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CENTRE FOR THE STUDY OF LIVING STANDARDS

ONTARIO'S PRODUCTIVITY PERFORMANCE, 2000-2012: A DETAILED ANALYSIS

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Ontario's Productivity Performance, 2000-2012: A Detailed Analysis

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Executive Summary

1. Introduction and Main Findings

It is widely recognized that productivity growth is the key driver of long-run increases in living standards. Therefore, a slowdown in productivity growth is a major cause for concern. This has in fact been the situation in Ontario since 2000. After advancing at a 1.9 per cent average annual rate between 1987 and 2000, business sector productivity growth has fallen to 0.5 per cent per year between 2000 and 2012, the second lowest growth rate among the provinces. Indeed, given the relative size of Ontario's economy, the province's weak productivity growth has largely been responsible for Canada's overall poor productivity performance.

The objective of this report is to explain the slowdown in productivity growth in Ontario since 2000. The report provides an overview of the productivity performance of the Ontario economy, with a focus on the 2000-2012 period. The report also examines both the supply-side and demand-side factors that influenced Ontario's productivity performance. The main cause of Ontario's lackluster productivity growth is found to be the deterioration of external demand conditions. The drop in international exports, due to weak demand growth in the United States, loss of cost competitiveness linked to the appreciation of Canadian dollar and increasing international competition, played a direct role in the slowdown in Ontario's productivity growth.

The report is organized into eight sections. The first section introduces the report. The second section discusses the definitions, concepts and data sources used throughout the report. The third section analyzes output and input trends in Ontario. The fourth section examines productivity trends in Ontario and draws a comparison to its past and the rest of Canada. The fifth section looks at the sectoral contributions to business labour productivity growth in Ontario. The sixth section identifies and discusses the supply-side factors influencing productivity growth in Ontario. The seventh section identifies and discusses the demand-side factors. The eighth and ninth sections provide recommendations for public policy and future research and conclude.

2. Labour Productivity Growth Trends and Comparisons

Productivity can be broadly defined as a measure of how much output is produced per unit of input. Despite this simple definition, several different productivity measures arise from the use of distinct concepts of output and input.[1] The main productivity measure used in this

[1] Partial productivity measures are a ratio between output and a single input, such as labour or capital. Multifactor productivity (MFP) 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. Therefore, MFP growth is a residual, reflecting output growth that is not accounted for by measured input growth.

report is *labour productivity*, defined as real GDP (at basic prices) per hour worked.[2] The main findings of the report concerning labour productivity are outlined below.

- Real output growth in Ontario's business sector dropped after 2000. Business sector real output advanced at an average annual rate of 1.2 per cent between 2000 and 2012, less than one-half of the 3.1 per cent growth rate experienced in the 1987-2000 period.

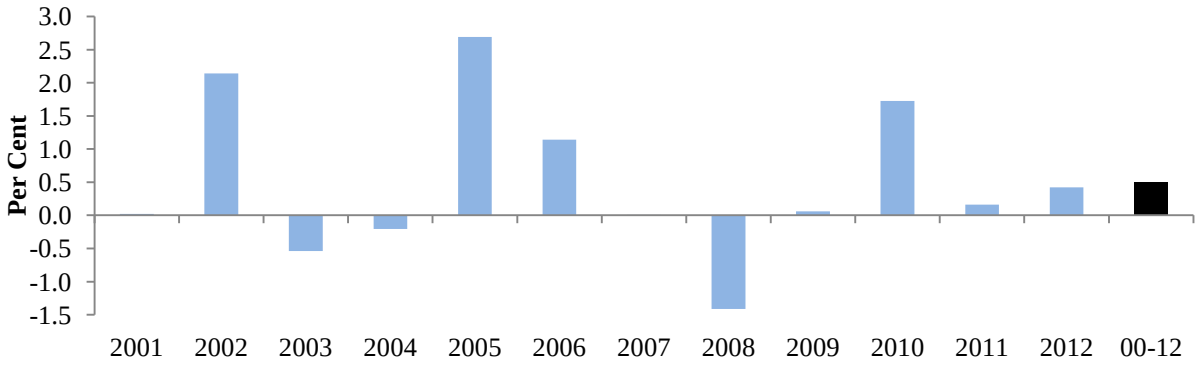
- The large drop in Ontario's business sector output growth after 2000 did not result in a similar decline in employment growth. After advancing at a 1.1 per cent average annual rate between 1987 and 2000, business sector employment growth slowed by only 0.1 percentage point to 1.0 per cent per year in the 2000-2012 period. Similarly, the growth rate for total hours worked in Ontario's business sector slowed from 1.2 per cent per year in 1987-2000 to 0.7 per cent per year in 2000-2012.

- Ontario's labour productivity performance deteriorated between 1987-2000 and 2000-2012. From 1987 to 2000, labour productivity in Ontario's business sector advanced at a 1.9 per cent average annual rate, above the national average (1.8 per cent) and the Canada excluding Ontario average (1.5 per cent). Labour productivity in Ontario's business sector slowed to a 0.5 per cent average annual rate in 2000-2012, below the national average (0.8 per cent) and the Canada excluding Ontario average (1.0 per cent).

- The slowdown in Ontario's labour productivity growth between the 1987-2000 and 2000-2012 periods was responsible for 53.7 per cent of the slowdown in aggregative business sector labour productivity growth in Canada over this period even though Ontario only accounts for 37 per cent of business sector GDP in Canada.

- Labour productivity growth in Ontario's business sector was weak throughout the 2000-2012 period, suggesting that Ontario's poor labour productivity performance cannot be attributed to the 2008-09 recession (Chart I). Labour productivity grew at comparable annual rates of 0.7 and 0.6 per cent in 2000-2007 and 2008-2012, respectively.

Chart I: Labour Productivity in Ontario, Business Sector, Annual and Compound Average Annual Growth Rates, Per Cent, 2000-2012

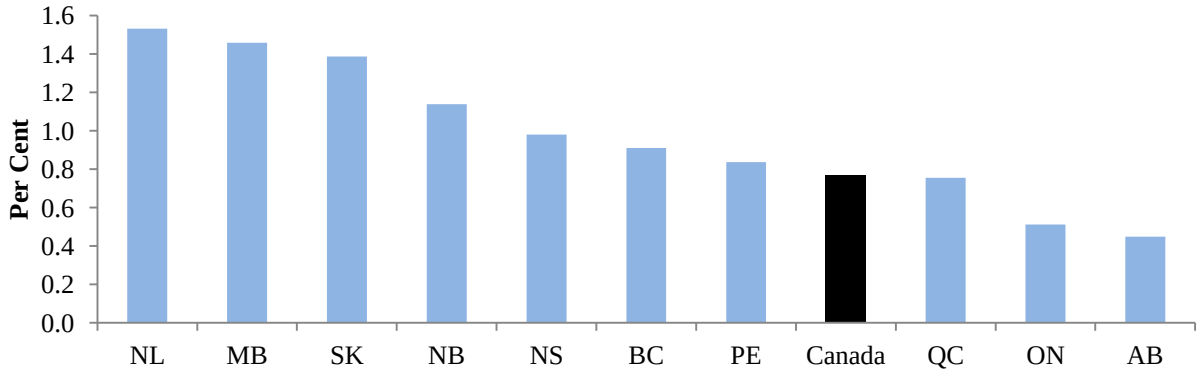


Source: CSLS calculations based on Statistics Canada data

[2] Alternatively, value-added labour productivity can be defined as real GDP (at basic prices) per worker.

- Labour productivity growth in Ontario's business sector in the 2000-2012 period, at 0.5 per cent per year, was the second lowest among the provinces, higher only than Alberta's annual growth rate of 0.4 per cent (Chart II).

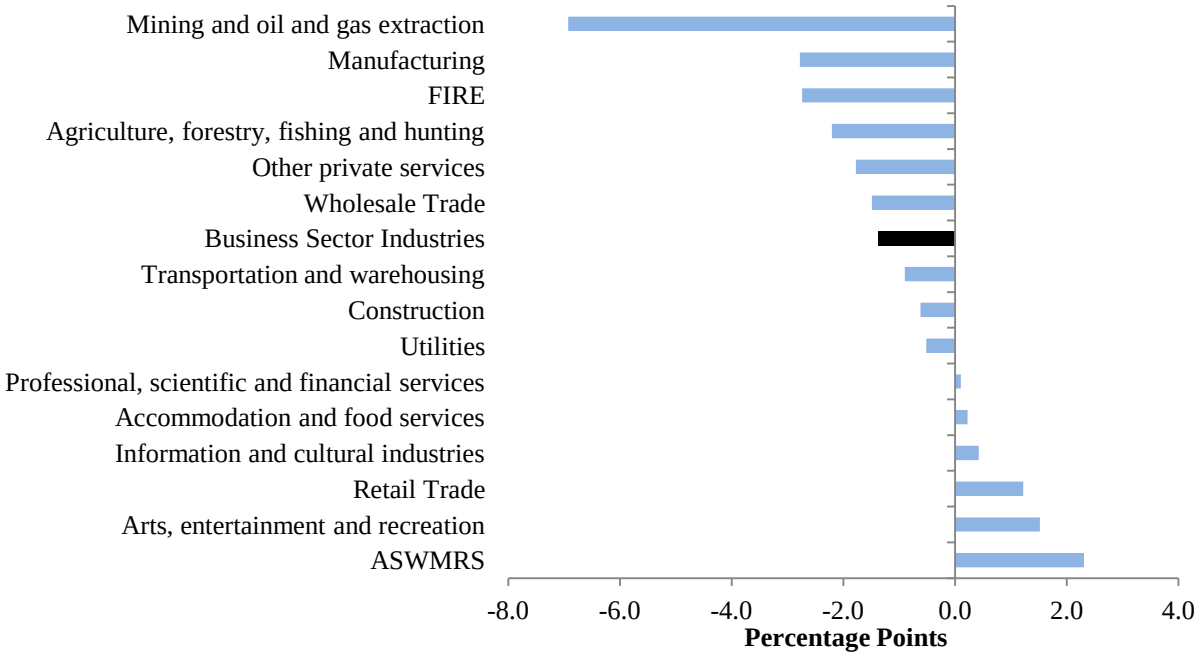
Chart II: Labour Productivity in Canada and the Provinces, Business Sector, Compound Average Annual Growth Rates, Per Cent, 2000-2012



Source: CSLS calculations based on Statistics Canada data

- The deterioration in Ontario's business sector labour productivity growth between the 1987-2000 and 2000-2012 periods was in large part due to a 2.8 percentage point fall in labour productivity growth in Ontario's manufacturing sector from 3.6 per cent per year in 1987-2000 to 0.8 per cent per year in 2000-2012 (Chart III). The fall in productivity growth in finance, insurance, real estate, rental and leasing (FIRE) of 2.7 percentage points was also an important contributor to the slowdown at the aggregate level.

