). Over the past 15 years, Canada and Australia have seen similar trends in the proportion of 25-64 year olds who have completed a tertiary education (Chart 33) and in the proportion who have completed a degree below the level of upper secondary education but have seen a divergence in trends in the proportion of 25-64 year olds with an upper or post-secondary education that does not count as tertiary education.

Although Australia has had its proportion of 25-64 year olds with a tertiary education degree averaging approximately 13 percentage points lower than Canada's in the period spanning 2000-2013, both countries have seen a steady increase in the proportion attaining tertiary education since 2000. Canada and Australia have seen respective increases from 40.1 per cent to 53.2 per cent and 27.5 to 39.5 per cent from 2000 to 2013, although it should be noted that Australia, unlike Canada, saw its proportion of people with tertiary education decrease slightly in 2013.

Australia and Canada have, on the other hand, seen opposite trends in regards to the share of 25-64 year olds with an upper secondary or post-secondary degree. While Canada's proportion has been steadily decreasing from 40.6 per cent in 2000 to 36.4 per cent in 2013, Australia's has been steadily increasing from 31.3 per cent to 36.2 per cent, ultimately leading to a convergence in the two countries' proportions in 2013.

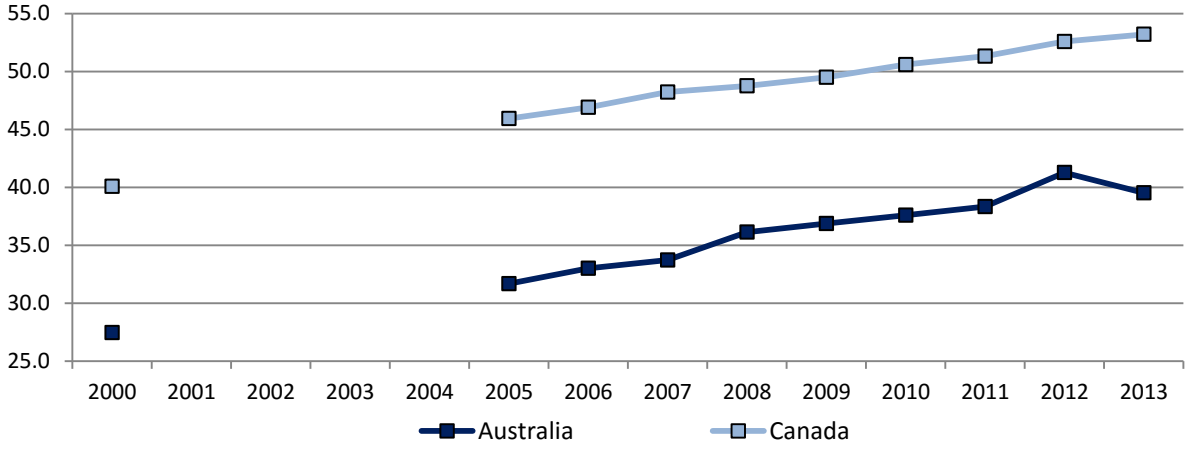
Both Australia and Canada have experienced declines in the proportion of 25-64 year olds with below an upper secondary education. Australia, which in 2000 had a more than double the proportion with below an upper secondary education than Canada (19.3 and 41.2 per cent respectively) has however seen a far more pronounced decline of 16.9 percentage points, compared with Canada's more modest decline of 9.0 percentage points. Although Canada's proportion of 25-64 year olds with below an upper secondary education remains lower than that of Australia in 2013 (10.4 and 24.3 per cent respectively), the gap between the two countries has narrowed since 2000, from 21.9 percentage points to 13.9 percentage points in 2013.[30]

We find that differences in human capital have not contributed to the gap in labour productivity growth between Canada and Australia. Australia has lower educational attainment levels than Canada, which is the opposite of what would be expected given that higher levels of educational attainment are supposed to drive faster productivity growth.

[30] A troubling observation is that the differential between Canadian and Australian enrollment rates for 20-29 year olds has increased from 1.5 percentage points (21.6 percent in Canada and 23.1 per cent in Australia) to 6.7 percentage points (26.1 per cent in Canada and 32.8 per cent in Australia).

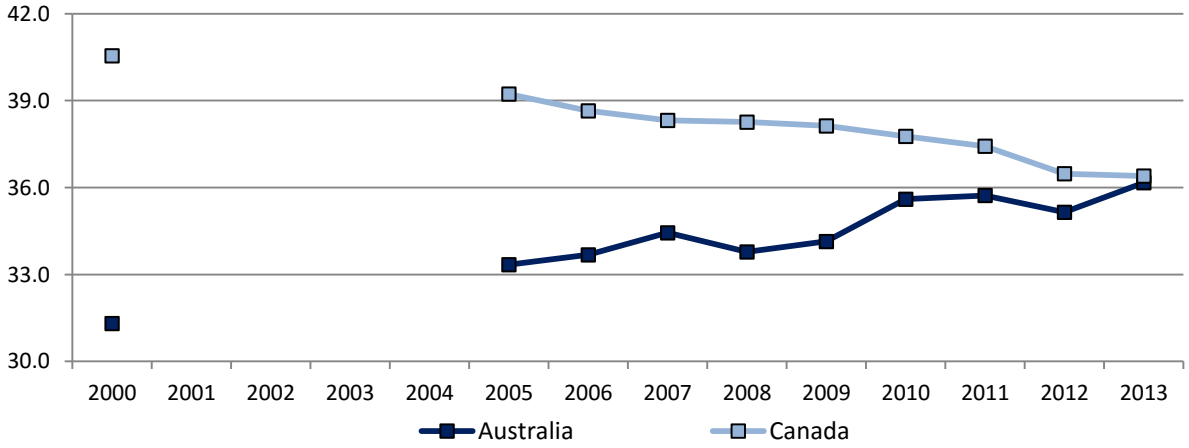
Chart 33: Share of 25-64 Year-Olds by Educational Attainment, Per Cent, Canada and Australia, 2000 and 2005-2012

Panel A: Tertiary education



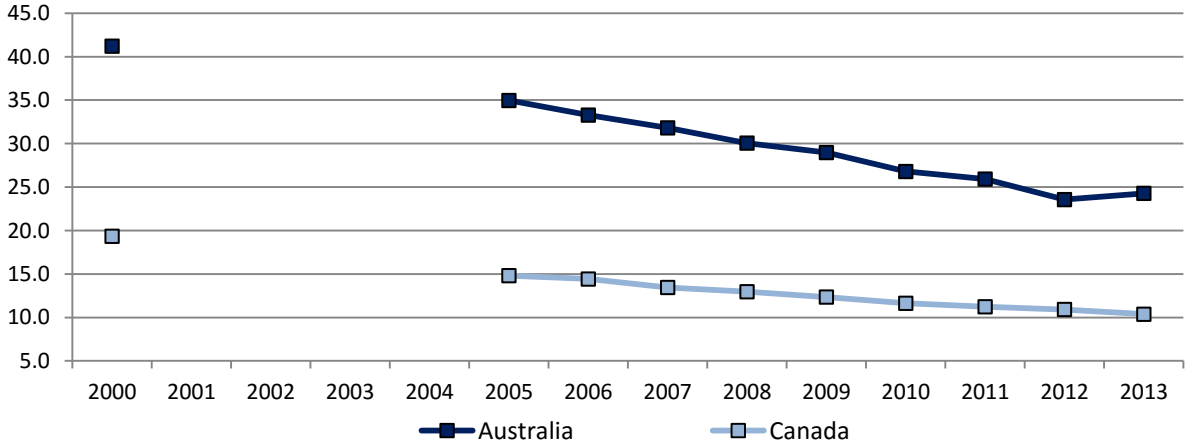
doi: 10.1787/36bce3fe-en (Accessed on 25 May 2015)

Panel B: Upper secondary or post-secondary non-tertiary education



Source: OECD (2015), Adult education level (indicator). doi: 10.1787/36bce3fe-en (Accessed on 25 May 2015)

Panel C: Below upper secondary education

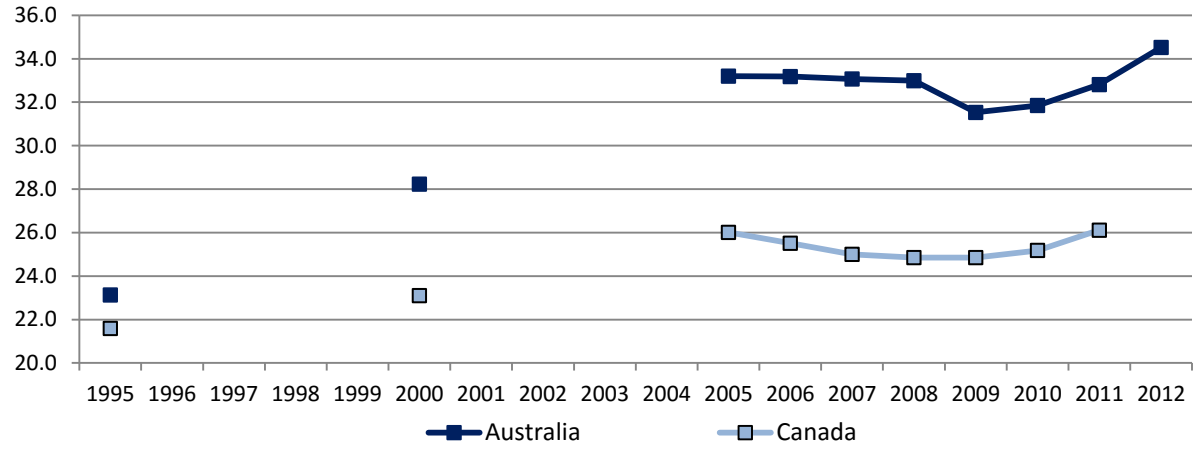


Source: OECD (2015), Adult education level (indicator). doi: 10.1787/36bce3fe-en (Accessed on 25 May 2015)

ii. Enrolment Rates

The enrolment rate (expressed as net enrolment rates, calculated by dividing the number of students of a particular age group in all levels of education by the size of the population of that age group, not distinguishing between full- and part-time enrolment) of Australia and Canada started out in a similar position in 1995, at 23.1 per cent and 21.6 per cent respectively, but have since diverged dramatically (Chart 34). Australia's enrolment rate increased substantially between 1995 and 2005, reaching 33.2 per cent and holding steady at that level until 2008. Since then there was a mild drop in 2009, followed by another increase to 34.5 per cent in 2012. Canada's enrollment on the other hand increased at a far slower pace, reaching only 26.0 per cent in 2005, a full 7.2 percentage points lower than Australia had achieved at that time. Similarly to Australia, since 2005 enrolment in Canada has decreased, and then increased once again to reach a level of 26.1 per cent in 2011 (2012 figures are not yet available).

Chart 34: Enrolment Rate for 20-29 Years-Olds, Per Cent, Canada and Australia, 1995, 2000 and 2005-2012



Source: OECD (2015), Enrolment rate (indicator). doi: 10.1787/1d7e7216-en (Accessed on 25 May 2015)

D. Microeconomic Environment

i. Labour Market Regulation

a. Employment Protection Legislation

As measured by the OECD, employment protection legislation in Canada and Australia results in roughly the same level of protection for individual workers and the collective (Table 30). Both countries rank within the top 10 OECD countries measured in the category of legislation designed for the protection of permanent workers against individual and collective dismissal, which can involve procedural inconveniences, notice periods, severance pay, and the difficulty of dismissal for individual workers and delays, costs or notification procedures required for collective dismissal. In terms of their regulations on temporary forms of employment, including regulations on fixed-term and temporary work agency contracts with

respect to their duration and type, as well as other regulations on work agencies and agency workers that increase the costs of hiring temporary agency workers relative to workers on permanent contracts, Canada and Australia currently rank first and sixth (respectively) among the 43 countries measured.

Table 30: OECD Indicators on Employment Protection Legislation, Canada and Australia, 2008 and 2013

Panel A: Score on a scale from 0 (least restrictions) to 6 (most restrictions)

	Canada		Australia	
	2008	2013	2008	2013
Protection of permanent workers against individual and collective dismissals	1.51	1.51	1.63	1.94
Protection of permanent workers against (individual) dismissal	0.92	0.92	1.13	1.57
Specific requirements for collective dismissal	2.97	2.97	2.88	2.88
Regulation on temporary forms of employment	0.21	0.21	0.79	1.04

Panel B: Ranking on a scale from 1 (least restrictive) to 43 (most restrictive)

	Canada		Australia	
	2008	2013	2008	2013
Protection of permanent workers against individual and collective dismissals	5	4	6	8
Protection of permanent workers against (individual) dismissal	2	2	3	8
Specific requirements for collective dismissal	23	22	17	16
Regulation on temporary forms of employment	1	1	7	6

Source: CSLS calculations based on OECD data.

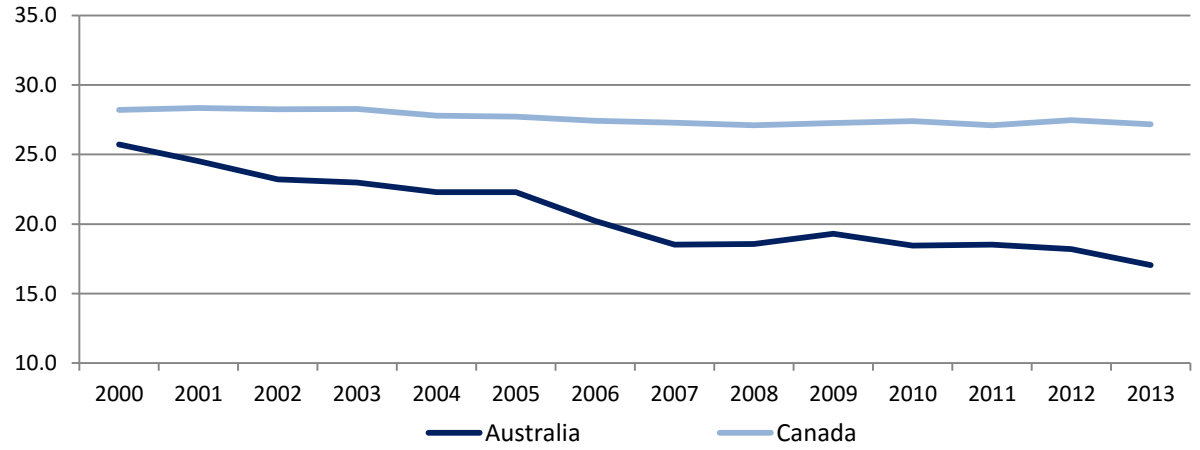
A comparison between the two countries shows that Canada has marginally less restrictions on protecting permanent workers against individual dismissals (2nd versus 8th in 2013) as well as regulating temporary forms of employment (where Canada ranks as the least restrictive country at 1st and Australia ranks 6th in 2013). On the other hand, Australia ranks as being less onerous in terms of specific requirements for collective dismissal, placing 6 ranks higher than Canada among the 43 countries evaluated in 2013 (22nd and 16th place).

The largest difference between the two countries in terms of their employment protection legislation is the paths they have taken since 2008. In 2013, Canada achieved the same scores on all categories of legislation as in 2008, and managed to marginally move up in the rankings in protection of permanent workers against both individual and collective dismissals as well as specific requirements for collective dismissal. Australia, on the other hand, has worsened its score in every category (excluding specific requirements for collective dismissal), implying an increase in restrictions.

b. Unionization

Trade union density, which corresponds to the proportion of wage and salary earners that are trade union members divided by the total number of wage and salary earners (whenever possible adjusted for non-active and self-employed members) has taken two very different paths in Canada and Australia (Chart 35). While Canada's trade union density has remained essentially flat since 2000 (28.2 per cent in 2000 compared to 27.1 per cent in 2013), Australia's has seen a marked decline from levels comparable to Canada's in 2000 (25.7 per cent) to levels significantly below Canada's in 2013 (17.0 per cent).

Chart 35: Trade Union Density, Per Cent, 2000-2013

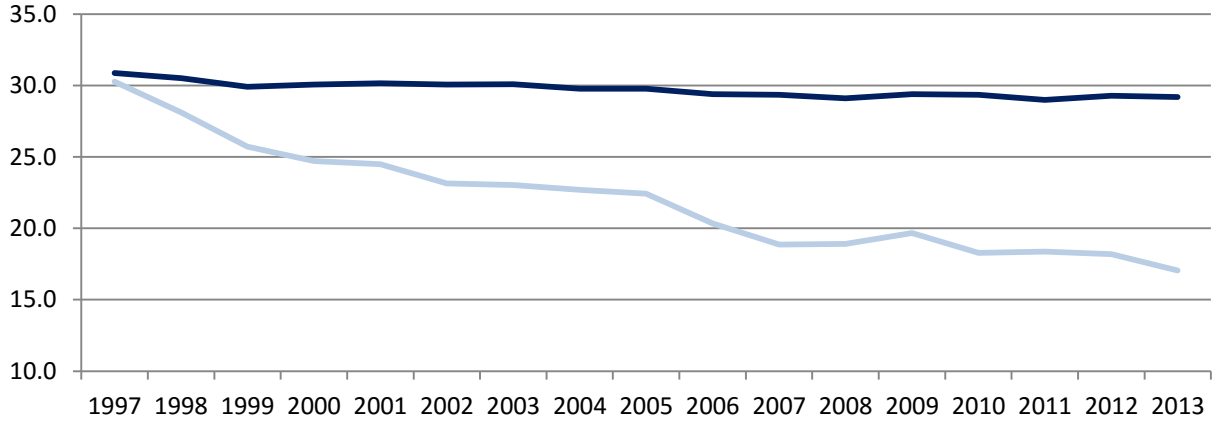


Source: CSLS calculations based on OECD data.

Chart 36 breaks down trends in trade union density into the private and public sectors. It shows that the different trajectories of Canada and the Australia are due to both the public and private sectors. With regard to the public sector, trade union density in Canada has actually increased from 69.8 per cent in 1997 to 72.0 per cent in 2013, while it has fallen from 54.7 per cent to 41.7 per cent in Australia over this period. With regard to the private sector, trade union density has fallen in both countries but to a much greater extent in Australia compared to Canada. In particular, private sector trade union density fell from 23.3 per cent in 1997 to 12.0 per cent in 2013 in Australia, while it only fell from 19.0 per cent to 15.9 per cent in Canada.

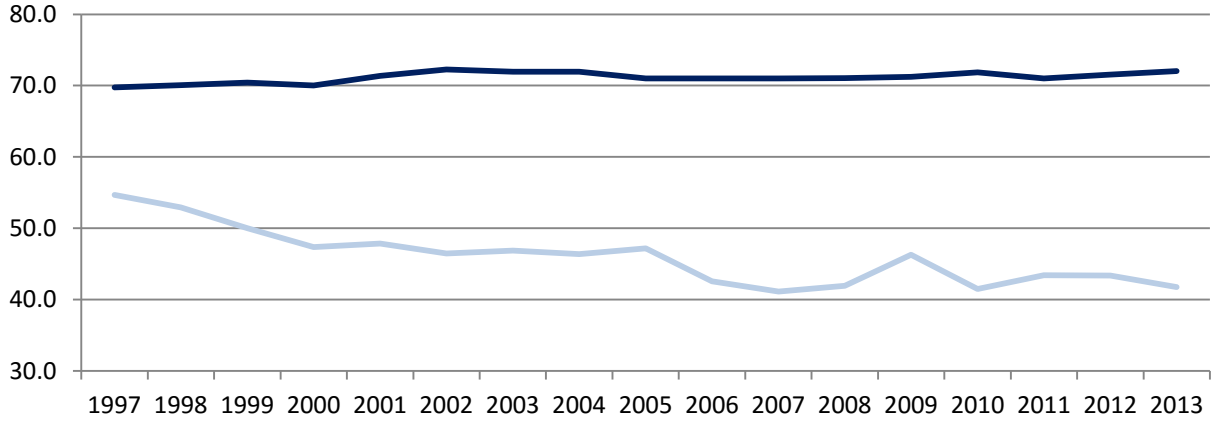
Chart 36: Trade Union Density by Sector, Canada and Australia, Per Cent, 1997-2013

Panel A: Total Economy

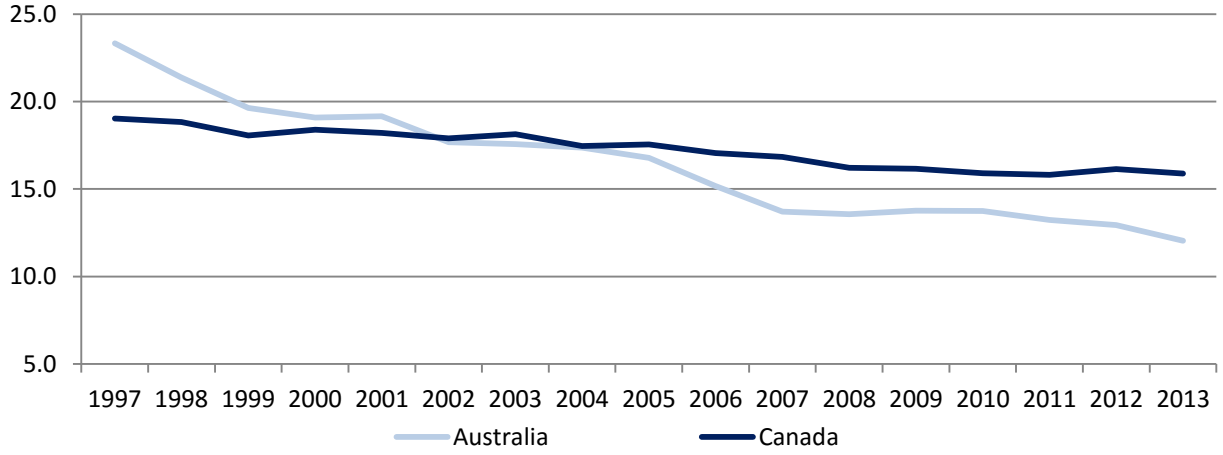


Note: According to the OECD, "trade union density corresponds to the ratio of wage and salary earners that are trade union members, divided by the total number of wage and salary earners."
Source: CSLS calculations based on OECD data.