Chart III: Change in Labour Productivity Growth at the Two-digit NAICS Business Sector Industry in Ontario between 1987-2000 and 2000-2012, Percentage Points



Source: CSLS calculations based on Statistics Canada data
Note: FIRE stands for Finance and Insurance and Real Estate and Rental and Leasing; and ASWMRS stands for Administrative and Support, Waste Management and Remediation Services.

- It is well known that Canada's labour productivity gap with the United States has widened significantly (Baldwin and Gu, 2009). This is also true for Ontario. In real terms, labour productivity in Ontario's business sector declined relative to the United States from 88.3 per cent in 1987 to 71.6 per cent in 2012.[3]

- Labour productivity growth in Ontario's business sector was only one-third of the U.S. average over the 2000-2012 period (0.5 per cent versus 1.6 per cent). All eight Great Lake states (Illinois, Indiana, Michigan, New York, Ohio, Minnesota, Pennsylvania, and Wisconsin) had considerably stronger labour productivity growth than Ontario.

- The United States outperformed Ontario in eight of the thirteen industries for which estimates are available for both countries. The most significant productivity differences were in manufacturing, information, mining and logging, and FIRE.

- Each of the eight Great Lake states enjoyed higher labour productivity growth than Ontario in eight industries: mining and logging; manufacturing; transportation and utilities; information; FIRE; professional, scientific and technical services; administrative, support, waste management and remediation services (ASWMRS); and arts, entertainment and recreation.

3. Possible Reasons for Ontario Productivity Shortfall

3.1 Sectoral Contributions

The report breaks down sectoral contributions to aggregate labour productivity growth into three components:

- The **within-sector effect**, which measures the contribution to aggregate productivity growth due solely to the productivity increase experienced by individual sectors;

- The **reallocation level effect**, which captures the contribution to aggregate labour productivity growth from labour movements from sectors with below-average labour productivity levels to sectors with above-average labour productivity levels; and

- The **reallocation growth effect**, which captures the contribution to aggregate labour productivity growth from labour movements from sectors with below-average labour productivity growth to sectors with above-average labour productivity growth.

The report provides a detailed decomposition at the industry level of aggregate labour productivity growth into the above-noted effects in Ontario for 1987-2000 and 2000-2012. The key findings are highlighted below:

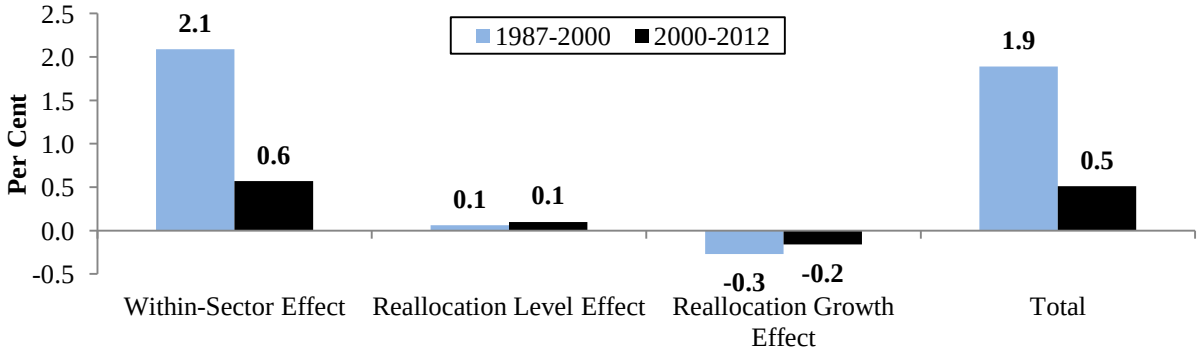
[3] Because of methodological differences between Canada and the United States in the construction of output and employment estimates, and the lack of official purchasing power parity (PPP) estimates at the state and province level for Canada and the United States, these estimates are exploratory in nature and should be interpreted with caution.

- In both periods, the main driver of aggregate productivity growth in Ontario was within-sector effects as the contributions of reallocation effects were relatively small (Chart IV). This means that slower growth within individual sectors rather than unfavourable labour movements drove the aggregate productivity slowdown from 1987-2000 to 2000-2012.

- In the 1987-2000 period, two sectors mostly drove business sector labour productivity growth in Ontario, accounting for nearly 75 per cent of the productivity gains. Manufacturing was the most important contributor (50.9 per cent or 0.96 percentage point), followed by FIRE (23.1 per cent or 0.44 percentage point) (Chart V). In other words, the manufacturing and financial sectors were the main engines of the Ontario economy in terms of generating productivity gains.

- In 2000-2012, the contribution of manufacturing and FIRE to business sector labour productivity growth were much smaller than in 1987-2000, at 0.08 and 0.11 percentage point, respectively. In terms of explaining the 1.4 percentage point slowdown in aggregate labour productivity growth in Ontario between 1987-2000 and 2000-2012, manufacturing accounted for nearly two-thirds (0.86 percentage point) and FIRE accounted for one-quarter (0.33 percentage point).

Chart IV: CSLS Labour Productivity Decomposition, Business Sector, Compound Average Annual Growth Rates, Per Cent, 1987-2000 and 2000-2012



Source: CSLS calculations based on Statistics Canada data

Chart V: Contribution of Manufacturing and FIRE to Business Sector Labour Productivity Growth in Ontario, Percentage Points, 1987-2000, 2000-2012, and 1987-2000 to 2000-2012

Source: CSLS calculations based on Statistics Canada data

3.2 Growth Accounting[4]

The report also analyzes aggregate labour productivity growth through a growth accounting framework, which allows us to decompose labour productivity growth into three components: capital intensity (the capital/labour ratio); labour composition (labour quality); and multifactor productivity (MFP). The key findings are highlighted below:

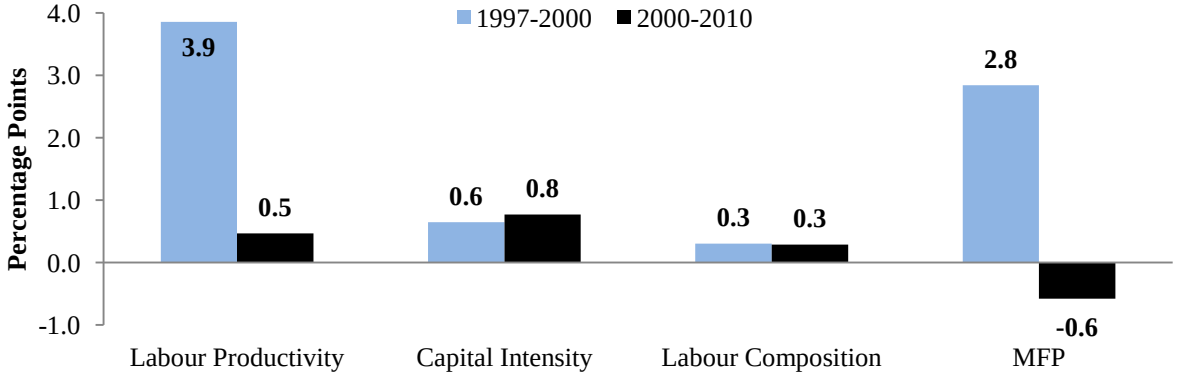
- From 2000 to 2010, capital intensity growth contributed 0.8 percentage point to Ontario's business sector labour productivity growth and labour composition contributed 0.3 percentage point. These positive contributions were offset by the -0.6 percentage point contribution of MFP.

- The decline in annual labour productivity growth rate after 2000 was entirely due to a decrease in the contribution of MFP growth to labour productivity growth (Chart VI).

- MFP growth in the Ontario business sector fell to an average annual rate of 0.6 per cent between 2000 and 2010, ranking Ontario eighth among the provinces in MFP growth. In the 1997-2000 period, MFP advanced at a robust 2.8 per cent in the Ontario business sector, the third fastest of all provinces. Ontario experienced the second largest fall in MFP growth among all provinces between these periods.

The importance of MFP growth in 1997-2000 relative to 2000-2010 reflects the different macroeconomic conditions of the two periods. When output growth is strong (*e.g.*, 1997-2000), labour productivity growth is also strong. When the contributions from capital intensity and labour composition are relatively stable, the source of increased labour productivity is allocated to the residual, namely the difference between labour productivity growth and the contributions from labour composition and capital intensity (*i.e.*, MFP growth).

Chart VI: Percentage Point Contributions to Labour Productivity Growth, Business Sector, Ontario, 1997-2000 and 2000-2010



Source: CSLS calculations based on Statistics Canada data

[4] The data discussed in this section are only available for a shorter period (1997-2010). Thus, unlike the other sections, we exclude the 1987-96 and 2011-12 periods from our analysis in this section.

3.3 Supply- and Demand-side Factors

In the long run, productivity is determined by the supply-side potential of the economy and is largely driven by technological development. A slower pace of technical change will reduce potential productivity growth. The availability of capital and skills are also factors affecting the supply-side productive capacity of the economy. But the long-run productivity potential of an economy cannot be realized without sufficient aggregate demand to ensure that the productive capacity is utilized. Thus, buoyant demand conditions are essential for robust productivity growth.

From this perspective, both supply-side and demand-side factors may have contributed to the slowdown in Ontario's productivity growth after 2000. Regarding the former, the rate of increase in the potential growth of the Ontario economy may have decelerated due to negative developments related to the supply-side drivers of productivity, such as innovation, skills and investment. Regarding the latter, the rate of demand growth may have fallen off due to external or domestic factors so that industries cannot make full use of their productive potential.

3.3.1 Supply-side Factors

After examining supply-side variables, the report concludes that Ontario has created an environment that is favourable for productivity growth. Despite certain weaknesses (*e.g.*, business expenditures on research and development (BERD) and non-residential investment), Ontario fares well relative to the rest of Canada in terms of public investment, information and communication technology (ICT) investment, human capital accumulation, higher education expenditures on research and development (HERD) growth, government expenditures on research and development (GOVERD) growth, and the adoption of innovations.

Ontario's Strengths

- Ontario is the province with the most educated population, as defined by the share of the population with a university degree and by the average number of years of educational attainment. It also has the second lowest high school non-completion rate and the third highest university enrolment rate among the provinces.

- Ontario is above the Canadian average in terms of the share of the labour force participating in apprenticeship programs. Ontario experienced a 7.2 percentage point increase in the growth of the number of apprentices from 1991-2000 to 2000-2011, larger than the increase for the rest of Canada.

- Ontario surpassed the OECD and Canadian averages in terms of reading and science sections of Programme for International Student Assessment (PISA). In terms of the mathematics section of PISA, Ontario was higher than the OECD average but was slightly below the Canadian average.

- Ontario fared relatively well, being higher than the Canadian average, with respect to growth in science, technology, engineering and mathematics (STEM) program enrolment

and STEM graduates as well as STEM program enrolment and STEM graduates as a share of total enrolment and total graduates.

- Ontario experienced a strong upward trend in HERD intensity to 0.76 per cent of GDP in 2011 from 0.52 per cent in 2000 and 0.23 per cent in 1981. Ontario's HERD intensity rose from 98 per cent of the national average in 1981 to 115 per cent in 2011.

- In 2011, GOVERD intensity in Ontario was 0.57 per cent, up from 0.45 per cent in 2000 and 0.36 per cent in 1981. Ontario's GOVERD intensity rose from 103 per cent of the national average in 1981 to 127 per cent in 2011.

- In 2010-2012, the percentage of enterprises that deployed new innovation was 71.2 per cent in Ontario, well above the rate for the rest of Canada. In addition, between the 2007-2009 and 2010-2012 periods, the percentage of enterprises in Ontario that deployed new innovations rose, while it fell nationally.

- Over the 1981-2012 period, Ontario's business sector dedicated a greater share of GDP to ICT investment than any other province. In 2012, 2.6 per cent of Ontario's GDP was devoted to ICT investment, compared to 2.0 per cent for the rest of Canada.

- In recent years, Ontario's public investment as a share of GDP has risen and is higher than the national average. More specifically, between 1994 and 2010, Ontario's public investment as a share of GDP rose from 83 to 104 per cent of the Canadian average.

Ontario's Weaknesses

- The BERD growth rate in Ontario has been very weak since 2000, the slowest of all the provinces due to a 23.9 per cent fall in manufacturing. Even though BERD growth in Ontario is the lowest of all provinces, its expenditure as share of nominal GDP is second highest in Canada which indicates Ontario's businesses are still investing heavily in research and development, while other provinces are trying to catch-up.

- In 2012, there was a 6.8 percentage point gap in the share of non-residential investment in GDP between Ontario and the rest of Canada. Ontario had the second lowest share of non-residential investment as a share of GDP among the provinces at 8.8 per cent. However, this large gap is largely attributable to a gap in structures, which reflects the very large investment by the resource sector in the western provinces and Newfoundland and Labrador, and should not necessarily be seen as a weakness of the Ontario economy.

3.3.2 Demand-side Factors

The key findings related to the slowdown in real output growth in Ontario between 1981-2000 and 2000-2012 are highlighted below:

- The most important stylized fact in the past three decades affecting the Ontario economy has been the near halving of trend *total economy* output growth between the 1981-2000

and 2000-2012 periods, from 3.1 to 1.6 per cent per year. In contrast to Ontario, the rest of Canada saw only a 0.3 percentage point fall in real output growth.

- The strength of the Ontario economy in the 1980s and 1990s, as manifested by its superior real GDP growth rate compared to the rest of Canada (3.1 per cent per year versus 2.5 per cent per year) was largely fuelled by exports. From 1981 to 2000, international exports grew at an average annual rate of 8.3 per cent and made a positive contribution of 79.3 per cent to Ontario's real output growth. From 17.8 per cent of GDP in 1981, international exports rose to 44.9 per cent in 2000.

- Ontario's international exports declined by an average annual rate of 0.5 per cent in real terms in 2000-2012. As a share of GDP, exports to countries fell from 44.9 per cent in 2000 to 35.0 per cent in 2012. After accounting for almost 80 per cent of output growth in 1981-2000, exports made a negative contribution of 11.3 per cent in 2000-2012.

- International export growth for Ontario was significantly lower for eight of eleven merchandise export categories in 2000-2012 relative to 1988-2000.[5] Most significantly, exports of motor vehicles and parts decreased 3.0 per cent per year in 2000-2012, down from an annual increase of 9.0 per cent in 1988-2000.

- A slowdown in investment growth also contributed to the slowdown in Ontario's output growth after 2000. Business investment advanced at a strong 4.1 per cent per year in Ontario from 1981 to 2000 because strong demand for exports required large investments in productive capacity. After 2000, investment growth in Ontario fell to 2.6 per cent per year, in part because of a lower need for productive capacity for exports.

3.3.3 What Explains the Decline in International Export Growth?

The slowdown in output growth in the Ontario economy after 2000 was largely due to the decline in international export growth. The key findings related to the slowdown in international export growth between 1981-2000 and 2000-2012 are highlighted below:

- Weak demand growth of the U.S. economy, both before and especially following the 2008 global financial crisis, is largely to blame. Between 1981 and 2000, final domestic demand in the United States grew at a compounded annual rate of 3.6 per cent, but fell to 1.7 per cent from 2000 to 2012. Since Ontario's major international export destination is the United States, accounting for 79.2 per cent of Ontario's international exports in 2012 (Gauthier, 2013), the weakness of the U.S. economy is one of the main contributors to the decline in Ontario's international exports.

- Canada also saw a decline in its share of the U.S. import market as the share of emerging markets (such as China, Mexico and South Korea) increased significantly. For example, U.S. imports from China grew at a compound annual rate of 12.8 per cent, from $100 billion (U.S. current dollars) in 2000 to $425 billion in 2012, while U.S. imports from

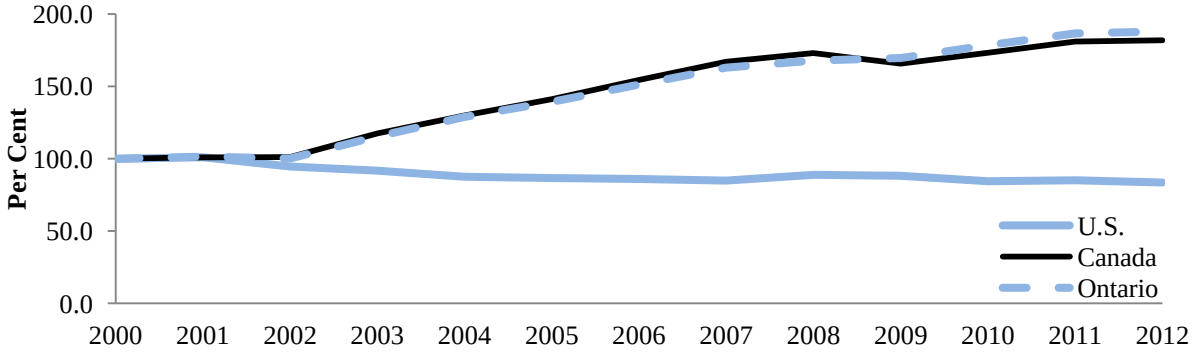
[5] Data are not available by merchandise exports category for 1981-1987.

Canada grew at a compound annual rate of 2.9 per cent, from $229 billion (U.S. current dollars) in 2000 to $324 billion in 2012.

- The loss of cost competitiveness (as measured by unit labour cost) also contributed to the decline in Ontario's international exports (Chart VII).[6] The gains made by emerging markets in the U.S. import share at the expense of Canada may be linked to the lack of cost competitiveness of Canadian exports.

- Between 2000 and 2012, Ontario and Canada's manufacturing unit labour cost (ULC) have risen 88.0 and 81.8 per cent respectively, which is in stark contrast to the United States where ULC has fallen 16.4 per cent. This represents a very significant decline in Ontario and Canada's cost competitiveness.

Chart VII: Unit Labour Cost (U.S. Dollars), Manufacturing Sector, Canada, Ontario and United States, 2000-2012 (Index, 2000=100)



Source: CSLS calculations based on data from Statistics Canada and The Conference Board
Note: Data for Canada were calculated based on data from the Conference Board, and differ from calculations based on data from Statistics Canada

- About half of the loss in Ontario's cost competitiveness was due to appreciation of the Canadian dollar from $0.69 U.S. in 2000 to about parity in 2012. Ontario's relative deterioration in labour productivity growth compared to the U.S. accounted for a further 56 per cent of the loss in Ontario's cost competitiveness (Chart VIII).

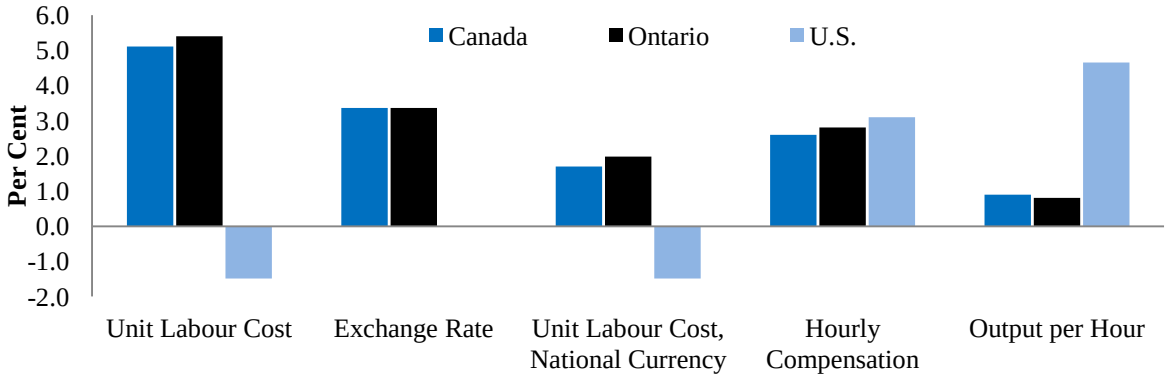
- As discussed earlier, productivity growth is a function of output growth, which in turn is affected by both demand conditions in foreign markets and exchange rates. A slump in the United States and an appreciation of the Canadian dollar can then reduce productivity growth by reducing output growth. It therefore seems likely that the total effect of an exchange rate appreciation on competitiveness is underestimated in a simple decomposition of changes in ULC, while the productivity effect is overestimated.

- The empirical literature suggests that the appreciation of the Canadian dollar has been due to both a weak U.S. dollar and soaring global commodity prices, most notably crude

[6] Unit labour cost (ULC) in a common currency, defined as the average cost of labour per unit of output, is a key metric in measuring the cost competitiveness of an economy. Changes in the cost competitiveness can be broken down into two effects: (i) an exchange rate effect; and (ii) changes in ULC in the domestic currency. The latter effect can be decomposed into: (i) changes in hourly labour compensation; and (ii) changes in labour productivity.

oil. For example, former Bank of Canada Governor Mark Carney estimated that one-half of the appreciation of the Canada-U.S. exchange was due to the rise of global commodity prices, and about 40 per cent to the depreciation of the U.S. dollar against other major currencies (Carney, 2012).

Chart VIII: Unit Labour Cost Growth (U.S. Dollars), Manufacturing Sector, Canada, Ontario, and the U.S., 2000-2012



Source: CSLS calculations based on data from Statistics Canada and The Conference Board
Note: Data for Canada were calculated based on data from the Conference Board, and differ from calculations based on data from Statistics Canada

- Research based on firm-level data by Statistics Canada has found that the manufacturing sector underwent considerable restructuring as a result of a change in economic conditions and an increase in excess capacity after 2000, which negatively contributed to productivity growth (Baldwin, Gu and Yan, 2013). A significant decline in productivity growth was due to lower capacity utilization at the plant level. The appreciation of the dollar led to the exit of many large exporters who were highly productive.