Panel B: Public Sector



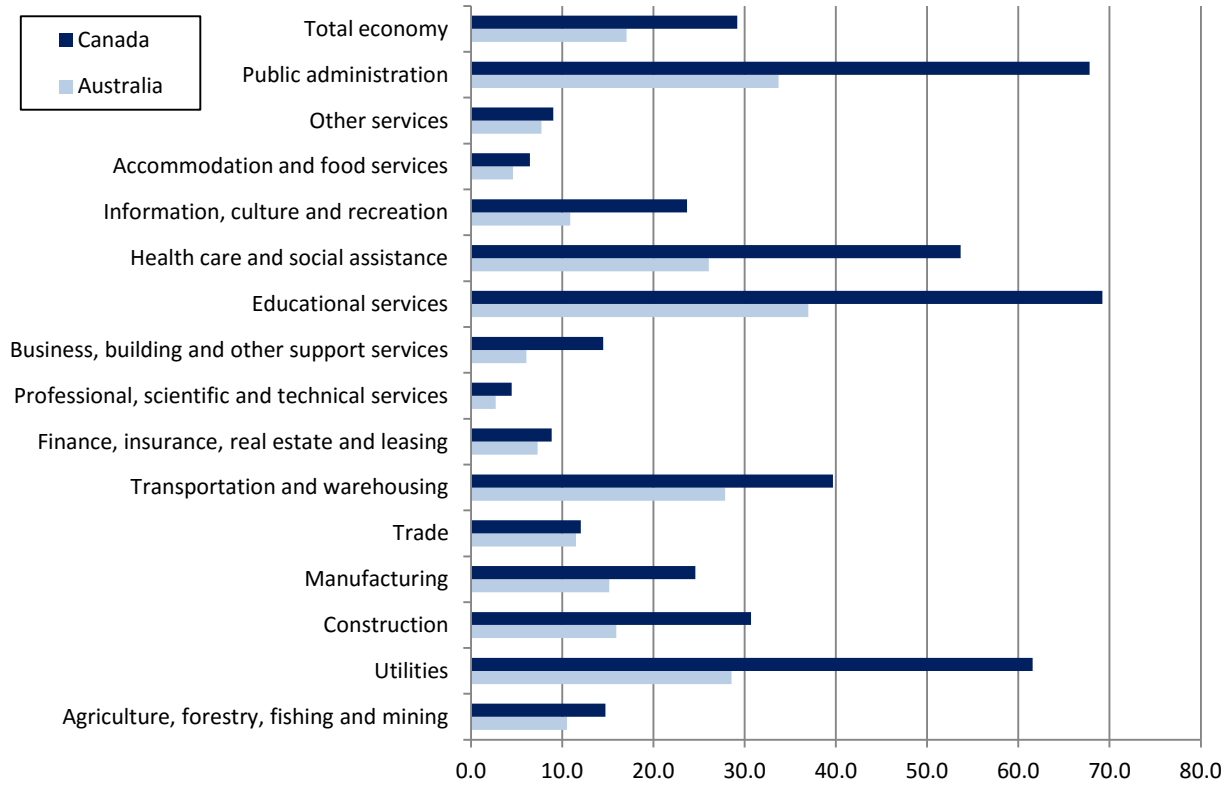
Panel C: Private Sector



Note: Trade union density is defined as the share of union members in total employment.
Source: CSLS calculations based on Statistics Canada and ABS data. Statistics Canada: 282-0223. ABS: 63100TS0001.

Trade union density is higher in Canada than in Australia for all fifteen industries for which there exist comparable data (Chart 37). The gap between Canada and Australia is largest for public administration (34.1 percentage points), followed by utilities (33.0 percentage points), educational services (32.3 percentage points), health care and social assistance (27.6 percentage points), construction (14.8 percentage points), information, culture and recreation (12.8 percentage points), transportation and warehousing (11.8 percentage points), manufacturing (9.4 percentage points), and business, building and other support services (8.4 percentage points).

Chart 37: Trade Union Density by Industry, Canada and Australia, Per Cent, 2013

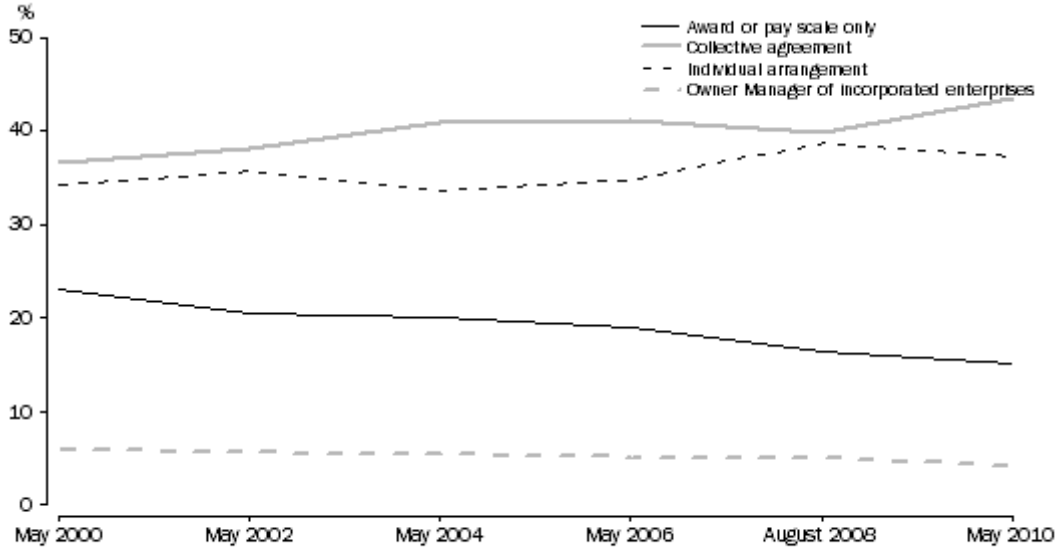


Note: Trade union density is defined as the share of union members in total employment.
Source: CSLS calculations based on Statistics Canada and ABS data. Statistics Canada: 282-0223. ABS: 63100TS0001.

Despite their lower rates of unionization, Australia has a unique "awards" system that imposes collective agreement-like minimum wages and other conditions on certain occupations and industries. Australia's unique awards system and its higher minimum wage (see the following sub-section) suggest that its labour market is more regulated, in total, than Canada's despite lower rates of union membership. Chart 38 shows that, while trade union membership is quite low in Australia, a significant share of employees had their wages determined by collective agreements and the awards system. In 2010, 43 per cent of employees had their wages set by collective agreements, while 15 per cent had their pay set by 'awards only'.[31]

[31] According to the ABS, employees in 'award only' had their wages specified by an award and *were not* paid more than the

Chart 38: Methods of Setting Pay, Share of All Employees, Australia, Per Cent, 2000- 2010



Notes: The biennial Survey of Employee Earnings and Hours was not designed as a time series, so caution should be exercised whe comparing data between different years.

Source: ABS (2011) "Trends in Employee Methods of Setting Pay and Jurisdictional Coverage." Retrieved from: http://www.abs.gov.au/AUSSTATS/abs@.nsf/Previousproducts/6105.0Feature%20Article1July%202011?opendocument&tabname=Summary&prodno=6105.0&issue=July%202011&num=&view=.

Today, the Fair Work Commission deals with most of Australia's national employment regulations. This organization is Australia's independent workplace relations board.[32] It has many important functions including but not limited to: creating a set of minimum conditions by making awards and setting the national minimum wage; facilitating negotiating between unions and businesses in the formation of enterprise (or collective) agreements; and dealing with unfair dismissals as well as a range of collective and individual workplace disputes.

In Australia, minimum employment conditions come from three main sources: enterprise (or collective) agreements, awards, and legislation.

Minimum entitlements for wages and employment conditions are most often found in enterprise agreements. Enterprise agreements are collective agreements made between employers and employees which specify the terms and conditions of employment. Employers must provide their employees with at least the minimum entitlements set out in these agreements. Most enterprise agreements specify wages rates, employment conditions (*i.e.*, leave, hours, breaks,

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award wage. Employees in 'collective agreement' had their wages set by enterprise (or collective) agreement. Employees in 'individual arrangement' include employees who had their wages set by an individual contract or registered individual agreement, or had their wages specified by an award and *were* paid more than the award wage.

[32] The following description of Australia's labour market regulations relies heavily on information provided by the Fair Work Commission's website at https://www.fwc.gov.au/at-the-commission/overview.

overtime, etc.), consultation, and dispute resolution procedures, among other issues. These conditions must be at least as good as those in the relevant award or legislation.

In the case where a business or employee is not covered by an enterprise agreement, the award covering the business or employee will apply. Awards are enforceable documents containing minimum wages and employment conditions in addition to any legislated minimums. Specifically, awards deal with minimum wage rates, employment conditions (*i.e.*, leave, hours, breaks, overtime, etc.), and consultation, among other things. They are used as the benchmark for assessing enterprise agreements prior to approval by the Fair Work Commission.

Awards cover entire industries or occupations. There are currently 123 awards in Australia, covering a wide array of industries and occupations. Most individuals who are not covered by an agreement are covered by an award. Again, the terms and conditions of employment laid out in an award must be at least as good as those in the legislation.

If an employee is not covered by an award or enterprise agreement, the minimum wage and employment conditions in the legislation will apply. In particular, the national minimum wage order and the National Employment Standards (NES) apply to employees covered by neither an award nor an enterprise agreement.

First, there is a national minimum wage which applies to all employees. The Fair Work Commission conducts an annual wage review and decides whether to change the national minimum wage and award minimum wages. For example, the most recent review led to a 3 per cent increase in both award minimum wages and the national minimum wage.

Second, there are the NES minimum standards that apply to all employees in Australia. The NES represent the minimum that enterprise agreements and awards must meet. However, enterprise agreement or awards can exceed the NES in terms of their desirability for employees. The NES sets standards related to maximum weekly hours, requests for flexible working arrangements, parental leave and related benefits, other sorts of leave, public holidays, and dismissal, among other things.

Australia's current regulations are primarily located in the *Fair Work Act 2009*. This legislation created the Fair Work Commission and contains the NES. It replaced the *WorkChoices* legislation, which is made up of the *Workplace Relations Act 1996* which was amended in 2005 by the *Workplace Relations Amendment (WorkChoices) Act 2005*. It also shifted jurisdictional coverage from state governments (which have their own pay-setting arrangements) to the federal government.

The creation of the Fair Work Commission, however, did not represent a dramatic change in the employment regulation framework.[33] The Fair Work Commission largely took over the roles of the Industrial Relations Commission (AIRC) and the Australian Fair Pay Commission. Similar to the Fair Work Commission, the AIRC created awards, certified enterprise agreements, registered trade unions, and dealt with disputes over unfair dismissals. In 2006, the AIRC's wage-setting powers were transferred to the Australian Fair Pay Commission. The AIRC was abolished in 2010, and its remaining functions were transferred to Fair Work Australia.

c. Minimum Wages

Increasing minimum wages can increase labour productivity through three main channels: 1) the substitution effect; 2) the composition effect; and 3) the x-inefficiency effect.

First, by increasing minimum wages, there is a substitution effect between capital and labour. Employers will choose to employ capital instead of labour at the minimum wage. For the remaining labour, there is now additional capital, which leads to capital deepening, and thereby increased labour productivity.

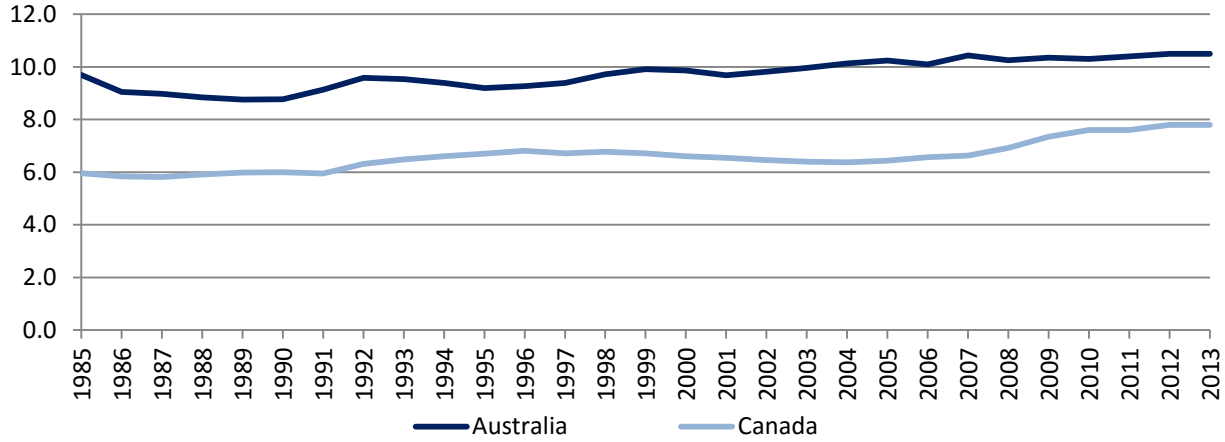
Second, by increasing minimum wages, the average quality of labour can be increased through the composition effect. In particular, when minimum wages increase, low-skilled labour flows out of the labour market, thereby increasing the skill composition of the employed. This increase in skill composition could potentially lead to improved labour productivity.

Third, by increasing minimum wages, x-inefficiency is decreased. Operational slack is the difference between the efficient business behaviour implied by economic theory and the business behaviour that is observed in practice. In general, the less competition a business faces, the larger will be x-inefficiency in this business. When minimum wages increase, x-inefficiency will decrease because a business will begin to employ its previously unused capacity. At times, decreasing x-inefficiency may result in increased productivity if unused capacity and organizational slack were embodied in the form of dormant capital.

Australia's minimum wage is much higher than Canada's minimum wage in absolute terms (Chart 39). In 2013, Australia's minimum wage expressed in PPP-adjusted 2013 U.S. dollars was $10.50, whereas Canada's minimum wage was $7.80 in PPP-adjusted 2013 U.S. dollars. The minimum wage increased in both countries between 1985 and 2013, but the increase was greater in Canada than Australia (23.6 per cent versus 7.7 per cent).

[33] However, the *Fair Work Act 2009* did remove provisions for federally registered individual statutory agreements, which were introduced in the *Workplace Relations Act 1996*. This represented a significant loosening of employment regulations.

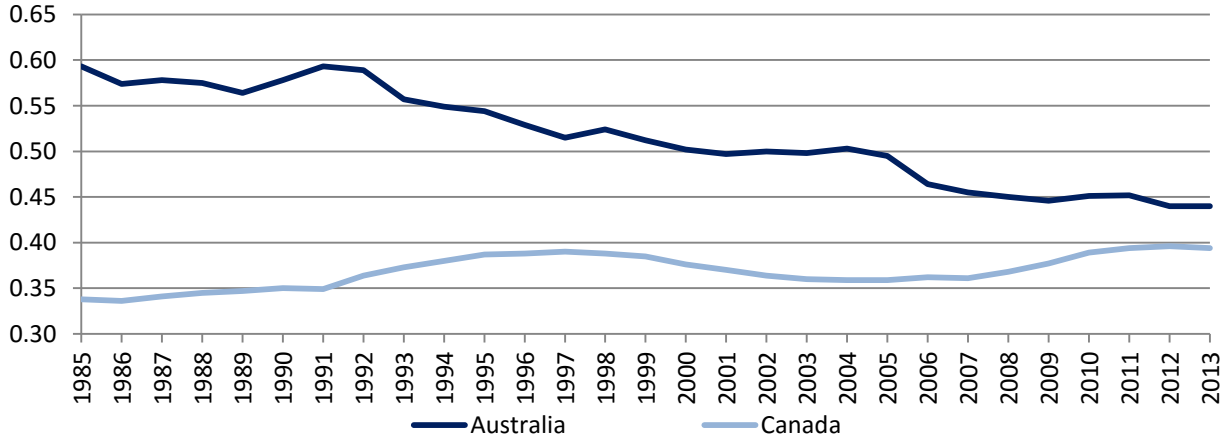
Chart 39: Real Hourly Minimum Wages in Constant Prices At 2013 USD PPPs, Canada and Australia, 1985-2013



Source: CSLS calculations based on OECD data.

Australia's minimum wage relative to the mean wage of full-time workers was higher than Canada's for every year between 1985 and 2013 (Chart 40). In 1985, Australia's relative was 0.59, while Canada's relative was 0.34, resulting in a gap between Canada and Australia of 0.25. By 2013, Australia's relative had decreased to 0.44, while Canada's relative had increased to 0.39, resulting in a much smaller gap of 0.05. The majority (75 per cent) of the change in the gap was driven by the decrease in Australia's relative.

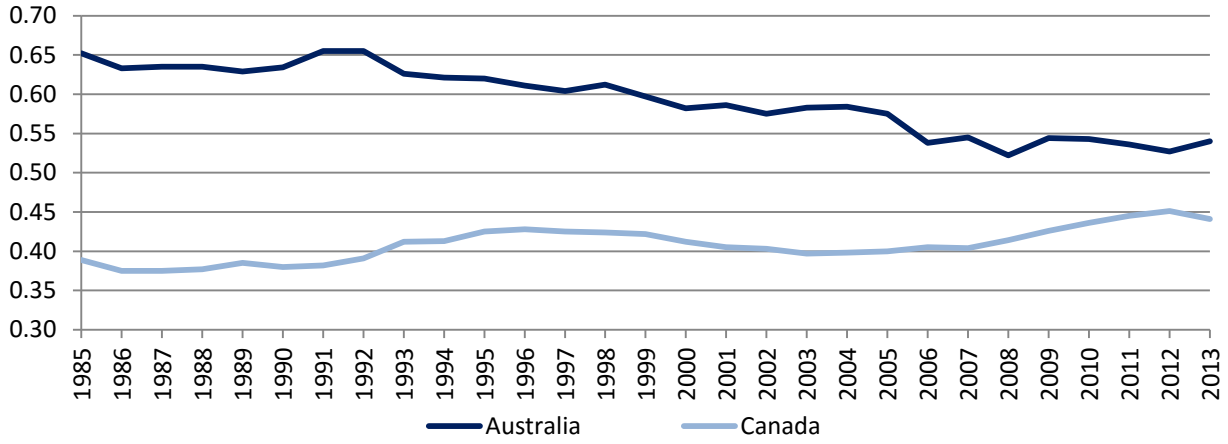
Chart 40: Minimum Relative to Mean Wages of Full Time Workers, Canada and Australia, 1985-2013



Source: CSLS calculations based on OECD data.

Between 1985 and 2013, Australia's minimum wage relative to the median wage of full-time workers was higher than Canada's (Chart 41). During this time period, Australia saw the relative between minimum wages and median wages fall from 0.65 to 0.54, while Canada saw its relative increase from 0.39 to 0.44. The trends in the relatives of these two countries have led to a diminishing gap: Australia's relative was only 0.10 higher than Canada's in 2013, whereas it was 0.26 higher in 1985.