4. Government Policies and Private Sector Actions to Lead to Better Productivity Growth

The main cause of Ontario's lackluster productivity growth has been the deterioration in external demand conditions. Since 2000, the decline in international exports, due to weak demand growth in the United States, loss of cost competitiveness linked to the appreciation of Canadian dollar, and increasing international competition, played a direct role in the slowdown in Ontario's productivity growth. Ontario's poor productivity performance cannot be simply attributed to public policy. Indeed, without the measures put in place by the Ontario government, it is likely that the province's productivity performance would have been even worse.

The revival of productivity growth in Ontario requires the resurgence of the Ontario economy. This depends on both external and internal factors largely beyond the government's control. International demand for Ontario's exports depends on the exchange rate and domestic demand conditions in importing countries. Exports are also determined by the ability of the Ontario private sector to produce and market high quality goods and services for which there is international demand.

The Ontario government has done much policy development in the past to foster productivity growth and the resulting policy framework is in general very good. There is no silver bullet that the Ontario government could take to supercharge productivity growth. However, more effective policies are always possible and should be strived for. Incremental (and possibly non-incremental) change to improve the suite of productivity-related policies run by the Ontario government is needed. Current policies and programs should always be monitored for opportunities for positive change.

Public policy does have an important role to play in contributing to and facilitating business sector productivity growth through the provision of public infrastructure, a highly skilled workforce, and incentives to invest and innovate through taxation and the regulatory environment. Indeed, public policy actions have implications for productivity growth. Appropriate public policy is a necessary but not a sufficient condition for productivity growth.

The report identifies six elements for a strategy to boost productivity growth in Ontario:

- Recognition of the importance of robust demand to stimulate productivity advance;
- Facilitation of the reallocation of resources from low-productivity activities to high-productivity activities (*e.g.*, through the removal of barriers to mobility, whether inter-regional, inter-industry or inter-occupational);
- Encouragement of the substitution of capital for labour in the production process by incenting firms to invest in capital through a reduction in the cost of capital relative to labour (*e.g.*, through lower taxes and subsidies for capital investment);
- Fostering technological diffusion and the adoption of best-practice techniques, especially by medium and small enterprises;
- Investment in public infrastructure, both as a means to increase the supply-side capacity of the economy and to boost demand when an output gap exists; and
- Continued emphasis on human capital development at all levels to make the workforce more productive.

5. Productivity Research Agenda, Particularly Focusing on Firm-level Research

Further productivity research in Canada should produce detailed studies of the productivity performance in all provinces and in all major sectors. These studies can identify the drivers of productivity growth in the different industries in each provincial economy, enabling policy makers to better craft policies that are suitable for productivity improvements.

A case can also be made that a better understanding of the firm-level behaviour can shed light on the causes of poor productivity performance and point to policies that can address this issue. The greater availability of firm-level micro-data from Statistics Canada now makes such

research possible to a wider range of researchers. The role of the potential influential factors at the firm level, such as firm size and scale, and managerial skills and experience, requires further research to determine their impact on productivity growth.

Ontario's Productivity Performance, 2000-2012: A Detailed Analysis

1. Introduction[7]

It is widely recognized that productivity growth is the key driver of long-run increases in living standards. Thus, a slowdown in productivity growth is a major cause for concern. This has in fact been the situation in Ontario since 2000. After advancing at an average annual rate of 1.9 per cent in the 1987-2000 period, business sector productivity growth fell to 0.5 per cent per year in the 2000-2012 period, the second lowest among the ten provinces. Indeed, given the relative size of the Ontario economy, Ontario's weak productivity performance has largely been responsible for Canada's poor performance. With declining labour force growth as baby boomers retire, productivity will assume increasing importance as a source of output growth. This makes the revival of Ontario's productivity growth a priority for economic policy.

The main objective of this report is to understand the productivity trends in Ontario between 2000 and 2012 and examine how these productivity trends are driven by changes in various supply and demand factors. Even though the main period of focus for this report is the 2000-2012 period, a comparison will be made to the past whenever it is possible. Identifying and understanding the behavior of the main drivers of productivity growth is necessary to develop a policy environment that fosters productivity growth.

The report provides a comprehensive overview of the productivity performance of the Ontario economy, with a focus on the 2000-2012 period. It presents estimates of labour, capital and multifactor productivity for the business sector, two-digit business sector industries and three-digit manufacturing industries, as well as sectoral contributions to aggregate labour productivity growth. The report also analyzes the supply-side and demand-side factors that influenced Ontario's productivity performance.

The report is organized into eight sections. Section I introduces this report. Section II discusses the definitions, concepts and data sources used in this report. Section III analyzes output and input trends in Ontario. Section IV examines productivity trends in Ontario and draws a comparison to its past and the rest of Canada. Section V looks at the sectoral contributions to business labour productivity growth in Ontario. Section VI identifies and discusses the supply-side factors influencing productivity growth in Ontario, while Section VII identifies and discusses the demand-side factors. Section VIII provides recommendations for public policy and discusses areas of future research. Section IX concludes this report.

[7] This report was written by Andrew Sharpe with contributions from Kevin Fung and Evan Capeluck. The CSLS would like to thank Ontario Ministry of Finance officials – in particular, Qaizar Hussain, David West, and Tony Stillo – for comments on an earlier draft. If you have any questions or comments, contact Andrew Sharpe at andrew.sharpe@csls.ca.

2. Definitions, Concepts and Data Source

This section discusses the main definitions, concepts and data sources used in this report. First, we discuss key issues related to productivity analysis and carefully define the productivity measures used in this report. Second, we describe the data sources used in this report.

2.1. Productivity Primer

Productivity can be broadly defined as a measure of how much output is produced per unit of input. 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.

2.1.1 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 between output and hours worked or employment in a certain activity, while capital productivity is the ratio of output to capital stock or capital services.

MFP 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. 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 and returns to scale. It also embeds errors due to the mismeasurement of inputs and outputs.

2.1.2 Productivity Measures Used in this Report

The main productivity measure used in this report is v*alue-added labour productivity*, defined as real GDP (at basic prices) per hour worked. Alternatively, value-added labour productivity could also have been defined as real GDP (at basic prices) per worker. However, the hours worked measure provides more accurate estimates of labour input, since it takes into account: (i) changes in the duration of the work week; and (ii) shifts from full-time employment to part-time employment.

2.2 Data Sources

For this report, the CSLS constructed the Ontario Productivity Database. This section discusses the data sources used to create the Ontario Productivity Database.

The Ontario Productivity Database makes extensive use of official productivity estimates from Statistics Canada's Canadian Productivity Accounts (CPA). We made use of the following CPA programs:[8]

- **Labour Productivity Measures – Provinces and Territories (Annual):** This program provides annual labour productivity estimates for Canada, the provinces, and the territories from 2007 to 2012. Estimates are available for the total economy, business sector and two-digit NAICS sectors. CANSIM table 383-0029 provides the main estimates for this program, and CANSIM tables 383-0030 and 383-0031 provide detailed labour estimates.

- **Productivity Measures and Related Variables – National and Provincial (Annual):** This program provides annual labour, capital and multifactor productivity estimates for Canada and the provinces. Labour and multifactor productivity estimates are available both on a value-added basis and on a gross-output basis. Estimates for Canada are available from 1961 to 2011 (or 2008, for three-digit NAICS subsectors), while provincial estimates are available from 1997 to 2010. National estimates cover the business sector, two-digit NAICS sectors, and three-digit NAICS sectors, but provincial estimates cover only the business sector and two-digit NAICS sectors. In addition to productivity estimates, the program has estimates for real GDP, nominal GDP, labour input, hours worked, labour composition, capital input, combined labour and capital input, labour compensation, capital cost, and many other variables. Provincial productivity estimates are provided in CANSIM table 383-0026, while national productivity estimates are provided in CANSIM tables 383-0021 and 383-0022. Detailed estimates for labour and capital inputs are available in CANSIM tables 383-0024 and 383-0025, respectively.

Many official series for Ontario produced by Statistics Canada only go back to 1997 and in some cases 2007. Given the importance of having as long an historical series as possible for Ontario productivity estimates, the CSLS has pushed back a number of series to 1987 based on different methods and assumptions. The procedures used are summarized below.

- Business sector real GDP data at the two-digit NAICS level in 2007 chained dollars were linked to growth rates from old CPA data series in 2002 chained dollars to extend our figures from 2007 to 1997. To further extend the data to 1987, growth rates were linked to another old CPA data series in 1997 chained dollars from 1997 to 1987.

- At the three-digit and four-digit level, GDP data in 2007 chained dollars was constructed in a similar fashion as described for the two-digit NAICS level GDP data.

- The total business sector GDP data for 1981 to 1986 were calculated by linking the growth rates to the total economy real GDP data from the National Accounts series.

[8] The CPA includes a third program, giving quarterly national labour productivity data, which was not used in the writing of this report.

- GDP data between 1987 and 1996 for the transportation and warehousing, and information and cultural industries sectors were suppressed by Statistics Canada for privacy reasons. The CSLS constructed the estimates for these two sectors by extrapolating backward for the suppressed sectors and aggregating them with unsuppressed data of other subsectors.

- With respect to hours worked, the data at the two-digit NAICS level were available between 1997 and 2012. Estimates between 1987 and 1996 were constructed by linking the growth rates to employment data from the LFS. For the three-digit and four-digit NAICS level, hours worked data were available between 1997 and 2012.

- Data for labour productivity levels estimates between 1987 and 1996 at the three-digit and four-digit NAICS level were constructed by linking the growth rates to the CSLS labour productivity database where labour productivity estimates were calculated in 1997 constant dollars per hour worked.

For comparisons with the United States, GDP data in 2009 chained dollars were accessed from the Bureau of Economic Analysis. Due to the unavailability of hours worked data at the business sector level, employment numbers were used from the Current Employment Statistics (CES) database at the Bureau of Labour Statistics.

3. An Overview of Ontario's Economy

Productivity developments cannot be analyzed in a vacuum. Consequently, an understanding of labour productivity requires an appreciation of the overall economic context. This section provides an overview of developments in the Ontario economy, with a focus on trends in real output, labour input, and capital input. The focus is the 2000-2012 period, with comparisons made to developments in the two previous decades.