Chart 41: Minimum Relative to Median Wages of Full Time Workers, Canada and Australia, 1985-2013

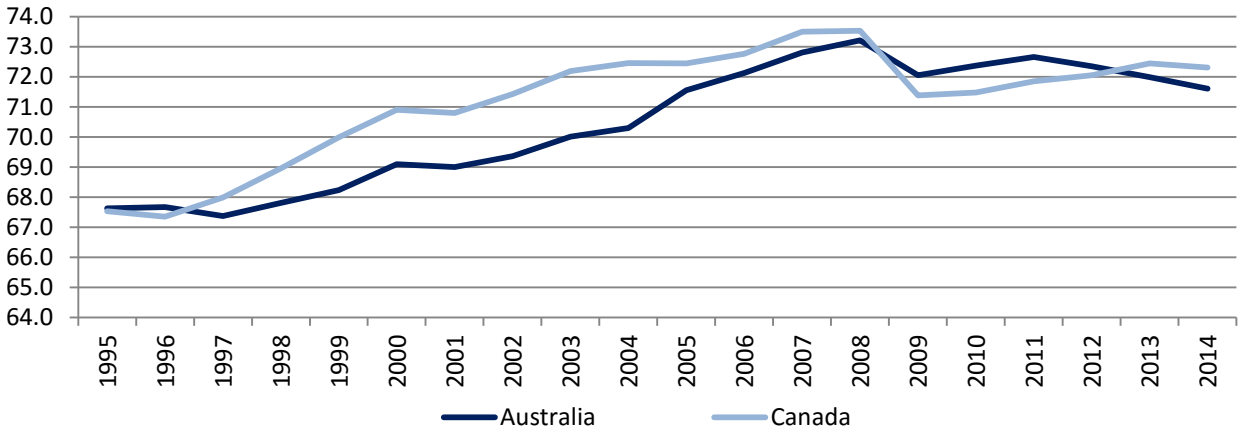


Source: CSLS calculations based on OECD data.

As seen before, minimum wages may have had an effect on capital deepening, since Australia's pace of capital deepening was much faster than Canada's pace of capital deepening between 1994 and 2013.

Increasing minimum wages, as discussed above, can lead to a substitution effect and a composition effect, both of which may reduce the employment rate below what would prevail with a lower minimum wage. In Australia, minimum wages are higher than in Canada. These higher minimum wages may have had an effect on the gap between Australia and Canada's employment rates between 1995 and 2008, but the impact appears to be minimal (Chart 42). The largest gaps between Canada's employment rate and Australia's employment rate were seen in the early-2000s, but these gaps were at most only 2.2 percentage points.

Chart 42: Employment Rates (% of Working Age Population), Canada and Australia, 1995-2014

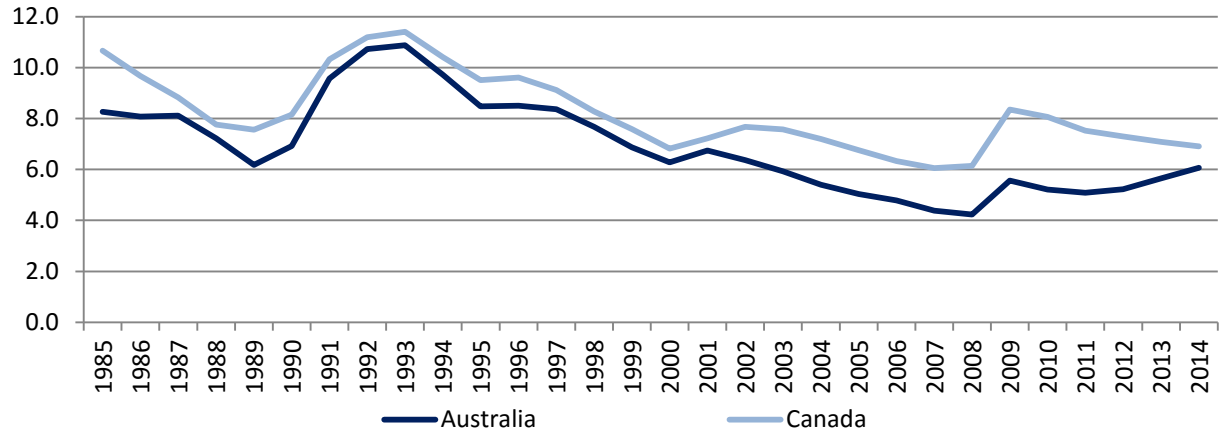


Source: CSLS calculations based on OECD data

The resulting substitution and composition effects from an increase in the minimum wage may also increase the unemployment rate above what would prevail with a lower minimum wage.

In Australia, since minimum wages are higher than in Canada, we might expect unemployment rates to be adversely affected, but contrary to expectations, unemployment rates in Australia were consistently lower than those in Canada between 1985 and 2014 (Chart 43).

Chart 43: Unemployment Rates, Canada and Australia, Per Cent, 1985-2014



Source: CSLS calculations based on OECD data.

ii. Product Market Regulation

In 2013, product market regulations appear to be more restrictive in Canada than in Australia, although this is highly subject to the weights applied to state control, barriers to entrepreneurship, and barriers to trade and investment. With equal weighting, Canada's product market regulations receive a score of 1.42 out of 6, which is slightly stricter than Australia's product market regulations score of 1.29 out of 6, where 0 is the least restrictive and 6 is the most restrictive (Table 31).

Canada's stricter regulatory policy is entirely driven by barriers to trade and investment, where Canada receives a score of 1.01 while Australia receives a score of 0.19, since Australia and Canada have similar levels of state control (1.99 and 1.92, respectively) and Australia's barriers to entrepreneurship are stricter than Canada's (1.69 versus 1.34).

When compared to Australia over the past fifteen years, Canada had overall stricter product market regulation in each year examined; however, Canada's score out of 6 has been falling, indicating that product market regulation is becoming less restrictive over the years. When comparing Australia and Canada, the greatest difference in product market regulation, according to the OECD indicator, was seen in 2003, while the smallest difference occurred in 2008. Relative to other OECD countries in 2013, Canada ranked seventeenth out of thirty-three, while Australia ranked eighth.

Table 31: Product Market Regulation Indicator and Sub-Indices, Canada and Australia, 2013 (0 to 6)

	1998	2003	2008	2013
			Product market regulation	
Australia	1.72	1.34	1.46	1.29
Canada	1.91	1.64	1.53	1.42
			State control	
Australia	2.28	1.59	2.21	1.99
Canada	2.15	2.08	1.96	1.92
			Barriers to entrepreneurship	
Australia	1.94	1.76	1.65	1.69
Canada	1.82	1.44	1.36	1.34
			Barriers to trade and investment	
Australia	0.95	0.67	0.53	0.19
Canada	1.75	1.40	1.27	1.01

Note: Product market regulation is the weighted average of state control, barriers to entrepreneurship, and barriers to trade and investment.

Source: CSLS calculations based on OECD data.

Table 32: Regulation Indicators, Canada and Australia, Score from 0 (least restrictions) to 6 (most restrictions), 2013

	Australia	Canada	Canada-Australia
	Regulation in Network Sectors		
All Network Sectors	1.50	1.72	0.22
Electricity	2.25	3.38	1.13
Gas	1.75	1.50	-0.25
Telecommunications	0.55	0.52	-0.03
Post	3.33	2.67	-0.66
Rail	2.63	2.25	-0.38
Airlines	0.00	1.00	1.00
Road	0.00	0.75	0.75
	Regulation in Retail Trade		
Retail Indicator	0.70	2.50	1.80
Licenses or permits needed to engage in commercial activity	2.67	5.70	3.03
Specific regulation of large outlet	--	0.00	--
Protection of existing firms	0.00	3.00	3.00
Regulation of shop opening hours	0.00	2.29	2.29
Price controls	0.86	4.00	3.14
Promotions/discounts	0.00	0.00	0.00
	Regulation in Professional Services		
All Professions	0.92	3.15	2.23
Accounting	1.38	3.50	2.12
Legal	2.31	3.23	0.92
Architect	0.00	3.27	3.27
Engineer	0.00	2.58	2.58

Source: CSLS calculations based on OECD data.

Canada has stricter regulation in network sectors than Australia according to the OECD. In 2013, Canada had a score of 1.72 out of 6, while Australia had a score of 1.50 out of 6, where 0 is the least restrictive and 6 is the most restrictive (Table 32). When broken down by sector, Canada's higher indicator is driven by the electricity sector, the airlines sector and the road sector, since Australia had an indicator that was higher than Canada's indicator for the gas sector, the telecommunications sector, the post sector and the rail sector.

Australia's regulation in retail trade was substantially lower than Canada's regulation in retail trade, according to the OECD indicators. In 2013, Canada had a score of 2.50 out of 6, while Australia had a score of 0.70 out of 6. By looking at the breakdown of the indicator, Canada's higher value for retail trade regulation is driven by licenses or permits needed to engage in commercial activity; protection of existing firms; regulation of shop opening hours; and price controls.

For professional services, Australia once again has lower regulatory barriers than Canada. In 2013, Canada had a score of 3.15 out of 6, while Australia had a score of 0.92 out of 6. In Canada, regulation is higher in all four professions examined: accounting, legal services, architecture, and engineering.

Deregulation of the Australian Dairy Industry

Milk pricing and supply were regulated by the Australian states and by the Australian government prior to 2000 using production quotas and milk pooling arrangements. Regional markets for milk arose because of these policies, since state authorities controlled the price, distribution and source of milk.

The Australian government established an independent inquiry into competition policy in Australia in the early 1990s. This independent inquiry recommended that the Australian government and the Australian states review laws and policies which restricted competition and rescind them if they did not pass a public benefit test.

In Victoria, competition law and policy reviews showed that milk pricing, distribution and sourcing policies created a negative net benefit. Hence, the government of Victoria State was forced to remove any regulations related to milk pricing. The reviews undertaken in the other Australian states found positive public net benefits, so milk pricing rules remained.

There was overarching support in Victoria for the removal of milk regulations. However, deregulation of the dairy industry in Victoria made regulation unsustainable for the other Australian states because of free interstate trade. Deregulation of dairy in Victoria would mean lower milk prices in neighbouring states, driving out the competition from local dairy suppliers. Thus, Victoria's negative net benefit test results, and subsequent deregulation, forced the other Australian states to agree to reform the dairy industry. The agreement of the other Australian states was conditional on a proper restructuring proposal from the federal government.

Conscious of the impact of instant deregulation on dairy farmers' incomes, the Australian government proposed the "Dairy Industry Adjustment Program." This program provided nearly $2 billion to assist farmers during structural adjustment pressures. There were three main groups that received funding from this program: farmers who continued to produce milk products, farmers who exited the industry, and communities that were dependent on dairy. The funds for this package were raised by imposing an 11 per cent levy on the sale of milk.

The funds were distributed to eligible individuals and communities between 2000 and 2008. The last scheduled payment to farmers was made in mid-April 2008.

As a result of this deregulation package, farm numbers have decline enormously from 12,896 in 2000 to 6,314 in 2013. During this period, the number of dairy cows decreased from 2,171 thousand to 1,690 thousand. This suggests that the average herd size in Australia increased from 168 cows in 2000 to 267 cows in 2013. This dramatic increase in the number of cows per farm suggests economies of scale.

In Canada, where there has not been deregulation in the dairy industry, there were 959 thousand dairy cows on 12,234 farms in 2013, representing an average herd size of 78 cows. In 2000, Canada had 19,363 dairy farms and 1,103 thousand dairy cows, representing an average herd size of 56 cows.

Furthermore, exports of dairy products in Australia increased enormously post-deregulation, while in Canada, where there continues to be dairy product regulation, exports have shown no significant increase. As for the producer price in Australia, deregulation did not seem to have a major impact on the long-term trend. Dairy prices continue to increase. Canada also shows increasing producer prices, but there appears to be less volatility than in Australia.

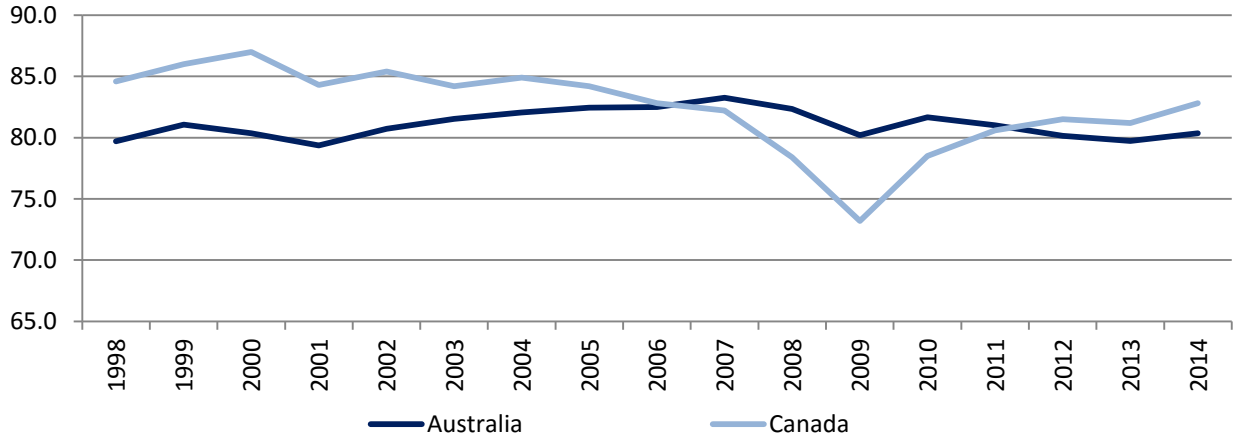
Sources: Government of Australia (2015) "Deregulation of the Australian Dairy Industry" Retrieved at http://www.agriculture.gov.au/ag-farm-food/meat-wool-dairy/dairy/deregulation-of-the-Australian-dairy-industry; Canadian Dairy Information Centre (2015) "Dairy Facts and Figures" Retrieved at http://dairyinfo.gc.ca/index_e.php?s1=dff-fcil&menupos=1.1; Dairy Australia (2015) "Cows and farms" http://www.dairyaustralia.com.au/Markets-and-statistics/Farm-facts/Cows-and-Farms.aspx; OECD (2015) "OECD-FAO Agricultural Outlook 2014-2023" Retrieved at http://stats.oecd.org/index.aspx?queryid=58652.

E. Macroeconomic Environment

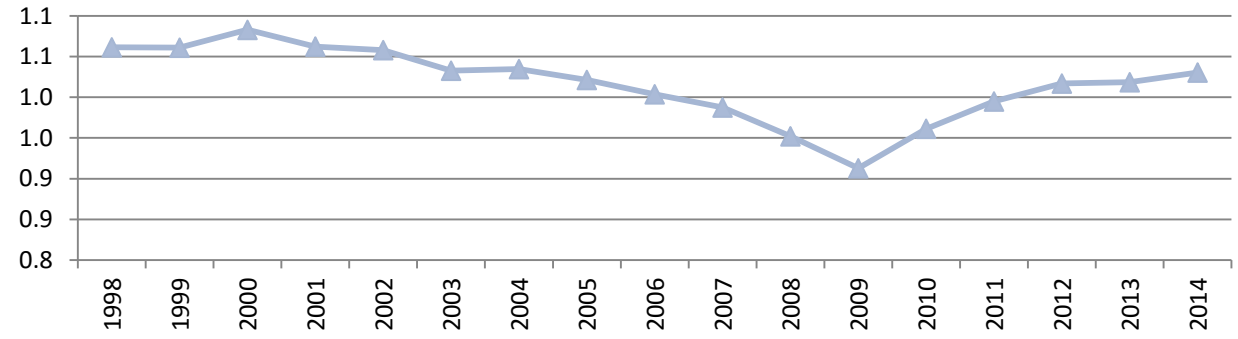
i. Capacity Utilization

As mentioned previously, capacity utilization can influence measures of labour productivity. In 2013, capacity utilization in Australia was 80.4 per cent, while it was 82.8 per cent in Canada. Excluding the five years between 2007 and 2011, capacity utilization was higher in Canada than Australia. Hence, over the 1998-2013 period, low levels of capacity utilization suggests that labour is working with less capital, which in turns implies that labour productivity levels are lower.

Chart 44: Capacity Utilization Rates, Canada and Australia, Per Cent, 1998-2014
Panel A: Levels



Panel B: Relative (Canada/Australia)



Note: Industrial capacity utilization rates for Canada. The National Australia Bank appears to report industrial capacity utilization rates, but this still requires confirmation.
Source: National Australia Bank from iEconomics and Statistics Canada

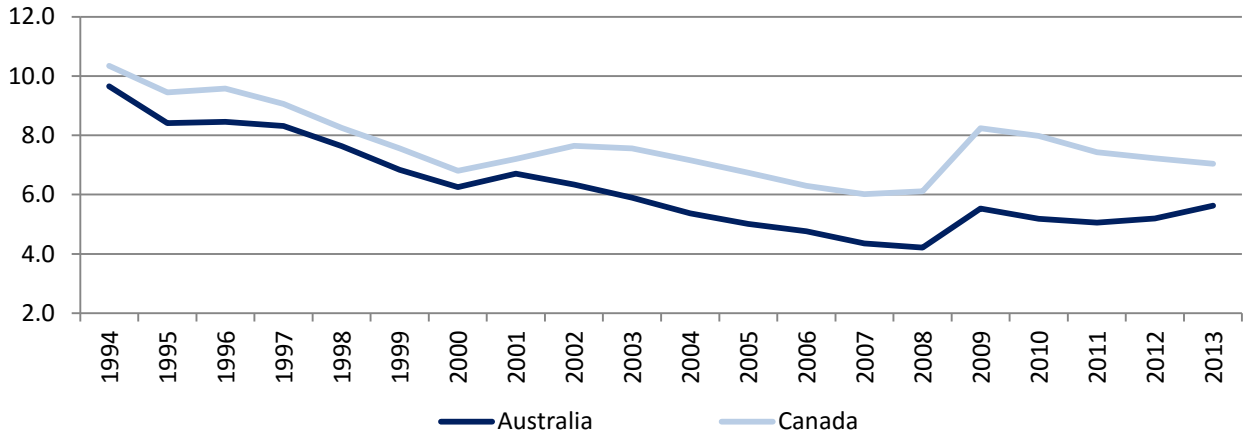
Between 1998 and 2014, capacity utilization does not explain the differing levels of labour productivity exhibited in Canada and Australia (Chart 44). In particular, since Canada's capacity utilization was consistently higher than Australia's, excluding the four years between 2007 and 2010, this would lead us to expect that Canada's labour productivity levels could be higher than Australia's, but in reality, the reverse is the case. However, over the 2000-2013

period, capacity utilization in Canada fell 0.5 per cent per year, while it fell more slowly in Australia at 0.1 per cent per year. Thus, capacity utilization may explain differing growth rates between 2000 and 2013, since the growth rate gap suggests that Australia should have had higher labour productivity growth over the period (which it did).

ii. Labour Market Utilization

Lower unemployment rates, as well as changes in other indicators that point to an increase in labour market tightness, imply that it is more difficult for firms to hire workers. In other words, a tighter labour market can have a positive impact on productivity through labour scarcity. This can spur additional investment in labour-saving capital. Therefore, the lower unemployment rate exhibited by Australia may, in part, explain its superior productivity performance in recent decades (5.62 versus 7.04 per cent in 2013) (Chart 45). On the other hand, the unemployment rate is not a comprehensive indicator of labour market tightness, as it does not account for the existence of discouraged workers, involuntary part-time workers, and economic short-time workers.

Chart 45: Unemployment Rate, Canada and Australia, Per Cent, 1994-2013

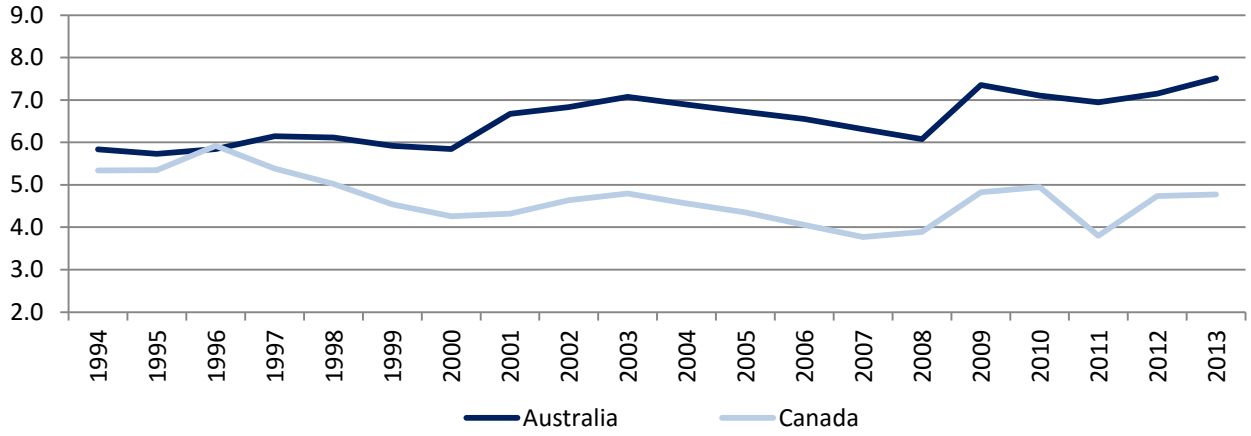


Source: CSLS calculations based on OECD data.

With respect to involuntary part-time workers, Australia appears to have had a weaker labour market than Canada throughout the 1994-2013 (Chart 46). The incidence of involuntary part-time workers actually increased from 5.8 per cent in 1994 to 7.5 per cent in 2013 in Australia. In contrast, Canada's incidence of involuntary part-time workers fell slightly from 5.3 per cent to 4.8 per cent over this period (although at much lower levels than involuntary unemployment at less than one per cent). The incidence of discouraged workers and the incidence of short-time workers were also consistently higher in Australia than in Canada throughout the 1994-2013 period (Chart **47** and Chart **48**).

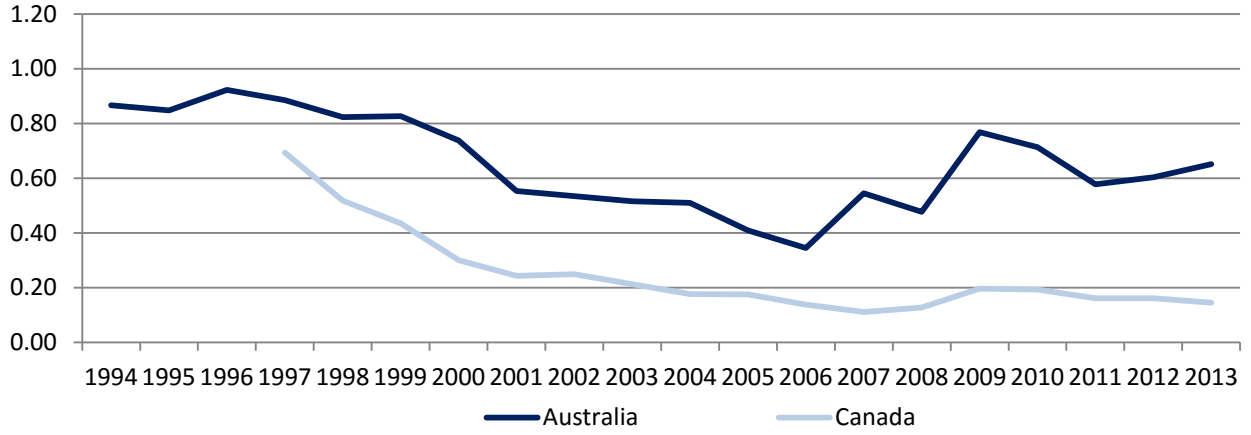
In sum, despite the lower unemployment rate experienced by Australia during the 1994-2013 period, alternative indicators suggest that Australia's labour market was actually *looser* than Canada's during this period. There are still two unknowns. First, it is unclear whether there were any significant differences in the labour market tightness between the two countries. Second, it is unclear whether differences in labour market tightness, if present, are an important explanation of differences in labour productivity growth between Canada and Australia.

Chart 46: Incidence of Involuntary Part-time Workers, Canada and Australia, Per Cent, 1994-2013



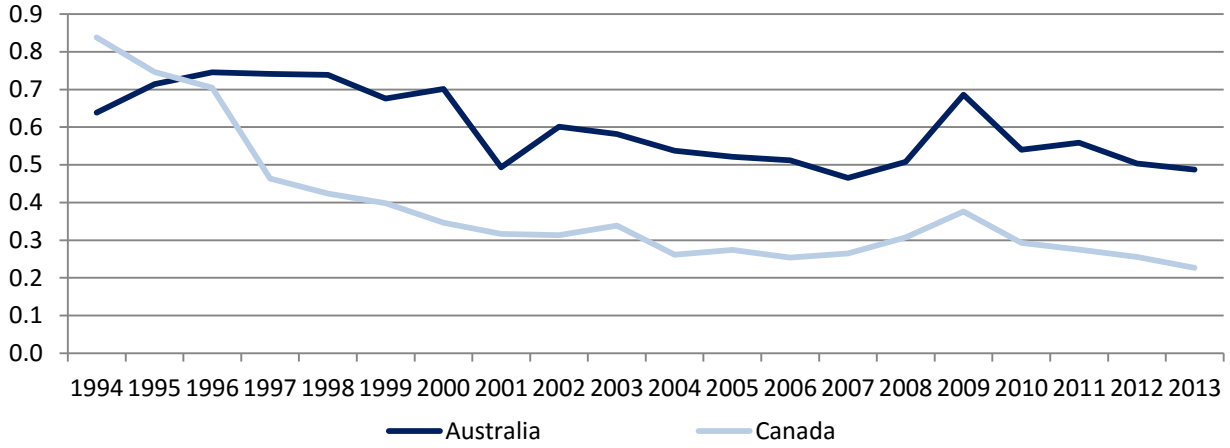
Note: The incidence of involuntary part-time workers is equal to the number of involuntary part-time workers expressed as a percentage of the labour force. According to the OECD, "involuntary part-time workers are part-timers (working less than 30-usual hours per week) because they could not find a full-time job." The definitions are not harmonised which may limit the comparison between Canada and Australia.
Source: CSLS calculations based on OECD data.

Chart 47: Incidence of Discouraged Workers, Canada and Australia, Per Cent of the Labour Force, 1994-2013



Note: The incidence of discouraged workers is equal to the number of discouraged workers expressed as a percentage of the labour force. The definitions are not harmonised which may limit the comparison between Canada and Australia.
Source: CSLS calculations based on OECD and Statistics Canada data. Statistics Canada: 282-0219.

Chart 48: Incidence of Economic Short-time Workers, Canada and Australia, Per Cent, 1994-2013

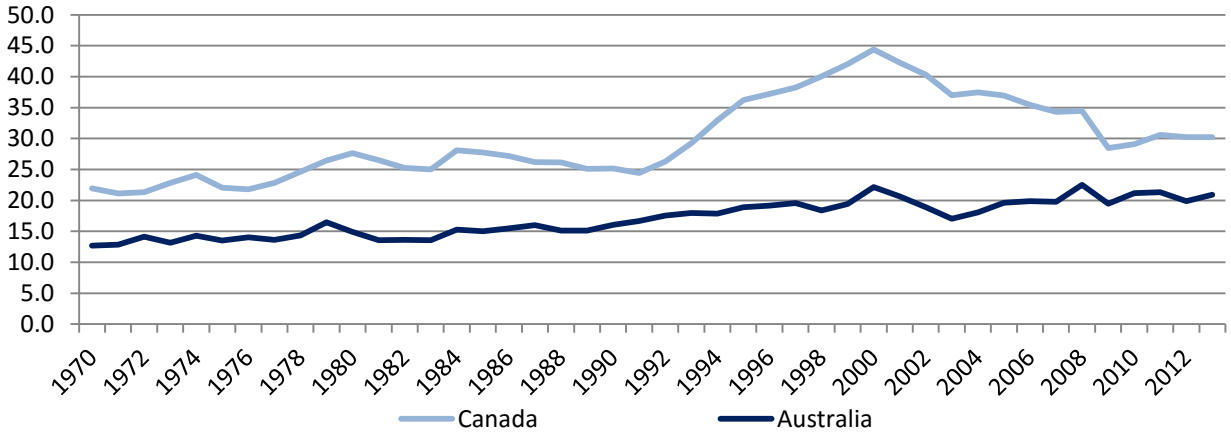


Note: The incidence of economic short-time workers is equal to the number of economic short-time workers expressed as a percentage of the labour force. According to the OECD, "economic short-time workers comprise workers who are working less than usual due to business slack, plant stoppage, or technical reasons." The definitions are not harmonised which may limit the comparison between Canada and Australia.
Source: CSLS calculations based on OECD and Statistics Canada data.

iii. Exports

Canada exports significantly more relative to its GDP than Australia, although exports have become increasingly important to aggregate demand in both countries since 1970 (Chart **49**). In 1970, Canada's exports were equal to 22.0 per cent of its nominal GDP, while Australia's were only worth 12.7 per cent. These shares gradually rose to 25.2 per cent and 16.0 per cent respectively by 1990. Canadian exports increased far faster than GDP in the 1990s, accounting for 44.4 per cent by 2000. Australian exports as a share of GDP also grew more quickly over this period, but at a very subdued pace compared to Canada's. Australia's exports were fairly stable at about 22.1 per cent of GDP from 2000-2013, but Canada's exports fell dramatically (relative to GDP) over this period. By 2013, Canadian exports represented only 30.2 per cent of GDP.

Chart 49: Nominal Exports as a Percentage of GDP, Canada and Australia, 1970-2013



Source: OECD.Stat, National Accounts, Annual National Accounts, Main Aggregates, Gross Domestic Product (GDP)

While exports are a much larger component of Canadian GDP, the growth rate of exports is far more relevant for growth in aggregate demand and growth in productivity. From 1970-2013, (real) export growth was strong in both countries, but it was 0.90 percentage points greater annually in Australia (4.93 per cent versus 4.03 per cent) (Table **33**). From 1994-2013, export growth was much greater in Australia (4.37 per cent versus 2.85 per cent). Canadian exports grew faster between 1994 and 2000 (8.76 per cent versus 7.53 per cent), but they have stagnated since 2000. Over the 2000-2013 period, Canadian exports have only grown at a rate of 0.24 per cent annually. Australia's export growth has also slowed down, but continued at a rate of 2.94 per cent from 2000 to 2013.

Table 33: Annual Growth Rate of Real Exports, Australia and Canada, 1970-2013

	1970-2013	1994-2013	1994-2000	2000-2013
Australia	4.93	4.37	7.53	2.94
Canada	4.03	2.85	8.76	0.24

Source: OECD.Stat, National Accounts, Annual National Accounts, Main Aggregates, Gross Domestic Product (GDP)

Australian exports are much more diversified in terms of the receiving country than Canada's (Table **34** and Table **35**). In 2009, the leading importer of Australian exports was China with 23.5 per cent. In contrast, about two-thirds of Canadian exports went to the United States in 2009. Canada's next largest importer was China (4.4 per cent).

Table 34: Exports by Destination, Per Cent of Total Exports, Australia

	1995	2000	2005	2009
China	4.18	6.38	13.95	23.51
Japan	25.21	20.25	19.05	17.35
Korea	8.10	8.34	8.12	8.11
India	1.89	2.00	5.80	7.37
United States	10.39	14.85	8.70	6.53
Chinese Taipei	4.43	5.35	3.94	3.26
New Zealand	4.27	3.92	4.40	2.63
United Kingdom	4.31	4.52	4.35	2.44
Indonesia	3.64	2.80	2.65	2.07
Thailand	2.18	1.56	2.50	1.99
Germany	3.37	2.70	2.07	1.88
Singapore	1.67	1.88	1.62	1.73
Malaysia	3.57	2.45	2.09	1.67
Saudi Arabia	0.72	1.53	1.84	1.58
Brazil	0.75	0.75	0.98	1.16
Canada	2.08	1.64	1.52	1.03
France	2.18	1.36	1.53	0.95
Italy	2.18	2.08	1.44	0.83
South Africa	0.87	0.95	1.05	0.71
Hong Kong, China	1.72	1.42	0.76	0.69
Rest of the World	12.29	13.27	11.64	12.51

Source: OECD.Stat, OECD-WTO Trade in Value Added (TiVA) Indicators by Industry with Partner, World

The structure of export destinations has changed considerably in both countries since 1995. The United States has become a less important importer for both Canada and Australia. The United States purchased 77.6 per cent of Canadian exports in 2000, but only 66.1 per cent in 2009. Similarly, the United States' share of Australian exports fell from 14.9 per cent in 2000 to just 6.5 per cent in 2009. This sharp decline will have been partly due to the American financial crisis and subsequent recession.

Growing demand from China has made it a major trading partner for both countries. China's share of Canadian exports rose from 1.26 per cent in 1995 to 4.38 per cent in 2009. Similarly, its share of Australian exports rose from 4.18 per cent in 1995 to 23.5 per cent of its exports in 2009. The decline in Canadian export growth from 2000 to 2013 compared to Australia will be due in part to Australia's relative proximity to China, where growth in domestic demand was very strong, and Canada's relative proximity to the United States, where domestic demand weakened significantly.

Table 35: Exports by Destination, Per Cent of Total Exports, Canada

	1995	2000	2005	2009
United States	70.83	77.62	75.95	66.13
China	1.26	1.42	2.35	4.38
Japan	5.63	3.25	2.55	2.80
United Kingdom	2.33	2.34	2.18	2.61
Mexico	0.69	1.39	1.60	2.07
Germany	2.34	1.37	1.18	1.94
France	1.36	0.92	0.99	1.58
Korea	1.30	0.88	0.95	1.28
India	0.27	0.27	0.55	0.84
Italy	1.25	0.90	0.71	0.82
Australia	0.72	0.53	0.62	0.80
Brazil	0.74	0.48	0.40	0.74
Saudi Arabia	0.29	0.26	0.28	0.64
Norway	0.44	0.37	0.43	0.52
Indonesia	0.52	0.31	0.36	0.49
Netherlands	0.66	0.41	0.31	0.48
Russian Federation	0.20	0.21	0.32	0.47
Spain	0.38	0.32	0.46	0.43
Chinese Taipei	1.00	0.56	0.44	0.42
Belgium	0.53	0.41	0.26	0.41
Rest of the World	7.26	5.78	7.11	10.15

Source: OECD.Stat, OECD-WTO Trade in Value Added (TiVA) Indicators by Industry with Partner, World

iv. The Importance of Demand-side Effects

Economists and policy makers have traditionally analyzed labour productivity through supply-side variables such as investment, innovation and human capital; however, most have neglected the direct effects from the demand side. Without sufficient demand, productivity cannot grow even with strong supply-side variables. In addition, an economic crisis linked to inadequate demand can have negative effects on the supply-side potential of the economy through reduced investment and R&D (Summers, 2014). It is important to examine whether different demand conditions can explain the gap in labour productivity growth between Canada and Australia because of the heavy reliance of both economies on exports.

As shown in the preceding section, the slowdown in output growth in both Australia and Canada between 1994-2000 and 2000-2013 was related to the decline in international export growth. While export growth was quite similar in both countries in 1994-2000, it was

significantly stronger in Australia than in Canada in 2000-2013. This may explain the increase in the gap in labour productivity growth rates between 1994-2000 and 2000-2013. While Australia's exports increased 2.94 per cent per year in 2000-2013, Canada's exports grew merely 0.24 per cent per year. The divergence between the two countries in terms of export performance was largely related to geography: Australia's exports benefited from its proximity to China which grew rapidly throughout this period, while Canadian exports were afflicted by weak growth in domestic demand in its neighbour and closest trading partner, the United States, both before and especially following the 2008 global financial crisis.

As previously mentioned, the weaker demand conditions in Canada compared to Australia led to an increase in the gap in output growth between 1994-2000 and 2000-2013, and that this development was associated with an increase in the gap in labour productivity growth. However, this is not a mere correlation, but a causal relationship, with slower output and demand growth leading to slower productivity growth.

The proposition that labour productivity growth is a function of output growth is known as "Verdoorn's law," named after a Dutch economist who originally formulated the relationship in the 1950s. His empirical results showed that there was a strong positive association between output growth and labour productivity growth. Kaldor (1966) also posited such a relationship, showing that a 1 per cent increase in output led to an increase in labour productivity of approximately 0.5 per cent.[34]

The statistical relationship between output growth and labour productivity growth could in principle run in either direction. It is indeed possible that a change in supply-side conditions, such as a technological shock, could raise or lower potential productivity growth and thereby increase or decrease actual output and labour productivity growth. However, the empirical evidence presented in this report provides limited support to such a supply-side productivity effect in the short- to medium-term.

A more likely scenario is one that runs from changes in demand conditions to changes in labour productivity. A number of explanations have been advanced to explain why weak demand growth could have negative effects on labour productivity growth. These explanations include less spreading of overhead costs and fewer static and dynamic economies of scale (like less learning-by-doing and less x-inefficiency). Weak demand is also bad for profits, which reduces both investment and R&D, key drivers of productivity growth. The situation reverses itself when demand is strong.

Spiro (2013) sums it up nicely: even with strong supply-side variables such as human capital or better capital equipment in an economy, the potential of these variables cannot be

[34] This is productivity elasticity.

realized if there is insufficient demand. The highly-educated workforce will seek employment in low-productivity sectors, such as retail or food services, because the demand is not there to create high-productivity jobs. Capital equipment will sit idle because there is no need to produce large amounts of output. In addition, businesses that do not sell enough output cannot justify investing in more, newer and better capital. The lack of ability to deploy human capital and physical capital into high-productivity sectors diminishes the cost competitiveness of an economy. This loss of cost competitiveness relative to other economies can further reduce output growth, which reduces labour productivity growth even more, thereby creating a vicious cycle.

Rao and Li (2013) further the argument made by Spiro that a slowdown in demand can negatively affect the accumulation of physical and human capital, causing a slowdown in productivity growth. This slowdown leads to a loss of cost competitiveness, reducing demand and exacerbating the decrease of capital accumulation; thus, creating a vicious cycle. In addition, Rao and Li used panel data to show "93 percent of the fall in average labour productivity growth in Canada between the periods of 1981 to 2000 and 2000 to 2012 can be attributed to the drop in real GDP growth." In addition, they showed that the fall in internal and external demand impacts key labour productivity growth drivers such as R&D spending and M&E investments.[35]

Table **36** shows that the growth rates of demand have declined more in Canada than in Australia between 1994-2000 and 2000-2013 (1.82 percentage points compared to 0.81 percentage points). Under the contribution rows, it becomes immediately clear that exports were responsible for the large majority of this decline in Canada (156.7 per cent), whereas in Australia both exports and consumption were large contributors (108.9 and 50.0 per cent). Since exports were such a large contributor to the changes in GDP growth between the two periods in both countries, the following section will examine trends in exports in both Canada and Australia.

[35] A recent study by Statistics Canada (Baldwin, Gu and Yan, 2013) uses firm-level data to analyze the post-2000 productivity slowdown in Canadian manufacturing. The conclusions of that study are very similar to this report. They found that the Canadian manufacturing sector underwent considerable restructuring as a result of a change in the economic environment and the development of excess capacity after 2000 and that these developments accounted for the deterioration in productivity growth. They found that most if not all of the decline in aggregate labour productivity growth in manufacturing was due to the decline in labour productivity growth within plants associated with declining capacity utilization. They also found that the appreciation of the Canadian dollar led to the exit of many large exporters that were relatively more productive. As a result, the exiting firms in the post-2000 period were as productive as entrants, which is typically not the case. Therefore, the process of entry and exit seemed to have little adverse impact on productivity growth, as in the earlier periods.

Table 36: Growth Rates of Demand Components, Constant Prices, National Currency, National Base Year

	Canada						Australia					
	GDP	C	G	I	X	M	GDP	C	G	I	X	M
					Absolute							
94-13	2.57	3.06	1.86	4.33	2.85	4.47	3.30	3.49	3.06	5.13	4.37	7.02
94-00	3.81	3.46	0.73	5.71	8.76	7.87	3.85	4.00	3.22	3.35	7.53	6.62
00-13	1.99	2.87	2.38	3.70	0.24	2.94	3.04	3.26	2.98	5.96	2.94	7.21
					Change							
Δ(94-00) to (00-13)	-1.82	-0.59	1.65	-2.01	-8.52	-4.93	-0.81	-0.74	-0.24	2.61	-4.59	0.60
					Contribution							
Absolute	-1.82	-0.32	0.34	-0.43	-2.83	1.43	-0.81	-0.40	-0.04	0.61	-0.87	-0.09
Per Cent	100.0	17.5	-18.8	23.7	156.7	-79.0	100.0	50.0	5.4	-75.6	108.9	11.3

Note: 'C' represents consumption from households and non-profit institutions serving households. 'G' represents consumption from general government. 'I' represents gross capital formation. 'X' represents exports and 'M' represents imports.
Source: OECD National Accounts, Main Aggregates, Gross Domestic Product, Gross Domestic Product.

F. Key Points

This section has focused on investigating the possible reasons behind the gap in labour productivity growth between Australia and Canada in 1994-2013 (1.31 per cent in Canada and 2.33 per cent in Australia). Based on the evidence provided throughout this section, the gap in labour productivity growth between Australia and Canada is reflected by a gap between these countries in many of the drivers of labour productivity growth.

With respect to the supply-side drivers of labour productivity growth, Australia outperformed Canada in terms of capital intensity growth, growth in BERD intensity, product market regulation, and barriers to trade and investment. A simple growth accounting exercise showed that capital deepening accounted for 71 per cent of the gap in labour productivity growth in this period. The remainder was accounted for by MFP. Australia surpassed Canada in terms of investment intensity and investment growth for structures, M&E and ICT.

Australia also exhibited more rapid growth in BERD, although its BERD intensity was still lower than Canada's over much of the observed period. More notably, Australia has significantly less product market regulation than Canada according to the OECD, as well as fewer barriers to trade and investment. This may, in part, explain the stronger labour productivity growth of Australia. As we shall see in the following section, many economists attribute Australia's rapid productivity growth in the late-1990s to deregulation and the reduction of barriers to trade and investment.