3.1 Real GDP

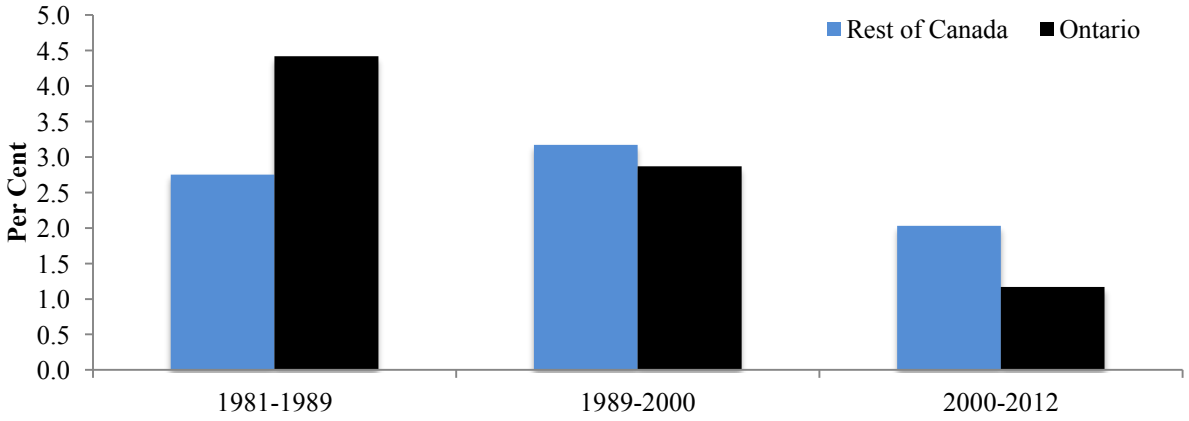
3.1.1 Business Sector

From 1981 to 1989, real GDP in Ontario's business sector grew at a compound annual rate of 4.42 per cent, which was much greater than growth in the rest of Canada (ROC), at 2.75 per cent per year (Chart 1). This faster growth resulted in Ontario's share of Canada's business sector nominal GDP rising from 36.9 per cent in 1981 to 43.7 per cent in 1989 (Chart 2).

Between 1989 and 2000, real GDP growth in the ROC caught up and slightly surpassed that in Ontario (3.17 per cent versus 2.87 per cent). As a result, Ontario's share of national business sector output fell slightly by 2000. More specifically, it fell sharply in the first half of the 1990s and then rose again in the second half of the decade.

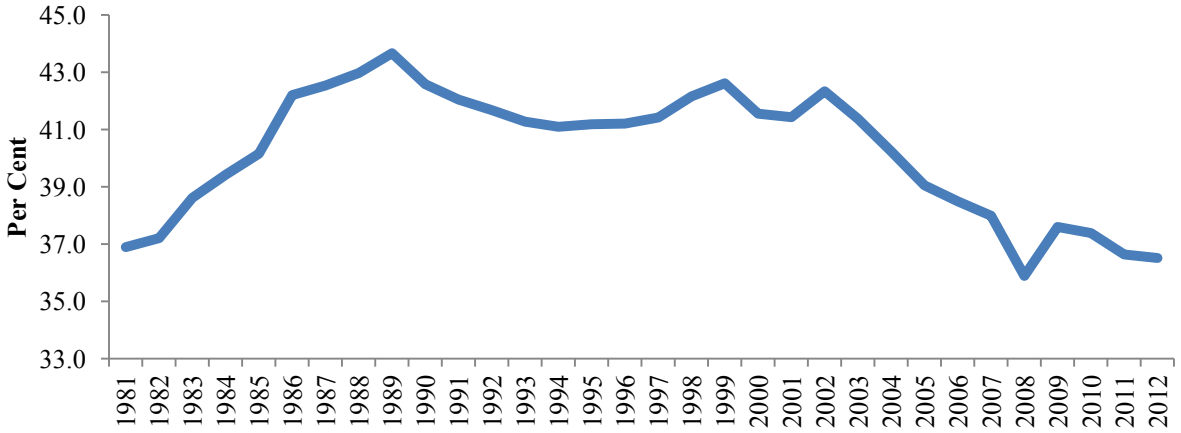
Between 2000 and 2012, business sector output growth fell 1.71 percentage points to 1.17 per cent in Ontario and 1.14 percentage points to 2.03 per cent in the ROC. With this slower growth, Ontario's share of Canada's business sector GDP fell to 36.5 per cent by 2012.

Chart 1: Compound Annual Growth in Real GDP, Business Sector, Ontario and Rest of Canada, 1981-2012



Source: CSLS calculations based on Statistics Canada data

Chart 2: Nominal GDP in Ontario's Business Sector as a Share of Canada's Business Sector, 1981-2012



Source: CSLS calculations based on Statistics Canada data

Overall, between 1989 and 2000, real GDP in Canada's business sector grew at a compound annual rate of 3.05 per cent per year, and slowed down to 1.70 per cent per year between 2000 and 2012. Much of this slower growth at the national level was attributable to developments in Ontario. After accounting for 37.4 per cent of Canada's business sector output growth in 1989-2000, Ontario only accounted for 26.2 per cent in 2000-2012 (Table 1).

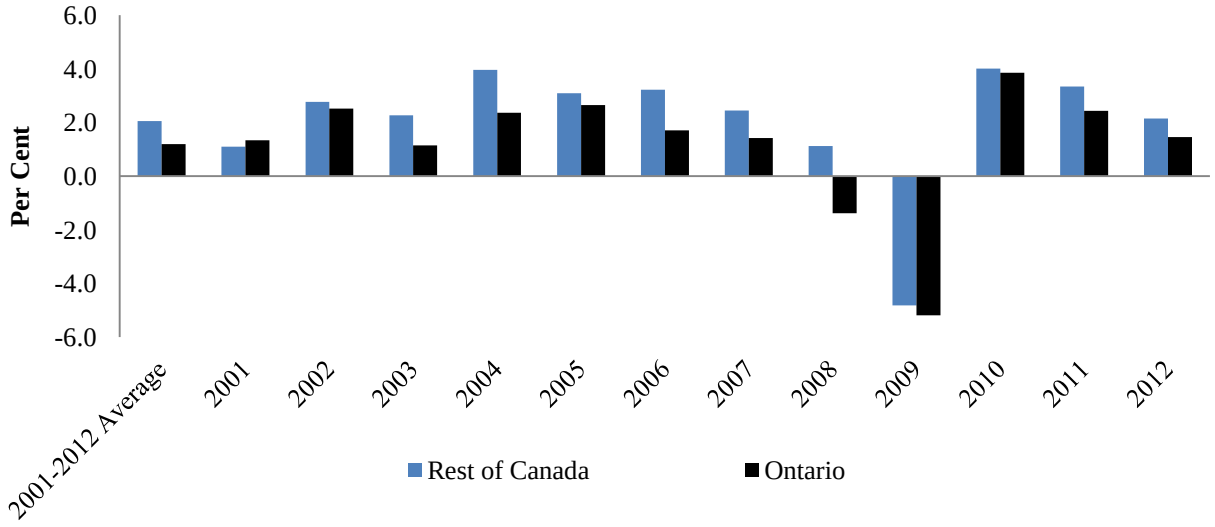
Chart 3 shows that the slower business sector output growth in Ontario compared to the ROC over the 2000-2012 period was not concentrated in several years, but pervasive throughout the decade. In all years but 2001, Ontario experienced slower output growth than the ROC. Among the ten provinces, only Nova Scotia experienced lower business sector output growth between 2000 and 2012 than Ontario (Chart 4).

Table 1: Real GDP Growth and Shares, Business Sector, Canada, Ontario and the Rest of Canada, 1989-2000 and 2000-2012

		Canada	Ontario	Rest of Canada
Levels (Millions of 2007 Chained Dollars)	1989	677,584	271,399	406,185
	2000	943,106	370,653	572,453
	2012	1,154,414	426,060	728,354
Growth Rates (Per Cent)	1989-2000	3.05	2.87	3.17
	2000-2012	1.70	1.17	2.03
	Change	-1.35	-1.71	-1.14
Share of Canada (Per Cent)	2000	100.00	39.30	60.70
	2012	100.00	36.91	63.09
	Change	--	-2.39	2.39
Contributions to Change (Per Cent)	1989-2000	100.00	37.38	62.62
	2000-2012	100.00	26.22	73.78
	Change	--	-11.16	11.16

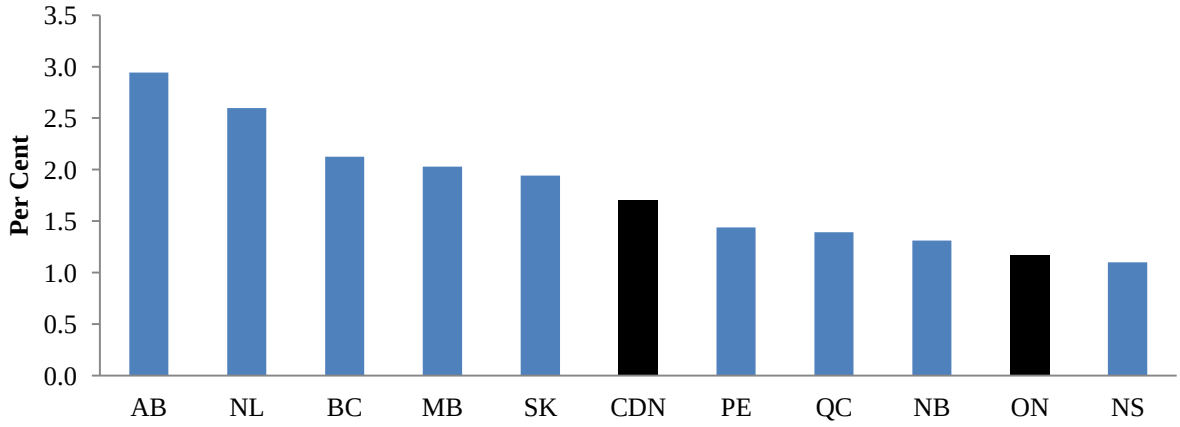
Source: CSLS calculations based on Statistics Canada data

Chart 3: Compound Annual Growth, Real GDP, Business Sector, Ontario and Rest of Canada, 2000-2012



Source: CSLS calculations based on Statistics Canada data

Chart 4: Compound Annual Growth, Real GDP, Business Sector for Canada, Provinces, 2000-2012



Source: CSLS calculations based on Statistics Canada data
Note: All growth rates reported are compound annual growth rates.