In contrast, we found no evidence that differences in human capital accumulation contributed to the labour productivity growth gap. The growth accounting exercise found that the contribution of changes in labour composition to labour productivity growth was the same in

both countries in 1994-2013, at 0.29 per cent per year. Therefore, it is unlikely that differences in human capital accumulation contributed to the gap.

There is little evidence that differences in labour market regulation contributed to the gap in labour productivity growth. While the intensity of union membership was quite steady in Canada over the observed period, it steadily declined in Australia. Although unionization has been on the decline in Australia, the share of the population covered by collective agreements has increased, and industry- and occupation-specific minimum wages and terms of employment are determined in Australia's unique "awards" system. Furthermore, according to the OECD Canada has slightly less labour market regulation (overall) than Australia.

In the previous section, we found that inter-industry shifts explain a significant portion of the gap in labour productivity growth between the two countries. In fact, they accounted for 32 per cent of the gap in 1994-2013. Most importantly, Australia reallocated more labour to mining, which alone accounted for 17 per cent of the gap. This occurred because the mining sector's share of total hours worked increased much more in Australia than in Canada.

The labour productivity growth gap in recent years seems to have been driven by the macroeconomic environment. With respect to the demand-side drivers of the gap in labour productivity growth, stronger export growth likely explains part of Australia's stronger productivity performance in 2000-2013. Exports grew 2.94 per cent per year in Australia in 2000-2013, compared to 0.24 per cent per year in Canada. A better macroeconomic environment associated with solid export growth improves labour productivity growth *à la* Verdoorn's law. In contrast, both countries exhibited similar growth in exports in 1994-2000.

Lower unemployment rates, as well as other changes that point to an increase in labour market tightness, can have a positive impact on labour productivity growth through labour scarcity. This can spur additional investment in labour-saving capital. It is unclear whether this factor has contributed to the gap in labour productivity growth. Despite the lower unemployment rate experienced by Australia, alternative indicators (*e.g.*, the incidence of discouraged searchers and involuntary part-time workers) suggest that Australia's labour market was actually looser than Canada's during this period. There is also a risk that methodological differences between Statistics Canada and the ABS limit comparisons of these indicators.

Theoretically, an increase in the minimum wage should have a similar effect on labour productivity growth to an increase in labour market tightness. Australia's minimum wage was higher than Canada's throughout the observed period. However, the minimum wage has fallen relative to mean and median wages over time in Australia, while it has increased relative to mean and median wages in Canada. It is therefore unlikely that Australia's higher minimum wage contributed to its superior labour productivity performance.

Table 37: Summary of Drivers and their Potential Impact on the Gap in Labour Productivity Growth

Driver	Impact	Reasoning
Capital Intensity	Significant	Capital intensity grew 1.66 per cent per year in Australia in 1994-2013 compared to 0.94 per cent per year in Canada, accounting for 71 per cent of the gap in labour productivity growth. Australia had stronger investment growth in structures, M&E and ICT. This likely increased productivity through supply-side channels and reflected the better macroeconomic environment in Australia.
Human Capital	Insignificant	In 1994-2013, the contribution of changes in labour composition to labour productivity growth was the same in both countries, at 0.29 percentage points per year. Therefore, it is unlikely that differences in human capital accumulation contributed to the gap.
Inter-industry Shifts	Significant	Inter-industry shifts explain a significant portion of the gap in labour productivity growth (32 per cent of the gap in 1994-2013). Most importantly, Australia reallocated more labour to mining (and oil and gas), which alone accounted for 17 per cent of the gap. Australia's share of hours worked in mining (and oil and gas) increased 2.5 percentage points, while Canada's share increased only 0.6 percentage points.
Quality of the Stock of Natural Resources	Small	Both countries exhibited negative labour productivity growth in mining. This likely reflected increased difficulty in extracting natural resources in both countries. The within-industry effect captures this decline in labour productivity and shows that the negative contribution from this factor was slightly less in Australian than Canada (-0.13 percentage points in Australia versus -0.16 percentage points in Canada). However, the within-industry effect explains only 2.9 per cent of the gap.
Innovation	Small, but positive	While BERD intensity was higher in Canada than in Australia over much of the period, growth in BERD intensity has been much more rapid in Australia than in Canada, particularly since 2000. Hence, BERD may have contributed more in Australia to productivity growth than in Canada.
Macroeconomic Environment	Likely	Stronger output growth over the total period (3.20 per cent per year versus 1.85 per cent per year) may explain part of Australia's stronger labour productivity performance between 1994 and 2013. Stronger output growth since 2000 was also likely a factor influencing Australia's stronger productivity performance in 2000-2013. In this period, stronger export growth was driven by investment and exports. Investment growth in Canada between 2000 and 2013 was only 3.70 per cent, while investment growth in Australia was 5.96 per cent. Furthermore, exports grew 2.94 per cent per year in Australia in 2000-2013, compared to 0.24 per cent per year in Canada. A better macroeconomic environment associated with solid export growth and investment growth improves labour productivity growth *à la* Verdoorn's law. In contrast, both countries exhibited similar growth in exports in 1994-2000.
Microeconomic Environment	Likely	According to the OECD, Australia has lower product market regulation and fewer barriers to trade and investment than Canada. This may, in part, explain the stronger labour productivity growth of Australia. However, Canada has slightly less labour market regulation (overall) than Australia.

Note: Since many factors explaining labour productivity growth are interrelated this chart overaccounts for labour productivity growth.

VI. The Impact of Public Policies on Australian Productivity Growth

This section analyses the impact of public policies on productivity growth in Australia. Policies include competition policy, product and labour market regulation, tax policy, trade policy, and support for innovation.

A. Productivity Boom in the 1990s: The Role of Microeconomic Reforms

i. Background

In Australia, both labour productivity growth and multifactor productivity (MFP) growth surged in the 1990s. Between 1994 and 2000, labour productivity in the total economy grew at an annual rate of 1.82 per cent, well above the growth rate from 1981 to 1994 of 1.16 per cent, driven by stronger growth in MFP at double its historical average in previous years (Productivity Commission, 1999).[36] Furthermore, the acceleration in productivity growth was also reflected in an increase in Australia's ranking among OECD countries in terms of MFP growth from 12th among 16 countries in the 1985-1994 period to 2nd among 18 countries in 1994-1999 (Productivity Commission, 2009). This productivity surge was preceded by a series of reforms that were implemented from the mid-1980s to the late-1990s.

Australia exhibited weak productivity growth before the 1990s, especially compared to Japan, the United States and other advanced economies in Europe (Parham, 2002). Throughout the 1960s, 1970s and 1980s, this relative underperformance was repeatedly attributed to overregulation in product, capital and labour markets and the poor performance of economic infrastructure (*i.e.*, electricity, gas, water, communications and transport) by government-sponsored enterprises (Parham, 2002). The Productivity Commission (2009) succinctly summarized the impact of these policies on the Australian economy:

> "One of the central economic problems that had faced Australia up to the mid-1980s was that large parts of the economy were inefficient, inward-looking and inflexible. In particular, protection policy had allowed small scale production to proliferate, distorted the flow of economic resources away from industries with the best potential to add value and prospects for growth, encouraged manufacturing to focus on import replacement, and fostered a culture that allowed poor management and work practices to develop and become entrenched. This meant Australia was not well placed to respond to the changes and challenges arising from rapid technological change, global integration and fiercer competition from abroad."

In response, successive Australian governments implemented a series of reforms to rectify the situation from the mid-1980s to the late-1990s. A great deal of research has been

[36] This is not consistent with our estimates which suggest that labour productivity in the total economy in Australia grew at 2.00 per cent per year between 1994 and 2000.

conducted on the impact of these reforms on productivity growth in Australia. In particular, it is widely believed that they explain the surge in productivity in the mid- to late-1990s. According to the standard narrative, which is frequently maintained by the Productivity Commission and other researchers, much of the improved productivity performance came from an unlocking of the supply-side potential of the Australian economy related to these reforms.

The reforms were wide-ranging and ambitious. They had both macro and micro dimensions, although the focus of the literature is largely on the role of microeconomic reforms. More specifically, these reforms included the introduction of financial deregulation, privatization of government enterprises, the introduction of enterprise-level wage bargaining and individual employment contracts, reduced tariffs, tax reform, a dramatic shift in macroeconomic policy, and a new competition policy.

In line with global trends during this period, Australia pursued a comprehensive program of trade liberalisation and other structural reforms. Above all, these reforms freed up product, labour and financial markets, promoted competition, and, at the most fundamental level, sought to extend and enhance the role of prices as signals for costs and relative returns.

Following a sweeping tariff cut in 1973, which reduced tariffs on most imported goods by 25 per cent, Australia failed to adopt any significant structural reforms for about a decade (Banks, 2005). This was largely due to significant public backlash following the tariff cut, which reduced the momentum needed for further structural reforms. Over the next ten years, the Australian government only adopted a series of small tariff cuts. However, the fight against protectionist policies was bolstered when a new government came to power in 1983 (Australian Labour Party). The Australian government quickly began to eliminate import quotas and implement broad tariff reductions. Initially, these changes only affected specific industries. And then, between 1988 and 1996, Australia phased in broad tariffs reductions affecting almost every industry. By 1996, tariffs on almost all imported goods were 5 per cent or less (Banks, 2005).

Australia also liberalized its financial sector, including the removal of exchange and interest rate controls, in the 1980s and 1990s. For example, the government floated the Australian dollar in 1983, with the objective of amplifying the gains from trade liberalization.

Trade liberalization exposed Australia's tradable-goods sector to increased international competition. This put pressure on firms and the government to lower their input costs, especially labour costs. According to Banks (2005), in the absence of strong international competition, Australian firms were able to "pass excessive input costs on to consumers through accommodating 'made-to-measure' increases in tariffs. But now, faced with a government intent on reducing protection, local managers and their workforces needed to improve their own performance and get value from their suppliers."

Figure 1: Summary of Australia's Microeconomic Reforms

Trade liberalisation — reductions in tariff assistance (that began in 1973) and the abolition of quantitative import controls — mainly in the automotive, whitegoods and textile, clothing and footwear industries — gathered pace from the mid 1980s. The effective rate of assistance to manufacturing fell from around 35 per cent in the early 1970s to 5 per cent by 2000.

Capital markets — the Australian dollar was floated in March 1983, foreign exchange controls and capital rationing (through interest rate controls) were removed progressively from the early 1980s and foreign-owned banks were allowed to compete — initially for corporate customers and then, in the 1990s, to act as deposit taking institutions.

Infrastructure — partial deregulation and restructuring of airlines, coastal shipping, telecommunications and the waterfront occurred from the late 1980s. Across-the-board commercialisation, corporatisation and privatisation initiatives for government business enterprises were progressively implemented from around the same time.

Labour markets — the Prices and Incomes Accord operated from 1983 to 1996. Award restructuring and simplification, and the shift from centralised wage fixing to enterprise bargaining, began in the late 1980s. Reform accelerated in the mid 1990s with the introduction of the *Workplace Relations Act 1996*, further award simplification (through limiting prescribed employment conditions in enterprise bargaining agreements) and the introduction of individual employment contracts (Australian Workplace Agreements).

Human services — competitive tendering and contracting out, performance-based funding and user charges were introduced in the late 1980s and extended in scope during the 1990s; administrative reforms (for example, financial management and program budgeting) were introduced in health, education and community services in the early 1990s.

'National Competition policy' reforms — In 1995, further broad-ranging reforms to essential service industries (including energy and road transport), government businesses and anti-competitive regulation was commenced by all Australian governments through a coordinated national program.

Macroeconomic policy — inflation targeting was introduced in 1993. From the mid 1980s, fiscal policy targeted higher national saving (and a lower current account deficit) and, from the mid 1990s, concentrated on reducing government debt, primarily financed through asset sales (privatisation).

Taxation reform — capital gains tax and the dividend imputation system were introduced in 1985 and 1987, respectively. The company tax rate was lowered progressively from the late 1980s. A broad-based consumption tax (GST) was implemented in 2000, replacing the narrow wholesale sales tax system and a range of inefficient state-based duties. And income tax rates were lowered at the same time.

Source: Banks (2005)

Increased international competition also put pressure on the Australian government to enact reforms aimed at improving the competitiveness of the economy. Microeconomic reforms ultimately led to dramatic liberalization in all product markets, factor markets (*i.e.* capital and labour markets), and the public and private sectors. At the same time, macroeconomic reforms led to "low inflation and greater stability, and tax reforms reduced distortions and improved

business incentives" (Banks, 2005).

The introduction of the National Competition Policy (NCP) was one of the most important elements of structural reform in the 1990s. In 1992, federal and state governments established the Independent Committee of Inquiry into a National Competition Policy. The recommendations of the Committee were published in the 'Hilmer report', named after the Committee Chair Fred Hilmer, in 1993.

In 1995, Australia's federal and state governments signed three agreements in which they committed to a comprehensive set of reforms, known as the NCP program or the 'Hilmer report reforms,' which were based on the recommendations of the Hilmer report. Simply put, the NCP program sought to minimize restrictions on competition and promote 'competitive neutrality'. According to Banks (2005), the NCP program was quite broad:

> "Among other things, the NCP program entailed: an extension of anti-competitive conduct laws to cover previously exempt government and unincorporated enterprises; the review of some 1,800 items of anti-competitive regulation; reforms to public monopolies, including 'competitive neutrality' mechanisms, certain structural reform requirements and prices oversight mechanisms where public monopolies were retained; and an access regime for network infrastructure."

In essence, the NCP program injected competitive vigour into the Australian economy, especially into sectors which were traditionally sheltered from competition such as utilities and other government monopolies.

ii. The Role of Microeconomic Reforms

In theory, microeconomic reforms should improve productivity performance through three key mechanisms: 1) by making the economy more flexible so that scarce resources are directed to more productive uses; 2) by improving the efficiency of the economy through greater international and domestic competition; and 3) by making the business culture more focused on pursuing opportunities to expand in both foreign and domestic markets.

According to the Productivity Commission (1999), most microeconomic reforms have some direct influence on productivity. For instance, the lowering of tariffs and industry-specific subsidies will "alter price and other signals which guide where capital assets, employment, finance and other resources are better used." In addition, loosening of labour market regulations should "facilitate the redesign of work arrangements within enterprises and allocate labour to where it can be most productively used." Furthermore, reforms can either reduce or remove regulatory barriers that "unnecessarily prevent firms from making productivity-enhancing adjustments to products and production processes."

Microeconomic reforms also influence productivity performance in a number of indirect ways. For example, the exposure to greater competition from abroad puts pressure on firms to lower costs and eliminate inefficiencies. It may also lead to the closure of inefficient firms and establishments, thereby increasing productivity growth through a composition effect. They also encourage Australian firms to be outward-oriented and to adopt foreign-sourced technologies and processes.

Broadly speaking, there are two types of evidence of the impact of microeconomic reforms on productivity performance: 1) aggregate-level evidence, which attempts to quantify the impact of these reforms on the productivity performance of the total economy; and 2) industry-level evidence, which tries to estimate the effect of microeconomic reforms on the productivity performance of specific industries. We first discuss the aggregate-level evidence, and then turn our attention to industry-level evidence.

Much of the aggregate evidence on the effects of microeconomic reforms in Australia applied general equilibrium models to simulate and determine the effects of these reforms. However, these studies are quite old and were often conducted before to the implementation of microeconomic reforms to forecast their impact. Generally speaking, they find large, positive effects of reform on productivity performance. For example, the Industry Commission (1995) estimated that the Hilmer report reforms would raise GDP by about 5.5 per cent through productivity gains over the long-term, once all adjustments had been made. However, these studies have been criticized for "the assumptions made about the size of productivity gains from microeconomic reform, and for failing to properly incorporate and value effects of reform on consumption" (Borland, 2001). For example, Quiggin (1997) adjusted the Industry Commission's assessment by assuming smaller productivity gains from reforms and accounting for adjustment costs, and found that reforms only raised GDP by about 0.7 per cent through productivity gains.

More recent studies have focused on the role of microeconomic reform in the acceleration of productivity growth in the late 1990s. For instance, the Productivity Commission (1999) argued that the acceleration of productivity growth was driven by the impact of microeconomic reforms. These reforms stimulated an increase in the trade orientation of Australian firms, specialization and the adoption of new technologies (notably ICT), all of which boosted productivity growth. But their evidence is mostly circumstantial:

> "The timing of the productivity response is at least consistent with a response to the introduction of reforms. While there were some important early steps, reforms grew in coverage and intensity in the late 1980s and into the 1990s. The evidence suggests that productivity growth has been strengthening throughout the 1990s. This could reflect a combination of lags in adjustment to earlier reforms (for example, liberalisation of trade barriers) and response to more recent reforms (for example, the evolution of change in the industrial relations system)."

By itself, the correlation between the microeconomic reforms and the surge in productivity growth is not sufficient to establish causality. It is possible that other factors can explain the productivity acceleration in the late 1990s, and that the productivity acceleration would have occurred with or without these reforms. However, the Productivity Commission's (2009) examination of alternative explanations led them to conclude that Australia's very strong productivity performance in the period cannot be fully explained by other factors. For example, the Commission dismissed the argument that the proliferation of ICTs was behind Australia's productivity surge in this period, arguing that the widespread adoption of ICTs occurred in most countries but the productivity surge in Australia was almost unmatched.

Many other authors have found evidence of a positive link between microeconomic reform and the productivity upsurge at the aggregate level (Salgado, 2000; Dowrick, 2000; OECD, 2000; Wooden, 2000). For example, Dowrick (2000) concluded that reforms must explain the productivity boom of the 1990s, after ruling out other explanations such as the presence of a worldwide productivity boom and recovery from a recession in the early 1990s. Using a similar approach, Wooden (2001) argues that the timing of the productivity acceleration indicates that labour market deregulation (specifically the shift to enterprise bargaining in 1993) accounts for the upsurge. However, Wooden did less to rule out the importance of other factors.

More recently, the Productivity Commission (2009) has outlined and refuted most other possible factors as being major contributors to the productivity upsurge in the 1990s. First, they show that, unlike the experience in the 1950s and 1960s, Australia was not simply benefiting from a global productivity boom. As mentioned above, Australia ranked 2nd among 18 OECD countries in terms of MFP growth in the late 1990s, a marked improvement from its productivity performance in previous years.

Second, the Productivity Commission (2009) argues that the productivity surge cannot be "dismissed as the normal result of recovery from the early 1990s recession," because the magnitude of the acceleration was both stronger and longer compared to previous recoveries.

Third, the Productivity Commission (2009) found that labour quality improvements did not account for much of the improvement in labour productivity growth. For example, Barnes and Kennard (2002) show that there was a deterioration in the contribution of labour composition compared to 1989-1994.

Fourth, the Productivity Commission (2009) found no evidence that ICT adoption was behind the improvement in MFP growth in the 1990s, which was responsible for much of the surge in labour productivity growth over this period. A detailed study by the Productivity Commission of the contribution of ICTs to labour productivity growth (Parham, Roberts and

Sun, 2001) concluded that ICTs could not account for the increase in MFP growth during the period.

After ruling out the aforementioned explanations, the Productivity Commission (2009) argues that the comprehensive reforms of the 1980s and 1990s are the most plausible explanation for the productivity surge in the late 1990s. They suggest that these reforms led to "greater economic flexibility, improved efficiency and international competitiveness, and a more outward looking, opportunity focused business culture."

Gary Banks, former Chairman of the Productivity Commission, looks at the factors driving the productivity surge documented in Australia beginning in the early 1990s (Banks, 2002). Not only did this surge in labour productivity and MFP, which followed a marked deceleration of productivity growth in the 1980s, set domestic records, it furthermore stands favorably in comparison to the experiences of other countries at the time.

The surge in productivity growth is delineated into two cycles, the first lasting from 1989 to 1994 and the second from 1994 to 2000 (Banks, 2002; Parham, 2002). During the first cycle, the main sectors contributing to productivity growth were the 'traditional' contributors to aggregate productivity growth – namely, agriculture, mining and manufacturing – as well as communication services and utilities, which experienced unprecedented productivity growth during that time. The second cycle was characterized by an upsurge in productivity growth in wholesale trade, construction, finance and insurance, and transport and storage. By far, wholesale trade contributed the most to the acceleration in aggregate MFP growth: it went from negative MFP growth in the first cycle to MFP growth of 5 per cent per year in the second cycle (Parham, 2002). In contrast, the 'traditional' sectors did not contribute to the productivity acceleration, nor did communication services and utilities.

Banks (2002) presents the mechanism as to achieving this growth in productivity in these sectors as a result of Australia's high use and fast rate of adoption of ICT. According to Parham (2002), Australia surpassed most countries in terms of ICT adoption in the 1990s, ranking 3rd among OECD countries in 1999 in terms of ICT investment intensity.

In some cases, Banks (2002) posits the association between ICT investment and productivity growth as a direct relationship, for example in the finance and insurance sector, where automation of banking services and the development of new information-hungry products directly increased productivity. However, in most cases, Banks credits growth in productivity as not resulting directly from the availability of new technologies, but rather the rate of uptake in combination with other changes which facilitated business transformations.