3.1.2 Two-Digit NAICS Industries

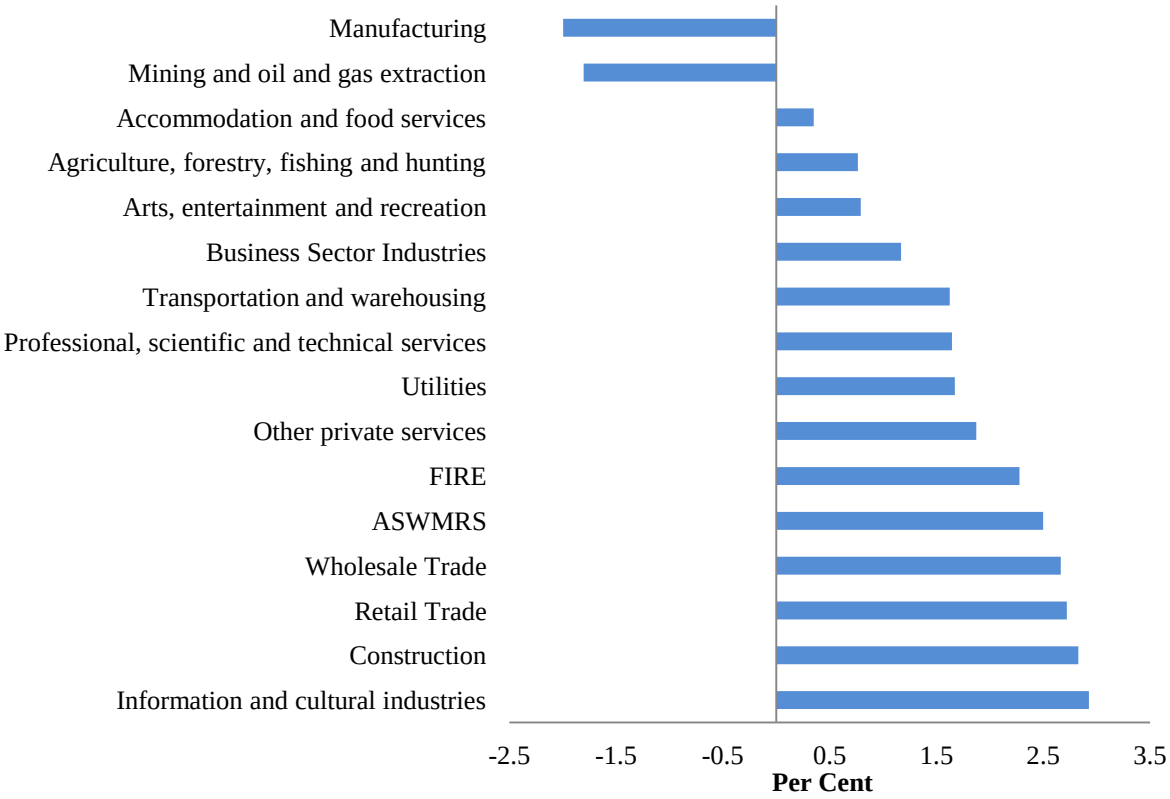
Table 2 provides estimates for real output for two-digit NAICS business sector industries for Ontario in 1987 (the first year for which data are available), 2000 and 2012; their share of business sector output; growth rates and contributions to total growth for the 1987-2000 and 2000-2012 periods; and the difference between the growth rates in the 1987-2000 and 2000-2012 periods. Table 3 provides similar data for the ROC.

By far, the most important industry development in Ontario between 2000 and 2012 took place in manufacturing. After advancing at a robust average annual rate of 3.5 per cent in 1987-2000, this sector experienced a decline of 2.0 per cent per year in real output in 2000-2012, the

largest fall of all two-digit NAICS business sector industries (Chart 5). Ontario's manufacturing sector also had the weakest performance in terms of output growth of all provinces (Chart 6).

The manufacturing sector's share of Ontario's business sector real output fell significantly, from 26.5 per cent in 2000 to 18.1 per cent in 2012. The change between the 1987-2000 and 2000-2012 periods in the contribution of manufacturing to business sector output growth in Ontario is stark. Between 1987 and 2000, manufacturing output increased by $35.4 billion (2007 dollars) and accounted for 30.4 per cent of Ontario's business sector output growth; however, between 2000 and 2012, manufacturing output fell by $21.1 billion, contributing -38.1 per cent to the change in the province's business sector output from 2000 to 2012.

Chart 5: Annual Real Output Growth, Business Sector, Ontario, 2000-2012



Source: CSLS calculations based on Statistics Canada data
Note: FIRE stands for Finance and Insurance and Real Estate and Rental and Leasing; and ASWMRS stands for Administrative and Support, Waste Management and Remediation Services.

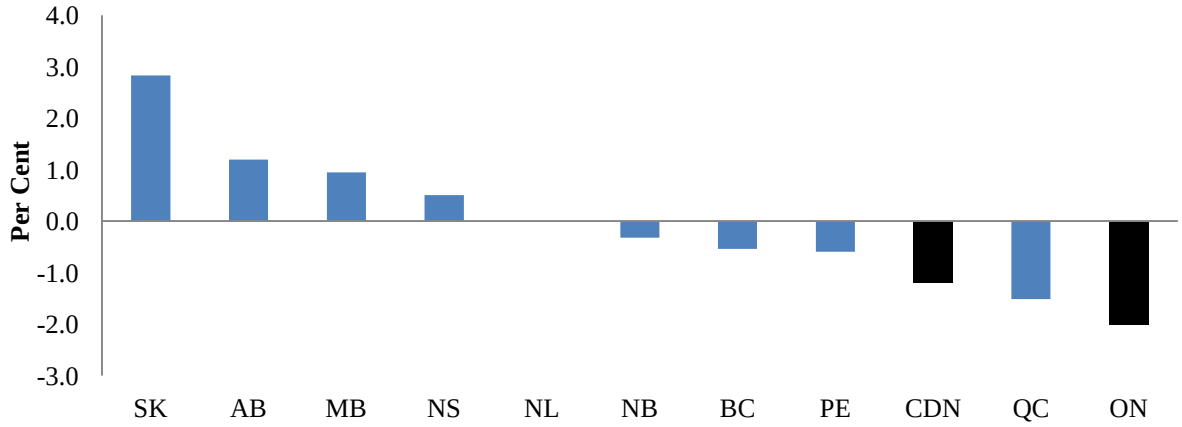
In contrast to manufacturing, finance, insurance, real estate, rental and leasing (FIRE) accounted for a greater share of real business sector output in Ontario than manufacturing at 20.3 per cent in 2012, up from 17.8 per cent in 2000. Between 2000 and 2012, FIRE accounted for 36.9 per cent of business sector output growth.[9]

Between 1987-2000 and 2000-2012, Ontario shifted from a manufacturing-driven economy to a FIRE-driven economy; this structural shift was also evident for the ROC (Table 3).

[9] It should be noted that FIRE includes imputed rent.

However, the size of the shift in the ROC was much smaller than in Ontario: the fall in the share on business sector output in manufacturing in the ROC in 2000-2012 was 4.3 percentage points, compared to 8.4 percentage points in Ontario; output growth in manufacturing was -0.42 per cent per year in 2000-2012 in the ROC, compared to -2.0 per cent in Ontario; and the contribution of manufacturing to business sector output growth in 2000-2012 in the ROC was -3.1 per cent, compared to -38.1 per cent in Ontario.

Chart 6: Annual Real Output Growth, Manufacturing, Canada and the Provinces, 2000-2012



Source: CSLS calculations based on Statistics Canada data

Table 2: Real GDP by Business Sector Industry (two-digit NAICS), Ontario, 1987, 2000, and 2012

	Levels (Millions, 2007 dollars)			**Shares of Business Sector (Per Cent)**			**Growth Rate (Per Cent)**			**Contributions to Change (Per Cent)**		
	1987	2000	2012	1987	2000	2012	1987-2000	2000-2012	Change in Growth Rate	1987-2000	2000-2012	Changes in Contribution
Business sector industries	248,496	370,653	426,060	100.00	100.00	100.00	3.12	1.17	-1.96	100	100	
Agriculture, forestry, fishing and hunting	3,509	4,357	4,774	1.41	1.18	1.12	1.68	0.77	-0.91	0.73	0.75	0.02
Mining and oil and gas extraction	10,678	9,359	7,522	4.30	2.52	1.77	-1.01	-1.80	-0.79	-1.13	-3.31	-2.18
Utilities	8,126	8,319	10,151	3.27	2.24	2.38	0.18	1.67	1.49	0.16	3.31	3.15
Construction	24,237	24,243	33,890	9.75	6.54	7.95	0.00	2.83	2.83	0.00	17.41	17.41
Manufacturing	62,696	98,107	77,014	25.23	26.47	18.08	3.50	-2.00	-5.50	30.43	-38.07	-68.50
Wholesale Trade	12,773	27,339	37,487	5.14	7.38	8.80	6.03	2.67	-3.36	12.52	18.32	5.80
Retail Trade	16,985	22,885	31,590	6.84	6.17	7.41	2.32	2.72	0.40	5.07	15.71	10.64
Transportation and warehousing	12,894	17,720	21,498	5.19	4.78	5.05	2.48	1.62	-0.86	4.87	6.82	1.95
Information and cultural industries	8,594	15,004	21,218	3.46	4.05	4.98	4.38	2.93	-1.45	6.47	11.21	4.74
FIRE	39,265	65,846	86,273	15.80	17.76	20.25	4.06	2.28	-1.78	22.85	36.87	14.02
Professional, scientific and technical services	13,163	30,062	36,568	5.30	8.11	8.58	6.56	1.65	-4.91	14.52	11.74	-2.78
ASWMRS	9,416	13,483	18,131	3.79	3.64	4.26	2.80	2.50	-0.30	3.50	8.39	4.89
Arts, entertainment and recreation	3,139	3,526	3,876	1.26	0.95	0.91	0.90	0.79	-0.11	0.33	0.63	0.30
Accommodation and food services	7,718	10,141	10,575	3.11	2.74	2.48	2.12	0.35	-1.77	2.08	0.78	-1.30
Other private services	14,612	19,815	24,756	5.88	5.35	5.81	2.37	1.87	-0.50	4.47	8.92	4.45

Source: CSLS calculations based on Statistics Canada data
Note: FIRE stands for Finance and Insurance and Real Estate and Rental and Leasing; and ASWMRS stands for Administrative and Support, Waste Management and Remediation Services.

Table 3: Real GDP by Business Sector Industry (two-digit NAICS), Rest of Canada, 1987, 2000, and 2012

	Levels (Millions, 2007 dollars)			Shares of Business Sector (Per Cent)			Growth Rate (Per Cent)			Contributions to Change (Per Cent)		
	1987	2000	2012	1987	2000	2012	1987-2000	2000-2012	Change in Growth Rate	1987-2000	2000-2012	Changes in Contribution
Business Sector Industries	383,269	572,453	728,354	100.00	100.00	100.00	3.13	2.03	-1.11	100.00	100.00	
Agriculture, forestry, fishing and hunting	14,050	17,252	19,317	3.67	3.01	2.65	1.59	0.95	-0.64	1.69	1.32	-0.37
Mining and oil and gas extraction	69,609	100,396	116,384	18.16	17.54	15.98	2.86	1.24	-1.62	16.27	10.26	-6.02
Utilities	18,271	22,101	25,171	4.77	3.86	3.46	1.47	1.09	-0.38	2.02	1.97	-0.06
Construction	37,471	44,091	78,648	9.78	7.70	10.80	1.26	4.94	3.68	3.50	22.17	18.67
Manufacturing	60,704	96,335	91,571	15.84	16.83	12.57	3.62	-0.42	-4.04	18.83	-3.06	-21.89
Wholesale Trade	18,997	32,299	47,655	4.96	5.64	6.54	4.17	3.29	-0.87	7.03	9.85	2.82
Retail Trade	29,579	34,120	52,226	7.72	5.96	7.17	1.10	3.61	2.51	2.40	11.61	9.21
Transportation and warehousing	22,879	35,161	41,932	5.97	6.14	5.76	3.36	1.48	-1.88	6.49	4.34	-2.15
Information and cultural industries	8,104	20,284	28,570	2.11	3.54	3.92	7.31	2.90	-4.42	6.44	5.31	-1.12
FIRE	45,744	69,034	97,321	11.94	12.06	13.36	3.22	2.90	-0.31	12.31	18.14	5.83
Professional, scientific and financial services	13,148	30,004	45,090	3.43	5.24	6.19	6.55	3.45	-3.10	8.91	9.68	0.77
ASWMRS	9,514	14,865	21,587	2.48	2.60	2.96	3.49	3.16	-0.33	2.83	4.31	1.48
Arts, entertainment and recreation	3,096	5,052	5,735	0.81	0.88	0.79	3.84	1.06	-2.78	1.03	0.44	-0.60
Accommodation and food services	14,520	17,383	20,896	3.79	3.04	2.87	1.39	1.55	0.15	1.51	2.25	0.74
Other private services	17,586	29,334	37,177	4.59	5.12	5.10	4.01	1.99	-2.02	6.21	5.03	-1.18