Wholesale retailers, which experienced unprecedented growth in productivity in the 1990s, are cited as an example of a business that successfully used ICTs – especially bar codes and scanning, which reduced the demand for labour and capital in the form of handling and storage. The key to achieving increased productivity was related to integrating new technologies into new, flexible arrangements that reduce costs and improve efficiency.

Parham (2002) performed an extended growth accounting exercise for Australian labour productivity growth in the 1990s. He found that ICTs made a very large contribution to the improvement in labour productivity growth in Australia, with a similar magnitude to the United States (about 0.3-0.4 percentage point). However, this was largely offset by a decrease in the contribution of other types of capital to labour productivity growth, leading to little or no change in the overall contribution of capital deepening. This was also the case for the United States. An increase in the pace of MFP growth accounted for the entire acceleration in labour productivity growth in Australia and for most of the acceleration in the United States.

Ultimately, Banks (2002) cites policy changes and microeconomic reform as the key drivers of Australia's productivity surge, citing the government's removal of protectionist barriers to world trade and injection of competitive market forces into established domestic industries as generating external competitive pressure on firms, but at the same time giving them the internal flexibility to respond to this pressure. Such practices are credited with fostering flexibility of business models and adaptation of ICTs due to a need to respond to increased competition with a greater focus on innovation. Government business enterprises, for example in the utilities sector, are named as an example of businesses that were exposed to greater commercial incentives and discipline through such reforms, which is subsequently credited for the increase in productivity in that sector in the early 1990s. Manufacturing is cited as an example of a sector that was previously protected from international competition and experienced a large increase in productivity growth as a result. Overall, Banks (2002) emphasizes the role of ICTs as a mechanism for this increased productivity growth, but mainly in the context of this as a response to changes in government policy, which is cited as a catalyst for these developments.

According to Parham (2012), strong labour productivity growth from 1994 to 2000 was a matter of stronger output growth alongside typical growth in hours worked, not a matter of weaker growth in hours worked combined with typical output growth. He attributes much of the productivity surge in the late 1990s to the microeconomic reforms of the 1980s and 1990s, which allowed for stronger output growth with typical labour input growth. He suggests that these reforms brought about direct productivity gains in the form of "better utilization of labour and capital" (that is, a reallocation of labour and capital from less productive activities to more productive activities), as well as indirect productivity gains by facilitating the adoption of ICTs by Australian businesses, as put forward by Banks (2002). Similarly, Parham (2002) pointed to

the competitive forces engendered by microeconomic reform to explain the rapid uptake in ICTs, especially since "there was very little in the way of policy strategy to encourage ICT uptake."

Parham (2002) frames Australia's productivity upsurge in the late 1990s as a 'catch up' after decades of exhibiting slower productivity growth than in other advanced economies. According to Parham, "Australia has enjoyed rapid productivity growth while it has embarked on much-delayed catch-up – a process that many other advanced countries undertook in earlier decades." Indeed, Australia converged toward the United States in terms of labour productivity levels during this period. This 'catch up' was spurred by numerous reforms, which have "released the shackles on the economy and have both forced it and allowed it to modernise." He argues that rapid investment in ICTs was only one component of modernization.

An implication of the 'catch-up' view of the 1990s productivity surge is that productivity growth will slow as Australia approaches the technological/productivity frontier, which may have been validated by the slowdown in productivity growth in the 2000s. However, it is unclear whether the reforms have had a permanent growth-enhancing effect (*i.e.,* an increase in the steady-state growth rate) or if they merely had a one-off level effect (*i.e.*, a one-time boost in Australia's productivity level, followed by a return to the previous steady-state growth rate).

Thus far, we have looked at aggregate-level evidence of the role of microeconomic reform in Australia's 1990s productivity surge. The studies considered have largely relied on descriptive analysis based on trends at the aggregate level, paying attention to the time trends in productivity and their relation to significant policy changes. There are significant weaknesses with this approach, some of which have been briefly touched on above. Parham (2002) succinctly highlights some of the difficulties inherent in assessing the impact of reforms:

> "Formal analysis of the influence of policy reforms on aggregate productivity growth is not straightforward. Capturing the implementation of reform and specifying an appropriate lag structure to allow for adjustment in production structures are particularly difficult. Reforms were not introduced seamlessly or overnight. Implementation has been drawn out, with variations in pace, over 15-20 years. There has been a mixture of industry-specific measures, introduced at different times, and more general measures, many of which were implemented in phases. Some reforms have been interdependent."

In other words, much of the aggregate-level evidence does not provide direct evidence of a link between microeconomic reform and productivity growth. According to Borland (2001), it does not "adequately explain why a series of microeconomic reforms implemented throughout the 1980s and 1990s should suddenly begin to affect productivity from the mid-1990s onwards." In addition, this evidence does not provide any insight regarding whether and to what extent each specific reform improved Australia's productivity performance.

In addition to analyzing the effect of microeconomic reform on productivity at the aggregate level, the Productivity Commission (1999) has conducted a series of detailed case studies at the industry level to look for further evidence of a relationship between reform and the productivity acceleration. In principle, a more disaggregated industry-level analysis makes it easier to examine relationships between productivity growth and the timing of reforms, as it allows researchers to account for the fact that different reforms were implemented in different industries at different times (Productivity Commission, 1999). Furthermore, given the diversity of experiences by industry (with certain industries like wholesale trade, construction, finance and insurance, and transport and storage accounting for much of the 1990s productivity upsurge), the increase in productivity growth may be more appropriately thought of as an industry-based story (or even a firm-based story) instead of an aggregate-level story.

The Productivity Commission's (1999) analysis of specific reforms and the experiences of individual firms and industries has also provided strong evidence of an association between productivity-friendly policy changes and productivity gains in some, but not all, instances. In particular, the Productivity Commission conducted five case studies – two by outside consultants and three by Commission staff – for the following industries: the whitegoods industry; textiles, clothing and footwear (TCF); the automotive industry; Yarra Valley Water; and NSW rail freight. The first three industries are located in the manufacturing sector, while the last two industries are government-sponsored enterprises.

By far, the policies that most affected the three manufacturing industries involved reductions in import protection. However, the degree, pace and timing of trade liberalization has differed by industry. In the 1970s, the manufacturing industries were inward-oriented and among the most insulated industries in Australia in terms of import protection, with 'temporary' quotas introduced in the mid-1970s. First, the quotas were eliminated in whitegoods in 1978, followed by the automotive industry in 1988 and TCF in 1993. Second, tariffs were gradually reduced throughout the 1980s and 1990s, opening these industries up to stronger competition. Tariffs on whitegoods were reduced significantly between 1978 and 1987. At the same time, labour productivity growth in the whitegoods industry increased from 5.3 per cent per year in the 1970s to 8.3 per cent per year in the 1980s. On the basis of the similarity in timing of the increase in productivity and microeconomic reform, the Productivity Commission (1999) argued that these reforms were behind the improvement in labour productivity growth.

Overall, the Productivity Commission (1999) identified microeconomic reform as a major factor affecting the productivity performance in all three manufacturing industries. However, the impact of reforms appears to have been greatest for the whitegoods industry, while the impact of reforms was only "reasonably well established in the case of Automotive […] [and] yet to be established in the case of TCF." This is likely related to the fact that reductions in import protection were implemented sooner, faster and to a greater extent in the whitegoods industry

compared to the automotive industry and TCF. For instance, the degree of import protection was essentially unchanged in the automotive industry and TCF in the 1980s, and the automotive industry and TCF were granted more gradual tariff reductions in the 1980s and 1990s.

Similarly, microeconomic reforms were also found to be the key determinant of an improvement in productivity growth in the two government-sponsored enterprises studied by the Productivity Commission (1999), NSW rail freight and Yarra Valley Water. These reforms increased productivity growth in NSW by "[encouraging] corporate reorganisation to give it a business focus, improve[ing] management and work practices, increasing investment, tackling the problem of overstaffing, rationalisation of some services and facilities, and the development of a customer service focus." In the case of Yarra Valley, increased productive growth was attained through "more efficient use of labour and the implementation of new management information systems."

Although much of the industry-level evidence presented does potentially provide more direct evidence on the impact of reforms, and overcomes some of the difficulties inherent in aggregate-level analysis, it also has its weaknesses. According to Borland (2000), it is difficult to attribute an increase in productivity growth in an industry or firm to a particular reform "in the absence of a comparison with a similar industry where microeconomic reform did not occur." In other words, researchers need to know the counterfactual (*i.e.,* 'What would have happened if this policy was not adopted?') to effectively assess the impact of policy changes.

iii. Alternative Views

Quiggin (2001) has a different take on Australia's productivity growth performance in the 1990s. This stance runs contrary to the mainstream narrative in two ways: 1) he disputes that the productivity growth of the 1990s was extraordinary or unprecedented; and 2) he argues that microeconomic reforms were *not* the main drivers of productivity growth in the 1990s. Quiggin begins with an overview of the literature on the impact of the microeconomic reforms of the 1980s and early 1990s, and finds that most authors and institutions that have addressed the topic have come to the conclusion that the reforms had a positive impact on economic growth, incomes and productivity. Although the exact estimates vary from source to source, what emerges is a consensus that the reforms are seen as leading to at least a 1-2 percentage point increase in real GDP growth over the medium term.

Quiggin (2001) then goes on to outline and rebut some of the claims as to the effects of microeconomic reform. The timing of productivity cycles is presented as being unclear, with individual years making a lot of difference to average productivity growth when placed in different cycles. Quiggin attempts to solve for this by constructing three productivity cycles, roughly in line with three Australian business cycles from 1964/65 to 1973/74, 1981/82 to 1988/89 and 1989/90 to 1999/00. Using this approach the article finds that, in terms of output,

labour productivity and MFP, performance in the 1990s was certainly better than in the 1980s but worse than the era preceding 1973, casting doubt on the notion that productivity growth in the 1990s was somehow out of line with historical results.

The methodology measuring labour productivity growth is further questioned in two ways. First, the exclusion of major yet statistically unreliable sectors, such as the property and business services sector, is presented as further undermining the reliability of labour productivity statistics, as any error or false assumptions about the excluded sectors would be found mirrored in the included sectors: underestimation of labour productivity in such a sector would, for example, show up in the data as an overestimation of labour productivity in other sectors. Using an alternative procedure created by Gruen and Stevens to estimate labour productivity growth in all non-farm sectors yields a 2.2 per cent growth rate in the 1990s, in line with the 1970s expansion, as opposed to the 2.9 per cent growth rate estimated for only the market sector.

Second, Quiggin (2001) argues that much of the productivity gains are a result of the increasing work intensity of Australian workers, either in the form of hidden increased average full-time work hours, decreases in the difference between measured and actual hours worked, or increases in work effort. Quiggin argues that gains to productivity from microeconomic reforms worked by shifting pressures and burdens onto workers in ways that do not show up in official statistics, improve the living standards or economic performance of the country, or provide a sustainable basis for future productivity improvements.

Finally, Quiggin (2001) points to other drivers of the 1990s productivity boom, such as changes in the composition of the labour force with less qualified workers being pushed out or into part-time; technological change; and human capital development, which was vastly improved in the 1980s but on the decline in the 1990s. None of these are presented as sustainable bases for future productivity growth.

Green, Toner and Agarwal (2012) argue that microeconomic reform in the 1980s and 1990s led to a ‘one-off’ improvement in the level of productivity, but not to an increase in the long-term productivity growth rate. This may explain the slowdown in productivity growth in Australia between the late 1990s and the 2000s.

While the privatisation policies of the 1990s encouraged a reduction in labour input per unit of output, it failed to provide incentives for firms to invest in capital, technological upgrades and workplace training. For example, Dolman and Gruen (2012) found that strong MFP growth in utilities in the 1990s was driven by cutting employment and investment following the implementation of reforms making government-sponsored enterprises more business oriented. In contrast, labour productivity growth in utilities was negative between 2000 and 2011. According to Green, Toner and Agarwal (2012), this decline was related “to rapid population growth,

deterioration of capital stock and increases in the ratio of peak to base demand which led to a significant expansion of capital investment and employment in the electricity industry over the 2000s." In other words, the 1990s productivity surge in this industry was due to under-investment in infrastructure, which was "a product of short-term profit maximisation." As a result, these productivity gains were ultimately reversed in the following decade, as the utilities industry had to ramp up investment in infrastructure.

The adoption of ICT systems in the 1990s also increased the level of productivity, but not the rate at which productivity grows in the long run. Major improvements in technology provide an initial increase in productivity growth; however, as the technology is diffused throughout the economy, the rate of productivity growth decreases as its uptake becomes "more saturated." This may explain why the contributions of improvements in ICT systems to productivity decreased in the 2000s due to the fact that these innovations "were less fundamental than those of the previous period."

Green, Toner and Agarwal (2012) argue that the neoclassical policies implemented as solutions to a decline in productivity have proved to be 'solutions in search of a problem' as the productivity slowdown is greatly attributed to declines in specific industries and temporary factors. Moreover, these neoclassical policies have produced increases in productivity during the 1990s that have not been sustained, and have even been reversed in some cases.

Green, Toner and Agarwal (2012) dismiss the notion that labour market deregulation was behind the 1990s productivity boom. In contrast, they suggest that productivity growth is "compatible with a wide range of industrial relations regimes and degrees of government intervention in the economy" and that "the evidence does not support the privileging of simplistic deregulation measures as a strategy for boosting productivity growth."

According to Hancock *et al.* (2007), while neoclassical economics generally suggests that labour market deregulation should improve productivity, there are many theoretical arguments pointing to a positive effect of stronger labour market regulation (associated with stricter labour standards, collective agreements, higher rates of unionization and higher wages) on productivity. For example, stronger labour market regulation and higher wages could incentivize firms to invest in training and new technology. In addition, collective bargaining could lower the transaction costs associated with the negotiation of individual contracts. However, since economic theory can point us in both directions with regard to the effect of labour market deregulation on productivity, they suggest that "we are left without unambiguous predictions as to the effects of industrial relations situations and arrangements."

B. Productivity Slowdown in the 2000s

Since the early 2000s, productivity growth has been considerably slower in Australia. There are many competing explanations for this slowdown in productivity growth.

All of this decline can be traced to the productivity performance of a small number of sectors of the economy. Australia's aggregate productivity growth rate in the market sector declined from 2.95 per cent annually over the 1994-2000 period to 2.04 per cent between 2000 and 2013. Recall that we found that 30.3 per cent of this decline was related to developments in the wholesale trade industry, 26.2 per cent to mining and oil and gas extraction, 19.8 per cent to utilities, 18.6 per cent to "other services", and 17.1 per cent to manufacturing (Table 20). These findings are broadly consistent with those in the literature, although there remains some disagreement as to how much of the productivity slowdown originated from a few sector specific shocks rather than economy-wide factors.

Booming resource prices resulted in large profits for the mining industry. The industry reacted to rising prices and strong growth in demand, particularly from China, by making significant investments in labour and capital inputs. Lags in the return to large scale capital investments of around three years on average in this industry may have explained some of the reduction in productivity, although such effects are only temporary (Productivity Commission, 2009). The more significant source of long-term reductions in productivity in this sector is likely that higher prices drove firms to utilize resource deposits of lower quality or with higher extraction costs. Easily accessible and high-quality natural resources will lead to lower costs and higher productivity than hard-to-reach and low-quality natural resources (Topp and Kulys, 2014; Sharpe and Waslander, 2014), so using a lower quality natural resource base on average will lower productivity.

Relatively sluggish growth in productivity related to the provision of utilities (electricity, gas, and water) has been linked to significant capital expansions. A rising population and increased demand for energy have spurred investments in this industry. Replacement of ageing transmission infrastructure, upgrades to meet government renewable energy targets, and construction of new water infrastructure to ensure water supply in drought conditions have resulted in rising inputs which do not immediately translate into higher output and drag productivity growth down (Eslake and Walsh, 2011; Productivity Commission, 2009).

The decline in productivity growth in wholesale trade likely reflects exhaustion of some of the sources of the sector's strong performance in the 1990s which caused the level of productivity growth to rise, namely adoption of new technologies (such as bar-coding, paperless pick systems, and automatic reordering processes) and increased competition.

Parham (2012) notes the importance of manufacturing in explaining the slump in MFP growth. He suggests that structural pressures within the industry related to the mining boom or the exchange rate may be to blame.

The literature has also suggested that agriculture was an important source of the productivity slowdown (Productivity Commission, 2009; Parham, 2012) because of a period of drought. We do not find the agriculture, forestry, and fishing industry to be a significant factor, most likely because we consider a slightly different time period than these earlier studies. In particular, we consider productivity growth from 2000 to 2013 and the drought ended in 2012.

There seems to be a broad agreement that specific shocks to the above sectors were important contributors to the slowdown, although there is no consensus as to exactly how much they can explain. For example, Eslake and Walsh (2011) estimate that mining and utilities can only explain about 10 per cent of the downturn while our decomposition finds that they can explain 46 per cent and the Productivity Commission (2009) found that mining, utilities, and agriculture, forestry, and fishing could explain 70 per cent. Eslake and Walsh (2011) and D'arcy and Gustafsson (2012) suggest that there was a broader-based slowdown since productivity growth fell considerably even if mining and utilities are excluded. Several hypotheses of the sources of this broader slowdown have been put forth.

Parham (2012) emphasizes that Australia's weaker productivity growth in the 2000s is not the result of slow growth in capital inputs. Both capital and input growth accelerated over the decade, but output growth remained fairly constant. This "unrequited input growth" implies that the source of the problem is poor MFP growth. Indeed, our decomposition of the sources of labour productivity growth into MFP growth, rising capital intensity, and labour composition earlier in this report reveals that a reduction in MFP growth from 1.28 per cent from 1994-2000 to -0.05 per cent from 2000 to 2013 is the culprit. Capital intensity growth actually rose from 1.34 per cent to 1.81 per cent between the two periods, while the contribution of labour composition was almost unchanged.

Unfortunately, it is difficult to identify the specific sources of MFP growth. Parham (2012) suggests that half to three-quarters of the reduction in MFP growth can be explained by what he calls "the usual suspects": compositional shifts (the reallocation of inputs to firms or industries which are less productive), volatility and cyclical effects (lumpy investment in capital, for example), adjustment processes (such as investment in anticipation of future returns or variable capacity utilization), and measurement problems (such as changes in quality or lags between expenditure and output).[37]

[37] Many of the industry-specific factors described above are captured by Parham's usual suspects.

One common suggestion is that the slowdown in productivity reflects a slowdown in the adoption of reforms. It is generally agreed that the reforms in the 1990s were the source of strong productivity growth at the time. Eslake and Walsh (2011) note that Australia fell from a rank of 5th in the Organization for Economic Co-operation and Development's (OECD) integrated product market regulator index in 2003 to 13th in 2008 because its rate of reforms slowed relative to other countries. Eslake and Walsh suggest that Australia has introduced some new regulations related to security (post 9/11) and corporate governance which have reduced productivity, although the magnitude of any impact from these reforms is unclear and likely very limited.

Although some analysts argue that the reforms of the 1990s should have permanently increased Australia's productivity growth rate, much of the improvement was likely temporary while the Australian economy converged to a higher level of productivity following the reforms. Although there may be scope to make similar productivity boosting reforms in future, much of the improvement resulting from the specific reforms in the 1990s has likely been exhausted,

Another argument which has been put forth is that the productivity slowdown is a consequence of Australia's otherwise strong economic performance in the 2000s. Some have suggested that the period of high profitability has caused firms to become complacent, as they can survive and profit even if inefficient (Eslake and Walsh, 2011). Low unemployment rates may also be a factor. Low unemployment suggests that firms are constrained by the availability of workers, which may result in bottlenecks in production and the hiring of less skilled or qualified workers (Productivity Commission, 2009). The negative impact of hiring workers of below-average quality on productivity growth is not necessarily socially undesirable because of the positive effect of employment on economic well-being.

Slower MFP could also suggest that there has been a reduction in technological progress. D'arcy and Gustafsson (2012) entertain the idea that the global technological frontier may not be expanding as rapidly in recent times, because there seems to have been a slowdown in productivity growth in most OECD countries in the 2000s. However, they caution that there could be other common factors which explain this international slowdown, and that a few leading countries (notably, the United States) did not experience the productivity slowdown.

Alternatively, it could be that that new technologies are being developed at the same pace, but Australia is not taking adopting them as quickly. Some have suggested this based on reduced ICT adoption in Australia in the 2000s compared to the 1990s (D'arcy and Gustafsson, 2012; Eslake and Walsh, 2011). Others have suggested that Australian firms clearly remain committed to developing and adopting new technology, as evidenced by trends in business sector investment in R&D (Productivity Commission, 2009).

While the exact causes are not fully understood, it is clear that labour productivity growth slowed in Australia in the 2000s because of an absence of MFP growth (as opposed to less capital deepening). Several industry specific shocks such as the resource boom in mining, the drought in agriculture (and water), and the introduction of new technologies in wholesale trade in the 1990s were clearly significant contributors, along with dwindling effects from the reforms enacted in the 1990s.

Eslake and Walsh (2011) caution that the effects of falling productivity growth have so far largely been masked by Australia's marked improvement in terms of trade as well as high rates of capital investment, but that these factors cannot replace the long-term growth that productivity gains provide. They therefore go on to recommend that productivity-enhancing measures should be taken as to attempt to reverse recent trends.

C. Policy Recommendations

Banks (2012) provides a comprehensive list of steps to boost productivity as recommended by the Productivity Commission that have not been acted upon or have not been fully implemented by governments. He outlines the three main channels by which a government can influence productivity: incentives, capabilities and flexibility.

Incentives, which are described as the 'driver' of innovation and productivity improvements should, according to the recommendations given, seek to promote competition in the workings of the economy, as competition forces businesses to be flexible and adaptive in response to threats from other businesses. The larger the playing field of competition, preferably worldwide, the greater the benefits to productivity, as inefficient businesses will be forced to improve or go out of business. In order to further international competition, Banks proposes abolishing all remaining tariffs on imported goods, limiting anti-dumping actions, and getting rid of public sector procurement preferences, which generally favor local companies that are more inefficient. To promote competition in the domestic market, it is recommended to reform or abolish selective industry support in the form of subsidies or drought support, as well as cutting down, abolishing or reforming regulations that protect firms from competition, for example pharmacy ownership restrictions, taxi licensing, costal shipping protections, bans on parallel book imports, and licensing and regulation on professional services.

Capability policies revolve around improving the human, knowledge, institutional and infrastructure resources available to firms for efficient production. These fall under four categories, namely human capital, innovation, infrastructure and government services. Improvements to human capital are suggested largely within the framework of improving education. This includes improving the quality of teachers and teaching by raising standards, implementing performance reviews, the use of salary differentials in underserved subjects and regions, increased audits of schools as well as improving cooperation between schools and

industry. It is further suggested to focus early childhood education more heavily on low-income individuals for whom the payoff is far greater.

To improve knowledge infrastructure, Banks recommends focusing government resources on basic/strategic research that is broadly applicable as opposed to specific commercial or regional research, as well as evaluating all existing innovation policies for effectiveness and fostering greater cooperation between researchers, firms and the government. Infrastructure reforms proposed by Banks focus heavily on promoting efficiency as the ultimate goal of utility management as well as variable pricing to access services such as roads, water and electricity to better reflect costs, effectively tying revenue to spending.

The flexibility reforms proposed by Banks (2012) centered around reviewing the regulatory apparatus of the state and having better cost-benefit analysis of rules. He proposes regular review of regulations as to their costs and effectiveness, and suggests having regulations developed at arm's length from policy departments so as to increase the likelihood of objective evaluation. Some of the areas in which the report suggests regulations could be streamlined, reformed or eliminated include native vegetation, heritage, renewable energy, developmental approval, occupational licensing, water, waste management and chemicals.

Beyond the scope of incentives, capabilities and flexibility policies the report goes on the recommend a reform of the taxation system so as to decrease the number of taxes, broaden the base of taxation, lower rates, and a focus on broad-based goods and services taxes as opposed to specific and distorting ones.

In a similar vein, Walsh and Estlake (2011) recommend that Australia undertake reforms to its regulatory processes to create a comprehensive model that incorporates both objective cost-benefit analysis and prospective and retrospective reviews of proposed and existing regulations. In some areas, such as the taxis, pharmacies and professional services, it is suggested that deregulation may be necessary to spur improvements in productivity. Tax reform, based around lower corporate income taxes, improved taxation of non-renewable resources, switching to a broad-based taxation system and changing the structure of several taxes, is promoted as a means of substantially increasing productivity. Improvements to delivery of public services, the quality of education, innovation and infrastructure are recommended, but there are few concrete details or suggestions as to how this should be done.

Put simply, Walsh and Estlake (2011) advocate another round of productivity-friendly reforms to boost productivity growth in Australia. Their long list of reforms includes further labour and product market deregulation, removing barriers to foreign direct investment, improvements to education, innovation and infrastructure planning, improving the delivery of public services, and making the tax system less distortionary.

Green, Toner and Agarwal (2012) contest the argument that microeconomic reform has led to sustained productivity gains. Thus, they aim to provide alternatives to traditional neoclassical policies directed at increasing productivity. First, they recommend that governments should boost innovation. One component of creating greater and more successful innovation is collaboration between businesses, research institutions and educational institutions. Another component of successful innovation is derived from government policy. Small- and medium-sized firms would benefit from government incentives to invest in capital, research and development and workforce training initiatives.

Second, Green, Toner and Agarwal (2012) recommend that the Australian government improve management performance of Australian businesses by prioritizing management education and workplace training.

Third, Green, Toner and Agarwal (2012) suggest that workforce skills in Australia are not fully utilised, with almost half of employers considering their employees as over-qualified, and that this under-utilisation of skills presents a "major drain on productivity" and indicates greater potential for Australian businesses to engage in greater performance through utilisation of existing skills. They recommend that the Australian government find ways to encourage the renovation of management practices and the organisational culture of the workplace.

It is difficult to draw lessons from Australia's superior productivity performance and 1990s productivity surge for Canada. Although many studies indicate that the productivity reforms were good for productivity, we simply do not know if they only had a one-off effect or if they led to a sustained increased in Australia's productivity growth rate. In addition, there are good reasons to doubt the standard narrative – the one supported by the Productivity Commission – that microeconomic reform was responsible for the 1990s productivity surge, particularly given that much of the evidence of this causal relationship is largely circumstantial.

Furthermore, the evidence of the impact of reforms on Australia's 1990s productivity surge generally does not distinguish between separate policies but looks at the effect of reforms as a whole. Thus, it is difficult to draw lessons for Canada, as we simply do not know which exact policies had the largest impact on productivity growth in Australia. In theory, it is possible that a few of the policy changes had a large, positive effect on productivity, while others had a negligible (or maybe even negative) effect on productivity.

Since Canada pursued many of the same policy reforms as Australia in the 1980s and 1990s, such as trade liberalization, the loosening of labour and product market regulations and the adoption of a new monetary policy framework, it is unclear where Canadian policymakers should draw lessons from the Australian experience. One plausible area for further deregulation

is the product market, as OECD data suggests that product market regulations are significantly more restrictive in Canada than in Australia. The supply management system for dairy and poultry products is one clear example of where Australia has loosened product market regulations further than Canada.

VII. Australian Government Productivity Commission

This section presents the institutional framework by which public policies affecting productivity are developed in Australia. In this regard, the role of the Australian Productivity Commission is crucial. The history, functions and impact of the Productivity Commission are discussed, as well as the role of the Productivity Commission in the genesis, development and application of productivity-enhancing policies in Australia.

A. History

The Productivity Commission is the arm's length research and advisory body of the Australian government. Its principal role is to inform policymaking on a wide range of economic, social and environmental matters, and to advise the government on policy reforms which are in the long-term interest of Australians. As suggested by its name, a major focus of the Commission is to deepen understanding of productivity in general and Australia's productivity performance in particular, and to find ways to enhance Australia's productivity performance.

The productivity commission, in its current form, was created in 1998. Its roots can be traced back to a series of commissions and boards, dating back to 1921, that advised the Australian government on economic matters that, over time, increased in scope and purview. The first such board was the Tariff Board, created in 1921, whose duty it was to advise the government on trade barriers as well as taxes and subsidies on internationally-traded commodities, with the goal of developing Australian industries.

As the economic consensus around the harm of tariffs and trade barriers solidified, the Tariff Board was eventually replaced by the Industries Assistance Commission (IAC) in 1974. The IAC had a broader mandate than its predecessor that included all forms of government non-regulatory assistance to industry. The IAC's policy objectives were expanded beyond economic development to include the well-being of Australians and the efficient use of productive resources, and the IAC was mandated to focus not on the protection of industries but rather on the interests of consumers and consuming industries and assisting the government in achieving 'structural change' while minimizing social and economic hardship.

In 1989, the Business Regulation Review Unit was incorporated into the IAC to create a new Industry Commission (IC), following the government's stated goal of reducing industry

regulations in the *Industry Commissions Act* of 1989, which also broadened the Commission's purview into analyzing the social and environmental consequences of recommendations in its reports. Consequently, the IC reported on a variety of matters beyond the scope of the IAC's mandate, including operations of statutory marketing corporations, urban planning and transport, public housing, workers compensation, and more. Its reports paved the way for the *National Competition Reform Act 1995*, which created Australia's National Competition Policy, and the subsequent reform of the IC into the Productivity Commission.

The Productivity Commission was created in the *Productivity Commission Act* of 1998, which fused the Industry Commission with the Inter-State Commission, the Bureau of Industry Economics, and the Economic Planning Advisory Commission. After the Productivity Commission was created, its role was once again expanded to focus on achieving a more efficient and productive economy, with the goal of improving living standards. Its purview includes a wide range of fields, examining impediments to improved economic performance in social, environmental and economic fields. Since its inception, the Productivity Commission has produced a variety of reports, issued recommendations on productivity as well as worked with the governments of Australia and New Zealand to improve intra- and international economic ties.

B. Core Functions[38]

The Productivity Commission is an independent research and advisory agency. Its name is a misnomer, as it was created to advise the government on a wide range of topics including economic issues in all sectors of the economy, as well as social and environmental issues. The most important function of the Commission is to undertake public inquiries, conduct research and provide advice on various issues at the request of the government. However, the Commission also conducts research to support its other activities, such as its annual reporting, performance monitoring and benchmarking.

This sub-section is organized into five parts. Each of the first four parts discusses one of the Commission's four main activities. The first part discusses its public inquiries and other research undertaken on request of the government. The second part discusses its self-initiated research and annual reporting on various topics. The third part discusses its performance monitoring activities. The fourth part briefly discusses its investigation of competitive neutrality complaints. The fifth part discusses the policy objectives that the Commission must adhere to when conducting its various activities.

[38] This sub-section draws from Productivity Commission (2014).

i. Public Inquiries and Research Studies Requested by Government

Public Inquiries

Much of the Productivity Commission's work is undertaken in the form of a public inquiry. Public inquiries take into account a wide range of information from many sources and a wide range of opinions from the public. The public is encouraged to make submissions to the Commission regarding the public inquiry, which are normally made freely accessible over the internet. In addition, the public is encouraged to comment on and respond to a draft report in writing and in public hearings. One example of public input is the Commission's examination of Disability Care and Support. During this inquiry, the Commission consulted with 119 organisations and individuals, received 1,062 submissions and conducted 23 days of public hearings involving more than 237 participants. All of the information relevant to this inquiry, including testimony and documentation, is publicly accessible.

There have been public inquiries on a wide range of topics. Some recent examples include: childcare, public infrastructure, resource exploration, climate change adaptation, and the abovementioned inquiry into disability care and support.

Ultimately, the decision as to what to do with the Commission's recommendations is left to the Australian government, which may choose whether or not to adopt or otherwise act on them. Once finished, the Commission's recommendations are posted alongside the final draft of the public inquiry on the Commission's website. According to the Productivity Commission (2014), "in practice more recommendations have been accepted than rejected [and] [e]ven when the Commission's recommendations are not adopted, government policy-making is usually well-served by the information gathering, public participation and scrutiny of different proposals and ideas that the inquiry process stimulates."

Research Studies Commission by Government

In past years, it has become more common for the government to task the Commission with investigating a particular issue or topic. This has had the effect of increasing the number of projects undertaken by the Commission. This normally occurs in fields where the government feels there is a degree of importance, but where a full public inquiry is not necessary.

Recent examples of such commissioned research studies include an assessment of geographic labour mobility in Australia; benchmarking major project development assessment processes against international best practice; a review of regulator engagement with small business; a benchmarking study into regulatory impact analysis; a review of carbon emission policies in key economies; and advice on several issues related to education and training.

ii. Self-Initiated Research and Annual Reporting

Self-Initiated research

In addition to government-commissioned research, the Commission also undertakes a variety of self-initiated research consistent with its mandate of improving Australia's economic performance. The research goals are guided by government statements on policy priorities as well as parliamentary debate and committee work, and include policy recommendations for governments. When compiling such research, the Commission consults and works with a variety of interest groups across Australia. One example of such self-initiated research is a series of reports whose goal it is to present options for future policymakers so as to deal with oncoming problems, for example demographic changes, by examining among other things the possibility of indexing retirement benefits to life expectancy.

Annual Reporting

Under the *Productivity Commission Act 1998*, the Productivity Commission must report annually on its activities, industry and productivity performance, and the effects of industry assistance and regulation. This occurs in the form of the Annual Report series, which includes:

- Annual Report: This provides an overview of the Commission's operations and performance. It also examines the effect of government assistance and regulations on industry performance, as well as providing a broad overview of Australia's productivity, economic, and living standards performance.

- Trade & Assistance Review: This looks at the state of trade policy, developments in assistance to industry and contains the Commission's estimates of the effect of government assistance to various industries.

iii. Performance Monitoring and Benchmarking

The Commission is also involved in various performance monitoring and benchmarking activities, which are briefly outlined below.

- Monitoring the performance of government services: The Commission works with the inter-governmental Steering Committee for the Review of Government Service Provision by providing secretarial services and research capacity in order to evaluate the performance of government services. The findings of the Commission and the Committee are then passed on to the Council of Australian Governments.

- Report on Government Services: The Commission releases an annual Report on Government Services (RoGS) in order to examine health, education, justice, housing, and community services provided by the government in order to evaluate them on the basis of equity, effectiveness and efficiency. The goal of the RoGS is to catalyze improved service delivery by providing various stakeholders, including the providers and recipients of these services with useful and accurate comparative information.

- Overcoming Indigenous Disadvantage Report & Indigenous Expenditure Report: The Commission also cooperates with the Steering Committee to release the regular report on outcomes for indigenous Australians, which seeks to identify the effectiveness of policies and programs relating to Indigenous peoples in Australia. It further releases estimates of expenditures on services provided to indigenous Australians so as to evaluate them for cost-effectiveness and service provision quality.

- National Agreements and National Partnerships: Data on National Agreements and National Partnership Agreements, as relating to performance and results, is also collected and released by the Productivity Commission, which is passed on to the Council of Australian Governments Reform so as to inform their decision-making and evaluation of past and future agreements.

iv. Competitive Neutrality Complaints

The Australian Government Competitive Neutrality Complaints Office (AGCNCO) is a separate unit within the Productivity Commission that is tasked with acting as the government's competitive neutrality complaints body. Individuals, organizations, and government bodies may all submit complaints relating to competitive neutrality, which are then reviewed by the AGCNCO. Following review, advice is submitted to the government via the Office of the Treasurer, who is tasked with responding to the complaints (although they may choose not to).

v. Policy Objectives

While performing these tasks, the Commission is required to keep various overarching policy objectives in mind. These policy objectives are enshrined in the *Productivity Commission Act 1998*. They are briefly outlined below.

- To boost overall economic performance through higher productivity;
- To reduce regulation of industry where it is undesirable for society as a whole;
- To promote the development of industries that are efficient, innovative and competitive;
- To facilitate adjustment to and soften hardships arising from structural changes;

- To recognize the interests of the community as a whole as well as groups who are likely to be affected by its proposals;
- To support employment growth and economic development in regional areas;
- To pay attention to Australia's international obligations and commitments, as well as the progress made by other countries in reducing barriers to trade; and
- To ensure that economic development is ecologically sustainable.

C. The Effect of the Productivity Commission on Policymaking in Australia

The Productivity Commission and its predecessors have been intimately involved in most of the significant reforms adopted in Australia in the past four decades. Notably, the Commission played an important role in the promotion and adoption of microeconomic reforms from the mid-1980s to the late 1990s.

Australia exhibited weak productivity growth in the 1960s, 1970s and 1980s, especially compared to Japan, the United States and other advanced economies in Europe (Parham, 2002). The growing sense of crisis roused public support for successive governments to undertake structural reforms to boost productivity growth and ameliorate other economic ailments. As a result, a series of comprehensive reforms were introduced from the mid-1980s to the late 1990s.

The Productivity Commission and its predecessors were involved in this process of reform. In particular, it played an advisory and research role. For example, it estimated the impact of microeconomic reforms such as the Hilmer report reforms prior to their implementation (Industry Commission, 1995) and after the fact in order to evaluate their effect (Productivity Commission, 1999).

The Commission has assisted reform in numerous ways. Firstly, its well-researched advice on structural reform has provided Government with impartial information that is focused on the long term welfare of the community. As noted, although governments have a large supply of information and advice, much of it may not allow for an unbiased assessment due to its self-serving or narrowly-focused nature.

The Commission's practices also make sure that a thorough analysis of the arguments of vested interests is carried out, diminishing their influence if they appear unwarranted. For example, opponents of National Competition Policy (NCP) that claimed depopulation and other regional issues in Australia were traceable to the policy were analyzed in a 1999 inquiry. The Commission found that long-term factors such as technical change, changes in consumer tastes and lifestyle preferences, along with declining prices for agricultural commodities, were mainly responsible. Moreover, modelling pursued as part of the inquiry implied that NCP was likely to raise net income in all but one region.

Second, the Commission's analysis and recommendations to the government are advantageous since they have been created with extensive public input and feedback on a draft report. This implies that they are more likely to consider all relevant details and are therefore, more likely to be more reliable.

Third, the processes of the Commission such as public submissions, hearings, drafts, and final reports, allow governments the chance to estimate the reactions of the community and interest groups to various approaches to policy. This is important since it has the ability to reduce the likelihood of unexpected responses which can lead to policy reversals. As noted, a prime example of policy reversal is seen in the 25 per cent tariff cut that ultimately led to a protectionist counter-reaction in significant industries that took decades to undo. However, the later liberalization program included approaches that have undergone public testing and have since stuck.

Fourth, the Commission's reports can be used by governments when making the case for policy changes, or in avoiding the pressure to initiate policy measures that may be costly. For example:

- The Commission's modelling in the late 1990s implied that Australia's GDP could be increased by about $16 billion, or $1,600 per household per year (1988 dollars) by wide-spread tariff liberalization and other micro-economic reforms. These figures played an important role in the successful implementation of reforms.

- The Commission's analysis of work practices in the economy's key industries (such as waterfront and construction), revealed productivity depleting arrangements. The studies gave independent support to government and business claims about the vital need for increased reform in those sectors.

Likewise, such in-depth and well-researched information can be used against a government that is reluctant to reform existing policies that are in need of change. Opposition parties from various sides of politics have, in many instances, used the Commission's reports in such a way.

Finally, the Commission's public inquiry processes and reporting can raise awareness of the costs of existing policies and the benefits from productivity-enhancing reforms. While this does not necessarily imply that the broader public would decide to support a given reform, it can help to galvanize or at least inform those individuals who would benefit most from the reform. The small interests who would lose the most from productivity-enhancing policy changes are likely to put up strong opposition to said changes. Even if these changes are good for the broader

community, the public may not be fully aware of the benefits coming from these changes and, in turn, may not support them. By informing the broader public on the costs and benefits of certain policies, the Commission has improved the dialogue on many key issues. For example, according to Banks (2002) "the Commission's detailed analysis of the costs borne by all sectors of the economy as a consequence of inefficiencies in government business enterprises producing utility services helped to marshall business groups behind GBE reform in Australia."

Nevertheless, the reforms that have been advocated have never been implemented without first gaining the favour of political leadership – "a process which has not always delivered, or sometimes taken a considerable time" (Banks, 2002). Indeed, the deep reforms implemented throughout the 1980s and 1990s, many of which were quite unpopular at the time, would have been impossible without strong political leadership. However, the Commission's work is "generally seen as having helped clarify such tradeoffs for governments, as well as engendering a political environment that has been more receptive to reform."

In its role as an advisor and productivity expert for the Australian government, the Productivity Commission will continue to support the adoption of what it sees as productivity-enhancing policy reforms. It will do this in a variety of ways including: by increasing awareness of the importance of productivity and productivity-enhancing policies for improvements in living standards; by improving our understanding of the drivers of productivity growth through research; by recommending and drawing attention to productivity-enhancing policies; and by putting greater emphasis on evidence-based policymaking.

However, there is a significant body of research that believes that the Productivity Commission has been a negative force in Australian society and for the Australian economy. Put simply, the core argument of this literature is that the Productivity Commission has a strong neoliberal bias, which has led to it advocate for what they perceive as damaging policy changes based on inherently flawed assumptions about how the economy operates.

According to Toner (2015), the Productivity Commission has repeatedly pressed Australian governments to apply neoclassical economics to public policy over the past four decades. However, the Commission rarely (if ever) refers to its underlying economic assumption as 'neoclassical' or 'neoliberal', but instead uses the term 'economic theory'. These theories have underpinned their promotion of a wide range of policies, including: reduced assistance to industry, the elimination of import protections for many industries, and the privatisation and commercialization of government-sponsored enterprises. Toner argues that the Productivity Commission "is unaffected either by doubt arising from serious reflection on the outcomes of its policy advice or advances in orthodox economic theory which either undermine or heavily qualify its hardline position." Other authors have similar views concerning the policies

advocated by the Productivity Commission (Purse, Meredith and Guthrie, 2004; Dalitz, 2014; Green, Toner and Agarwal, 2012).