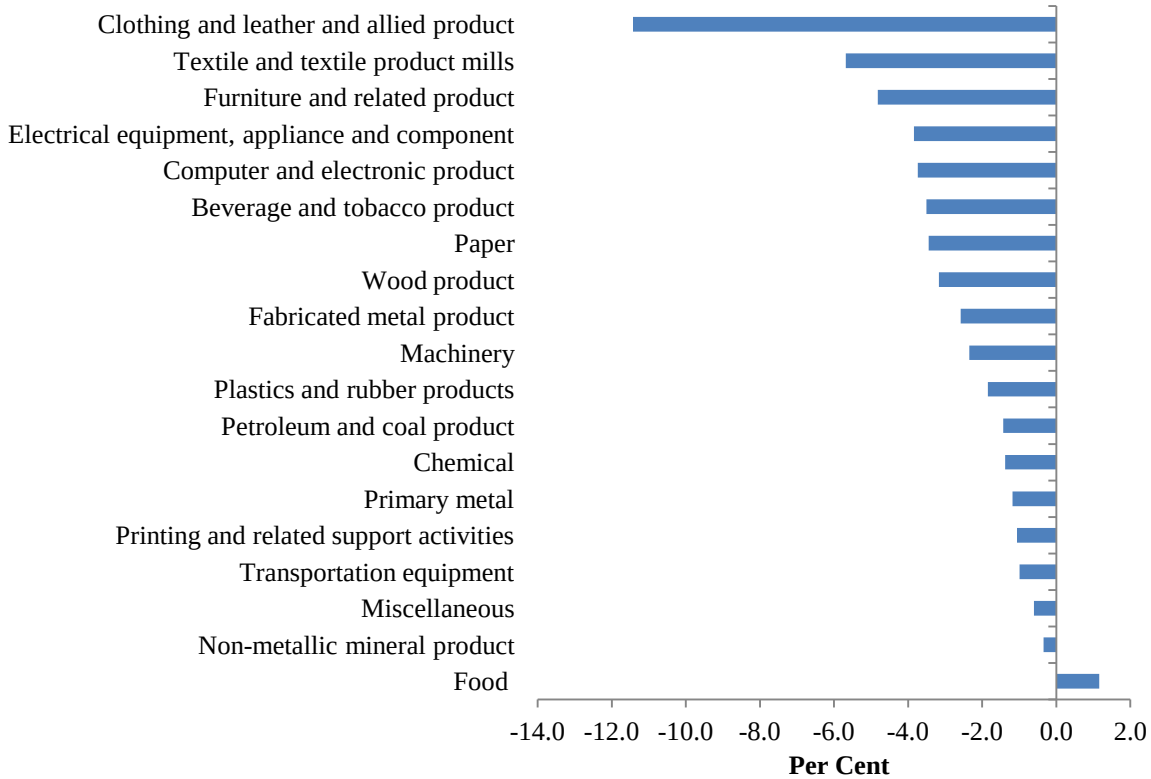
Source: CSLS calculations based on Statistics Canada data

3.1.3 Three-Digit NAICs Manufacturing Industries

In 2000, by far the most important manufacturing industry in Ontario in terms of value added, measured in 2007 dollars, was transportation equipment (21.8 per cent), followed by fabricated metal products (8.0 per cent), food manufacturing (7.9 per cent), machinery (7.7 per cent), chemicals (6.9 per cent), primary metal (6.7 per cent), and computer and electronics products (6.6 per cent).[10] The relative importance of these industries scarcely changed in 2012.

The decline in manufacturing in Ontario has been pervasive. Of the nineteen three-digit manufacturing industries, only food manufacturing had a higher level of real output in 2012 than in 2000 (Chart 7). All other industries had lower levels of real output in 2012. For example, output fell by 11.4 per cent per year in clothing and leather, 5.7 per cent per year in textile and textile product mills, and 4.8 per cent per year in the furniture industry. Other industries that experienced large declines were electrical equipment (-3.8 per cent per year), computer and electronic products (-3.7 per cent per year), beverage and tobacco (3.5 per cent per year), paper (-3.4 per cent per year) and wood (-3.2 per cent per year). Table 4 provides estimates of real output for the nineteen three-digit manufacturing sector industries for Ontario in 1987, 2000 and 2012; their share of business sector output; and growth rates and contributions to total growth for 1987-2000 and 2000-2012, as well as changes between periods.

Chart 7: Annual Real GDP Growth for Manufacturing Industries (three-digit NAICS), Ontario, 2000-2012



Source: Calculations based on Statistics Canada data

[10] It is not technically correct to calculate real industry shares using chained fisher data; however, the data needed to calculate nominal industry shares for Ontario are only available for 2007-2010.

Table 4: Real GDP by Manufacturing Sector Industry (three-digit NAICS), Ontario, 1987, 2000, and 2012

	Levels (Millions, 2007 dollars)			Shares of Manufacturing (Per cent)			Growth Rate (Per Cent)			Contributions to Change (Per Cent)		
	1987	2000	2012	1987	2000	2012	1987-2000	2000-2012	Change in Growth Rate	1987-2000	2000-2012	Changes in Contribution
Manufacturing	62,696	98,107	77,014	100.00	100.00	100.00	3.50	-2.00	-5.50	100.00	100.00	
Food manufacturing	..	7,724	8,970	..	7.87	11.65	..	1.16	..	..	-5.91	..
Beverage and tobacco product manufacturing	..	4,315	2,713	..	4.40	3.52	..	-3.51	..	..	7.60	..
Textile and textile product mills	..	1,172	548	..	1.19	0.71	..	-5.68	..	..	2.96	..
Clothing and leather and allied product manufacturing	..	1,837	380	..	1.87	0.49	..	-11.42	..	..	6.91	..
Wood product manufacturing	..	1,588	1,045	..	1.62	1.36	..	-3.16	..	..	2.57	..
Paper manufacturing	..	3,822	2,424	..	3.90	3.15	..	-3.44	..	..	6.63	..
Printing and related support activities	2,958	3,036	2,643	4.72	3.09	3.43	0.20	-1.06	-1.26	0.22	1.86	1.64
Petroleum and coal product manufacturing	..	1,959	1,624	..	2.00	2.11	..	-1.43	..	..	1.59	..
Chemical manufacturing	..	6,800	5,678	..	6.93	7.37	..	-1.38	..	..	5.32	..
Plastics and rubber products manufacturing	..	5,460	4,285	..	5.57	5.56	..	-1.85	..	..	5.57	..
Non-metallic mineral product manufacturing	..	2,296	2,197	..	2.34	2.85	..	-0.34	..	..	0.47	..
Primary metal manufacturing	..	6,607	5,661	..	6.73	7.35	..	-1.18	..	..	4.49	..
Fabricated metal product manufacturing	..	7,819	5,569	..	7.97	7.23	..	-2.58	..	..	10.66	..
Machinery manufacturing	4,768	7,589	5,571	7.60	7.74	7.23	3.64	-2.35	-5.99	7.97	9.57	1.60
Computer and electronic product manufacturing	..	6,425	3,914	..	6.55	5.08	..	-3.74	..	..	11.90	..
Electrical equipment, appliance and component manufacturing	..	2,969	1,784	..	3.03	2.32	..	-3.84	..	..	5.62	..
Transportation equipment manufacturing	..	21,422	18,830	..	21.84	24.45	..	-0.99	..	..	12.29	..
Furniture and related product manufacturing	..	3,457	1,819	..	3.52	2.36	..	-4.82	..	..	7.76	..
Miscellaneous manufacturing	1,581	1,810	1,673	2.52	1.85	2.17	1.05	-0.60	-1.65	0.65	0.65	0.00

Source: CSLS calculations based on Statistics Canada data

3.2 Labour Input

Labour input can be measured in terms of both hours worked and employment, with the difference between the two reflecting changes in the average number of hours worked per employee. Hours worked are a more accurate measure of labour input and all productivity estimates in this report are based on hours worked. However, it can be argued that employment should be the focus of this discussion rather than hours worked. Thus, this section presents both estimates, but focuses on net employment trends.