VIII. Conclusion

A. Summary

The objective of this paper has been to explain why Australia outperformed Canada in terms of productivity growth over the last two decades, and particularly since 2000, and to see if there are any lessons for Canada from Australia's performance.

The report noted that both aggregate measures of productivity, for the total economy and for the business/market sector, exhibited somewhat different trends, especially in Australia. Australia's superior productivity performance was more evident in the second measure.

The report has identified six factors, a number of them interrelated, that appear to explain Australia's superior productivity performance.

First, growth accounting estimates show that capital intensity growth contributed significantly more to business sector labour productivity growth in Australia than in Canada over the 1994-2013 period – 1.66 percentage points of the 2.33 per cent labour productivity growth versus 0.94 points of 1.31 per cent growth. Australia's faster pace of capital deepening is explained by much greater growth in capital services in Australia than in Canada (5.28 per cent per year versus 3.82 per cent).

Second, the macro-economic environment and demand conditions have been more favourable in Australia than Canada. Real output advanced at 3.5 per cent per year in the Australian business sector from 1994 to 2013 versus 2.8 per cent in Canada. The major reason for this divergence was faster export growth in Australia. This in turn was linked to faster growth in demand for Australia's exports in its largest market, China, compared to weak growth in domestic demand in the United States, by far the largest market for Canadian exports.

Third, Australia has greatly outperformed Canada on innovation, as proxied by R&D spending. From below Canada's GERD intensity in 1981, Australia exceeded Canada's level in 2006. Australia's performance on BERD was particularly impressive, increasing from 0.23 per cent of GDP in 1981 to 1.19 per cent in 2013. On the other hand Canada's BERD intensity rose only from 0.58 to 0.85 over the same period. Australia's somewhat higher multifactor productivity growth, which reflects the pace of technological progress (among other factors) may be due to this rise in R&D intensity.

Fourth, according to OECD measures of product market regulation, Australia is somewhat more market-oriented than Canada. Both countries have experienced downward trends in the extent of regulation since the 1990s. However, in 2013, Australia had lower scores than Canada for the three general indicators of product market regulation – state control, barriers to entrepreneurship, and barriers to trade and investment. It also had a slightly lower measure of regulation in network sectors, and significantly lower scores for retail trade and professional services. The most prominent difference between Australia and Canada in product market regulation is in the dairy sector. In 2000, Australia abolished milk production quotas, a decision Canada has yet to take.

Fifth, public attitudes to productivity appear to differ between Canada and Australia. In general, the Australian public appears to be better informed about the importance of productivity and more supportive of measures that boost productivity. This may reflect the role that the Australian Productivity Commission, a governmental body, has played in highlighting the productivity issue and championing market-oriented public policies. This organization has likely contributed to Australia's increased market orientation over time. Since the demise of the Economic Council of Canada in 1992, Canada has not had a similar government organization focused on productivity issues.

B. Lessons for Canada from Australia's Productivity Experience

Based on the above discussion of the reasons for Australia's superior productivity performance, a number of potential lessons for Canada emerge. They are highlighted below.

- Australia has greatly benefited from impressive export growth to the huge and fast growing Chinese market. Canada's main market, on the other hand, is the slow growing United States. Given the importance of demand growth for both output and productivity advance, Canada should focus greater attention on emerging markets where there is significant potential for growth in exports.

- Australia has been very successful in increasing its BERD intensity, Canada much less so. Given the great similarities between the two countries, Canada should closely examine the specific public policies that Australia has implemented to boost BERD intensity to determine if any could be adopted in this country.

- Canada's investment relative to Australia has also been shown to be a culprit of low productivity in Canada. Hence, Canada should pursue policies that boost investment.

- Australia has been aggressive in reducing product market regulation, Canada less so. Canada is in the middle of the pack among OECD countries in terms of product regulation, and therefore has room to move to a less restrictive policy regime. The greatest potential for productivity gains in the product market regulation area for Canada is the gradual phasing out of marketing boards, especially for dairy products. The Australian experience offers much insight in this regard.

- Canada lacks a governmental organization that focuses on productivity issues, the role played by the Productivity Commission in Australia. Given the positive implications for government revenues of even small increases in productivity, the costs of such an organization would be very small relative to the benefits. The federal government should establish an organization that would play a role similar to that of Australian Productivity Commission in championing the productivity issue.

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Appendices

Appendix A: Definitions, Concepts and Data Sources

This section discusses the main definitions, concepts and data sources used in the report. First, we review some of the key issues related to productivity analysis and carefully define the productivity measures used in the report. Next, we describe the main data sources used in Section II and III.

A. A Brief Productivity Primer[39]

Productivity can be broadly defined as a measure of how much output is produced per unit of input used. Despite this simple definition, several different productivity measures arise from the use of distinct concepts of output and input, with each of these measures serving different purposes. Here, we explain important topics related to productivity analysis, define the main productivity concepts used throughout the report, and discuss the reasons why productivity measurement is relevant to economic analysis.

i. Gross Output Productivity vs. Value Added Productivity

Since productivity is a ratio of output to inputs used in the production process, different productivity measures can be constructed using: 1) different measures of output; 2) different measures of inputs. In this subsection, we discuss the two most used measures of output: gross output and value added. The next subsection focuses on the choice of one or more inputs when constructing a productivity measure.

Gross output consists of all goods and services produced by an economy, sector, industry or establishment during a certain period of time. Value added, on the other hand, measures the contribution of primary inputs (labour and capital) to the production process. Value added is calculated by deducting intermediate inputs from gross output.

When dealing with the economy as a whole, the value-added approach is the natural choice, because it avoids double counting of intermediate inputs in the aggregate output. In practice, the value-added approach is also the standard choice of most sectoral productivity analysis. Trueblood and Ruttan (1992) argue, however, that when investigating the productivity performance of a particular sector, the focus should be on the total input-output relationship in order to evaluate the overall gains in both primary and intermediate input use. This is particularly true in the case of sectors that experienced significant shifts in the use of inputs through time,

[39] This sub-section is taken from De Avillez (2014).

such as the agricultural sector, where intermediate inputs (feed, fertilizers, pesticides, etc.) play a much more prominent role nowadays than they did in the past.

ii. Partial Productivity Measures vs. Multifactor Productivity

Economists distinguish between partial and multifactor productivity (MFP) measures. Partial productivity measures are a ratio between output and a single input, such as labour or capital. Labour productivity, for example, is commonly defined as the ratio of output to hours worked in a certain activity, while capital productivity is the ratio of output to capital stock.

MFP, in turn, is the ratio between output and *combined* inputs used in the production process. For example, value-added MFP is calculated as the ratio of value added to an index of *combined* labour and capital inputs, while gross-output MFP is calculated as the ratio of gross output to an index of *combined* labour, capital and intermediate inputs. Therefore, MFP growth is a residual, reflecting output growth that is not accounted for by measured input growth. MFP growth can be explained by a number of very different factors, such as improvements in technology and organization, capacity utilization, returns to scale, etc. It also embeds errors due to the mismeasurement of inputs and outputs.

iii. Productivity Growth Rates vs. Productivity Levels

Productivity can be expressed either in growth rates or in levels. The economics literature largely centres on productivity *growth rates*, which refer to changes in *real* variables (as opposed to *nominal* variables). For example, value-added labour productivity growth represents the increase of real GDP per hour worked over time, while gross-output MFP growth measures the increase of real gross output per unit of aggregate labour, capital, and intermediate inputs.

Labour productivity level comparisons are usually done in *nominal* terms, directly capturing the *value* generated by one hour of work (or one worker). Why use nominal labour productivity levels instead of real levels? The main limitation of real levels is that they are a function not only of real growth rates, but also of the nominal level in an *arbitrary* base or reference year. As a consequence, comparisons of real labour productivity levels across industries can lead to vastly different results depending on the state of relative prices in the chosen base or reference year. It is important to keep in mind, however, that changes in nominal productivity levels incorporate not only actual productivity growth, but also price changes.

iv. Productivity Measures Used in this Report

This report discusses three main productivity measures:

- Value-added labour productivity, defined here as real GDP (at basic prices) per hour worked. Alternatively, value-added labour productivity could also have been defined as GDP per worker. However, the hours worked measure provides more accurate estimates of labour input, since it takes into account: 1) changes in the duration of the work week; and 2) shifts from full-time employment to part-time employment.

- Value-added capital productivity, defined here as real GDP (at basic prices) per unit of capital services. Alternatively, value-added capital productivity could also have been defined as real GDP per unit of capital stock. However, the capital services measure provides more accurate estimates of capital input, since it takes into account changes in capital composition.

- Value-added multifactor productivity, defined here as the ratio between real GDP (at basic prices) and an index of *combined* capital and labour input.

v. Why Measure Productivity?

The OECD (2001) highlights five objectives of productivity measurement:

- Measuring technical change: In economics, a production technique can be understood as a particular way of combining inputs (labour, capital and intermediate inputs) and transforming them into output. Technical change can be either disembodied (*e.g.*, new organizational techniques) or embodied (*e.g.*, better quality capital goods). Economists often try to capture the effects of technical change in the economy or in an industry by using some measure of MFP. It is important to keep in mind, however, that the relationship between technical change and MFP is *not* straightforward. First, not all of the effects of technical change are captured by MFP. If inputs are quality adjusted, for instance, MFP will not capture embodied technical change, only disembodied technical change. Second, MFP captures a variety of effects, not only technical change. As a result, it is a mistake to attribute the entirety of MFP growth to technical change.

- Measuring efficiency improvements: From an engineering perspective, a production process is efficient if, for a given technology, it uses the least amount of inputs to produce one unit of output (or alternatively, if it produces the maximum amount of output for a given quantity of inputs). From an economist's perspective, however, allocative efficiency should also be taken into account. In other words, firms will only make changes to their production process if these changes are consistent with profit-maximizing behaviour. The OECD (2001:11) notes that: "when productivity measurement concerns the industry level, efficiency gains can either be due to improved

efficiency in individual establishments that make up the industry or to a shift of production towards more efficient establishments."

- Measuring real cost savings: Closely related to the two objectives discussed above, understanding productivity matters because it allows firms to produce a given amount of output using less input, which implies, *ceteris paribus*, lower costs. In other words, productivity improvements generate real cost savings.

- Measuring improvements in living standards: Productivity is linked to living standards. Most significantly, value-added labour productivity has a direct link to GDP per capita, which is a commonly used measure of living standards.

- Benchmarking production processes: At the firm level, productivity measures can be used to identify distortions and inefficiencies across production units. Such measures are often expressed in physical units. For example, a car company could compare the productivity of two (similar) factories by looking at the number of cars produced per day by each of the factories.

B. Data Sources

The report makes extensive use of official productivity estimates from Statistics Canada's Canadian Productivity Accounts (CPA), which are publicly available on Statistics Canada's website through CANSIM. In particular, the report uses the following sources:

- Table 383-0012 – *Indexes of labour productivity and related variables, by North American Industry Classification System (NAICS), seasonally adjusted, quarterly (index, 2007=100)*: This table provides quarterly labour productivity estimates for Canada from 1981 to 2013. Estimates are available for the total economy and two-digit NAICS industries. In addition to labour productivity, this table also has data on real GDP, number of jobs, average hours worked, hours worked, total compensation, total compensation per hour worked, unit labour costs, and unit labour costs in U.S. dollars. All estimates are provided in index number form.

- 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 unless otherwise noted)*: This table provides annual labour, capital and multifactor productivity estimates for Canada from 1961 to 2013. Estimates are available for the business sector and two-digit business-sector NAICS industries. In addition to productivity, this table also has data on labour input, hours worked, labour composition, capital services, capital stock, capital

composition, combined labour and capital inputs, real GDP, nominal GDP, labour compensation, capital cost, and the contributions of capital intensity and labour composition to labour productivity growth. All estimates are provided in index number form (excluding nominal GDP, labour compensation and capital cost, which are in current dollars).

The report also relies heavily on official productivity estimates from the Australian Bureau of Statistics (ABS), which are accessible on the ABS website. More specifically, the report relies on the following sources:

- Catalogue No. 5204.0 – *Australian System of National Accounts*: This catalogue includes a large share of the estimates generated from Australia's National Accounts Program. Among the tables in this catalogue, the report primarily uses Table 15 – *Labour Productivity and Input, Hours worked and Gross Value Added (GVA) per hour worked - by Industry*: This table provides annual estimates of hours worked and labour productivity for nineteen ANZSIC divisions (which are similar to two-digit NAICS industries) and the total economy from 1979 to 2013. Hours worked and labour productivity estimates are available for the total economy for the entire period. With respect to the ANZSIC divisions, hours worked estimates are available from 1986 to 2013, while labour productivity estimates are available from 1995 to 2013. All estimates are provided in index number form.

- Catalogue No. 5260.0.55.002 – *Estimates of Industry Multifactor Productivity, Australia*: This database provides annual labour, capital and multifactor productivity estimates for Australia from 1973 to 2013. Estimates are available for the market sector, a special twelve-industry aggregate, and sixteen market-sector ANZSIC divisions. In addition to productivity, this database also has data on labour input, hours worked, labour composition, capital services, capital stock, capital composition, combined labour and capital inputs, real GDP, and labour and capital income shares. The database also provides gross-output based MFP estimates, as well as data on gross output, intermediate inputs, combined labour, capital and intermediate inputs, and labour, capital and intermediate inputs cost shares. All estimates are provided in index number form (excluding capital stock, capital composition, labour and capital income shares, and labour, capital and intermediate inputs cost shares, which are either measured in dollars or percentage terms). It is important to note that estimates are available for the entire 1973-2013 period for the special twelve-industry aggregate, while estimates for the market sector and the ANZSIC divisions are only available from 1994 to 2013.

Appendix B: Sources of Labour Productivity Growth[40]

The standard neo-classical framework assumes a production function $F(\cdots)$ that combines inputs and transforms them into output (Y_t). In a value-added framework, inputs include labour (L_t) and capital (K_t), such that:

$$Y_t = A_t F(L_t, K_t) \tag{1}$$

where *A* represents multifactor productivity and *t* is a time subscript. In addition, labour input L_t can be decomposed into hours worked (H_t) and labour quality (QL_t):

$$L_t = H_t * QL_t; \tag{2}$$

and capital intensity (KI_t) can be defined as:

$$KI_t = \frac{K_t}{H_t} \tag{3}$$

A common functional form for $F(\cdots)$ used in growth accounting exercises is the Cobb-Douglas form, such that equation (1) becomes:

$$Y_t = A_t L_t^{\alpha} K_t^{\beta} \tag{4}$$

where the coefficients α and β indicate the output elasticity with respect to labour and capital, respectively.[41]

Since labour productivity is output per hour worked, we divide both sides of (4) by H_t:

$$\frac{Y_t}{H_t} = \frac{A_t L_t^{\alpha} K_t^{\beta} C_t^{\gamma}}{H_t} = \frac{A_t (H_t * QL_t)_t^{\alpha} K_t^{\beta}}{H_t} = A_t QL_t^{\alpha} * \left(\frac{K_t}{H_t}\right)^{\beta} = A_t QL_t^{\alpha} KI_t^{\beta} \tag{5}$$

Assuming constant returns to scale (such that $\alpha + \beta = 1$) and taking the natural logarithms of both sides of equation (5), we have that:

$$lp_t = (y_t - h_t) = a_t + \alpha\, ql_t + \beta(k_t - l_t) \tag{6}$$

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[40] This appendix is an extract from De Avillez (2014).

[41] The output elasticity with respect to a certain input measures the per cent change in output given a one per cent change in that particular input. In other words: how much does output increase if we increase the use of a particular input by one per cent? Intuitively, the coefficients α and β reflect the importance of each input in the production process.

where lower case letters denote the natural logarithm of the original variable (*e.g.*, $y = \ln(Y)$) and lp_t denotes the natural logarithm of labour productivity.

Thus, labour productivity growth from period *t-1* to period *t* can be approximated as:

$$\Delta lp = \Delta(y - l) = \Delta a + \alpha\, \Delta ql + \beta \Delta(k - l) \tag{7}$$

where Δ indicates the change in the variables between periods *t* and *t-1*.

Equation (7) decomposes labour productivity growth into three components: 1) multifactor productivity growth; 2) labour composition growth (weighted by the coefficient α and capital input growth that exceeds hours worked growth (weighted by the coefficient β). It is clear, therefore, that what matters for productivity growth is not capital input growth *per se*, but capital input growth in excess of hours worked growth. In other words, what matters for productivity growth is *capital intensity* growth. Increased capital intensity indicates *capital deepening* (*i.e.*, workers have more capital to work with).

If we assume, additionally, that factor and product markets are perfectly competitive, the coefficients α and β become equal to the (nominal) compensation shares of labour and capital (respectively) in output.

Appendix C: Decomposing Labour Productivity Growth by Sector[42]

To begin we note that at any given point in time

$$\bar{P} \equiv \frac{Q}{H} = \frac{\sum Q_i}{H} = \frac{\sum H_i P_i}{H} = \sum P_i h_i$$

where $\bar{P}$ represents the aggregate productivity level, P_i represents the productivity level in sector i, H represents aggregate hours worked, H_i represents the hours worked in sector i, h_i represents the share of aggregate hours worked in sector i, Q represents aggregate real value added, and Q_i represents real value added in sector i.

Equation (8) says that aggregate labour productivity $\bar{P}$ is equal to the weighted average of labour productivity in each of the sectors that make up the economy. The weight for each sector is its share of the total number of hours worked in the economy. Because we are interested in how shifts in hours worked across sectors affect aggregate labour productivity growth, we must move beyond a single point in time. Equation (9) expresses the absolute change in aggregate labour productivity between periods 0 and 1:

$$\Delta\bar{P} = \sum \Delta P_i h_i^0 + \sum P_i^0 \Delta h_i + \sum \Delta P_i \Delta h_i$$

where $\Delta P = P^1 - P^0$ and the superscripts denote the period. In equation (9), h_i^0 and P_i^0 are respectively the share of total hours worked in sector i and the level of labour productivity in sector i in period 0, expressed in dollars.

In order to obtain economically meaningful sectoral contributions to aggregate productivity growth, we adjust the second term of equation (10) by subtracting the aggregate (or weighted average) level of labour productivity $\bar{P}^0$ from the level of labour productivity in each sector in period 0, P_i^0. In the third term, we subtract the average change in labour productivity $\Delta\bar{P}$ from the change in labour productivity in each sector, ΔP_i. The first adjustment ensures that an increase in the hours share in a sector with a below-average labour productivity level makes a negative contribution to aggregate labour productivity growth. The second adjustment also ensures that an increase in the hours share in a sector with below-average absolute growth in labour productivity makes a negative contribution to aggregate labour productivity growth. The result of these adjustments is equation (10):

[42] This appendix is an extract from Sharpe and Thomson (2010).

$$\Delta\bar{P} = \underbrace{\sum \Delta P_i h_i^0}_{\substack{Within-sector \\ Effect}} + \underbrace{\sum (P_i^0 - \bar{P}^0)\Delta h_i}_{\substack{Reallocation\ Level \\ Effect}} + \underbrace{\sum (\Delta P_i - \Delta\bar{P})\Delta h_i}_{\substack{Reallocation\ Growth \\ Effect}}$$

We are able to subtract $\bar{P}^0$ and $\Delta\bar{P}$ from equation (9) because the terms $\Delta\bar{P}\,\Delta h_i$ and $\bar{P}^0\Delta h_i$ each sum to zero across all sectors, since $\bar{P}^0$ and $\Delta\bar{P}$ are constant and all changes in hours shares Δh_i sum to zero across sectors.

The three terms in equation (10) represent respectively the within-sector, reallocation level, and reallocation growth effects. The within-sector effect captures the change in labour productivity within a sector. The reallocation level effect indicates whether changes in the hours share has favoured sectors with above- or below-average labour productivity levels. The reallocation growth effect is the sum of the product of the absolute change in the share of hours worked and the absolute change in the labour productivity level for each of the sectors. It measures whether an economy is subject to a phenomenon akin to Baumol's cost disease (*i.e.*, the tendency of labour to move towards sectors with relatively small absolute increases in labour productivity). A negative reallocation growth effect at the aggregate level means that labour is moving to sectors with relatively smaller absolute labour productivity increases.

There are some limitations to this analysis. First, the analysis assumes that differences in technological, institutional and market structures across sectors lead to differences in average levels of labour productivity, even if marginal products are the same. It also assumes that when a sector loses or gains labour, the changes in output per hour are equal to the sector's average output per hour worked. Second, these results are sensitive to the level of disaggregation.