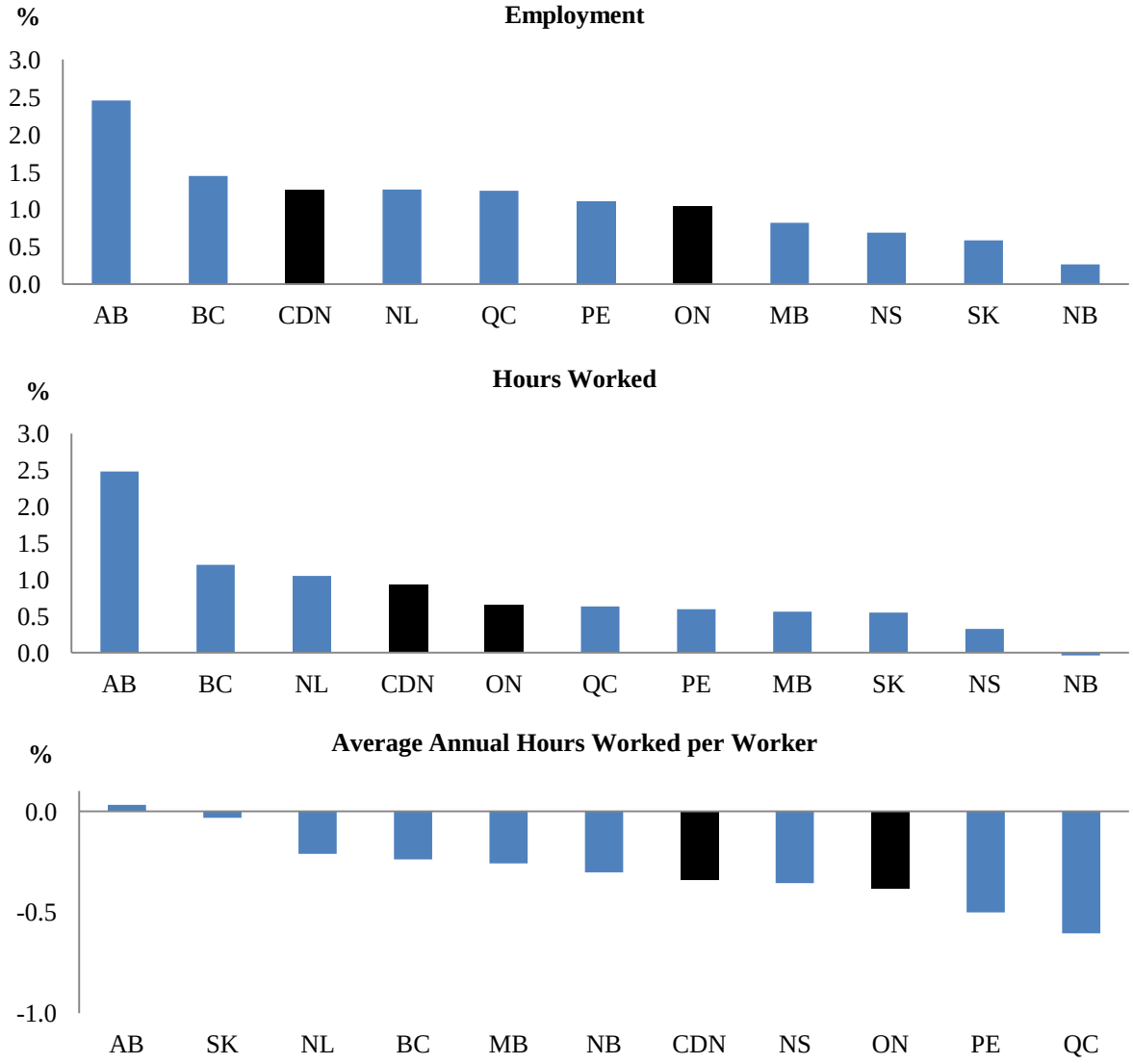
3.2.1 Business Sector

Between 2000 and 2012, business sector employment in Ontario, based on estimates from Statistics Canada's Canadian Productivity Accounts (CPA), advanced at a 1.04 per cent average annual rate, compared to only 0.65 per cent for hours (Chart 8). This implies that average hours per worker fell 0.38 per cent per year from 1,817 hours in 2000 to 1,736 hours in 2012. This development largely reflects a rise in the share of part-time workers in total employment from 18.0 per cent in 2000 to 18.9 per cent in 2012 and a reallocation of workers from industries with above-average weekly hours (such as manufacturing) to industries with below-average weekly hours (such as retail trade).

Between 2000 and 2012, employment growth in Ontario's business sector (1.04 per cent per year) was below the national average (1.27 per cent per year) and below the average for the ROC (1.33 per cent per year) (Appendix Table 4 and Appendix Table 5). In contrast to Ontario's poor performance in terms of business sector real GDP growth among the provinces, four provinces had slower employment growth than Ontario from 2000 to 2012 – namely, Nova Scotia, New Brunswick, Saskatchewan and Manitoba. In addition, six provinces had slower growth in hours worked than Ontario (Chart 8).

The previous sub-section of the report documented a large fall in Ontario's business sector real GDP growth between 1987-2000 and 2000-2012: 2.7 percentage points from 3.12 to 1.17 per cent (Table 2). In contrast, labour input growth experienced a much smaller decrease. The 1.04 per cent average annual increase in business sector employment in Ontario between 2000 and 2012 was only 0.08 percentage points lower than the 1.11 per cent rate recorded between 1987 and 2000 (Appendix Table 4). Ontario's pattern of relatively stable employment growth and falling output growth accounts for the decline in labour productivity growth.

Chart 8: Annual Business Sector Employment Growth for Canada and the Provinces, 2000-2012



Source: CSLS calculations based on Statistics Canada data

3.2.2 Two-digit NAICS Industries

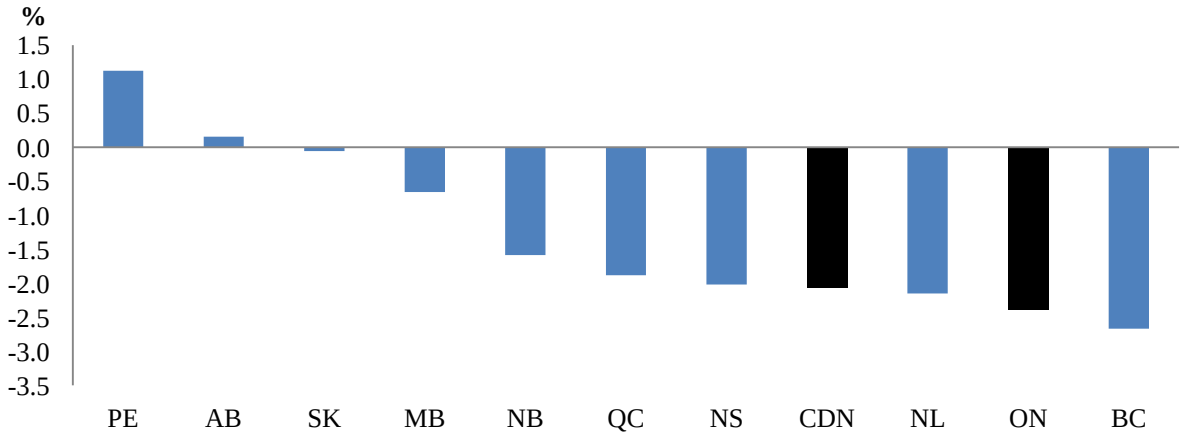
Appendix Table 4 provides estimates of employment for two-digit NAICS business sector industries for Ontario in 1987 (the first year for which data are available), 2000, and 2012; their share of business sector employment; and growth rates and contributions to total employment growth for the 1987-2000 and 2000-2012 periods, as well as changes between periods. Appendix Table 5 provides similar data for the ROC.

Appendix Table 6 provides estimates of total hours worked for two-digit NAICS business sector industries for Ontario in 1987, 2000, and 2012; their share of the business sector total; and growth rates and contributions to total hours worked growth for the 1987-2000 and 2000-2012 periods, as well as changes between periods. Appendix Table 7 provides similar data for the ROC.

Appendix Table 8 provides estimates of the average annual hours worked per worker for two-digit NAICS business sector industries for Ontario in 1987, 2000, and 2012; their proportion of the business sector average; and growth rates and contributions to average annual hours worked per worker growth in the business sector for the 1987-2000 and 2000-2012 period, as well as changes between periods. Appendix Table 9 provides similar data for the ROC.

Again, the most important industry development in terms of labour input in Ontario between 2000 and 2012 took place in manufacturing. After experiencing little change in employment between 1987 and 2000 (-0.13 per cent per year), manufacturing employment in Ontario declined by 2.4 per cent per year between 2000 and 2012, the largest fall of any two-digit NAICS industry in the province (Chart 10). Ontario's manufacturing sector also has the second lowest performance in terms of employment growth of all provinces during 2000-2012 (Chart 9). As a result, manufacturing's share of total business sector employment in Ontario fell significantly from 2000 to 2012.

Chart 9: Annual Employment Growth, Manufacturing Sector, Canada and the Provinces, 2000-2012



Source: CSLS calculations based on Statistics Canada data

Between 1987 and 2000, Ontario's manufacturing sector lost only 16 thousand jobs. In contrast, Ontario's manufacturing sector lost 250 thousand jobs between 2000 and 2012,

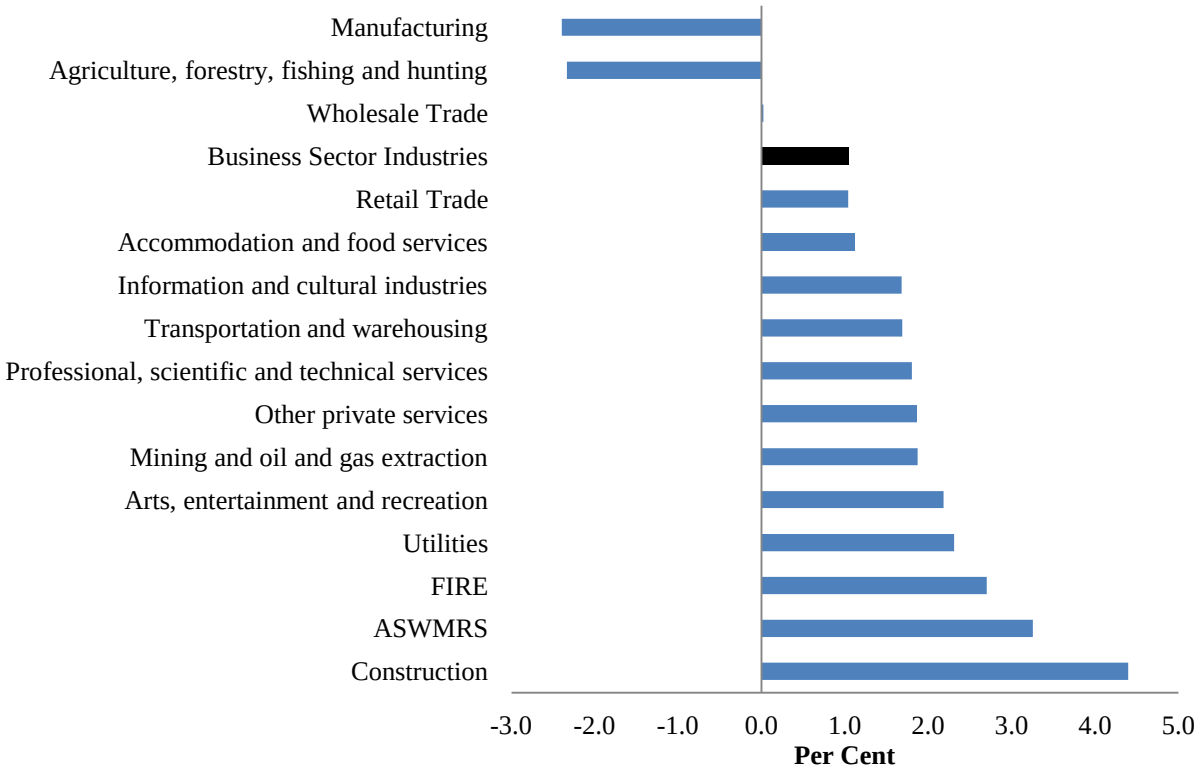
contributing -35.1 per cent to the province's change in business sector employment during the period. No other sector experienced such a dramatic decrease in net employment. This structural shift was evident in the ROC. However, the size of this structural shift was much smaller in the ROC than in Ontario: the fall in the share of business sector employment in manufacturing in the ROC in 2000-2012 was 5.1 percentage points, compared to 6.9 percentage points in Ontario; employment growth in manufacturing was -1.77 per cent per year in 2000-2012 in the ROC, compared to -2.39 per cent in Ontario; and the contribution of manufacturing to business sector employment growth in 2000-2012 in the ROC was -3.1 per cent, compared to -35.1 per cent in Ontario.

The decline of employment in the manufacturing sector in Ontario was reflected in the downsizing or closing of factories. According to Statistics Canada's estimates, the number of manufacturing establishments in the province fell by 14 per cent from 36,731 in 2004 to 31,572 in 2010 (or an average annual decline of -2.51 per cent).

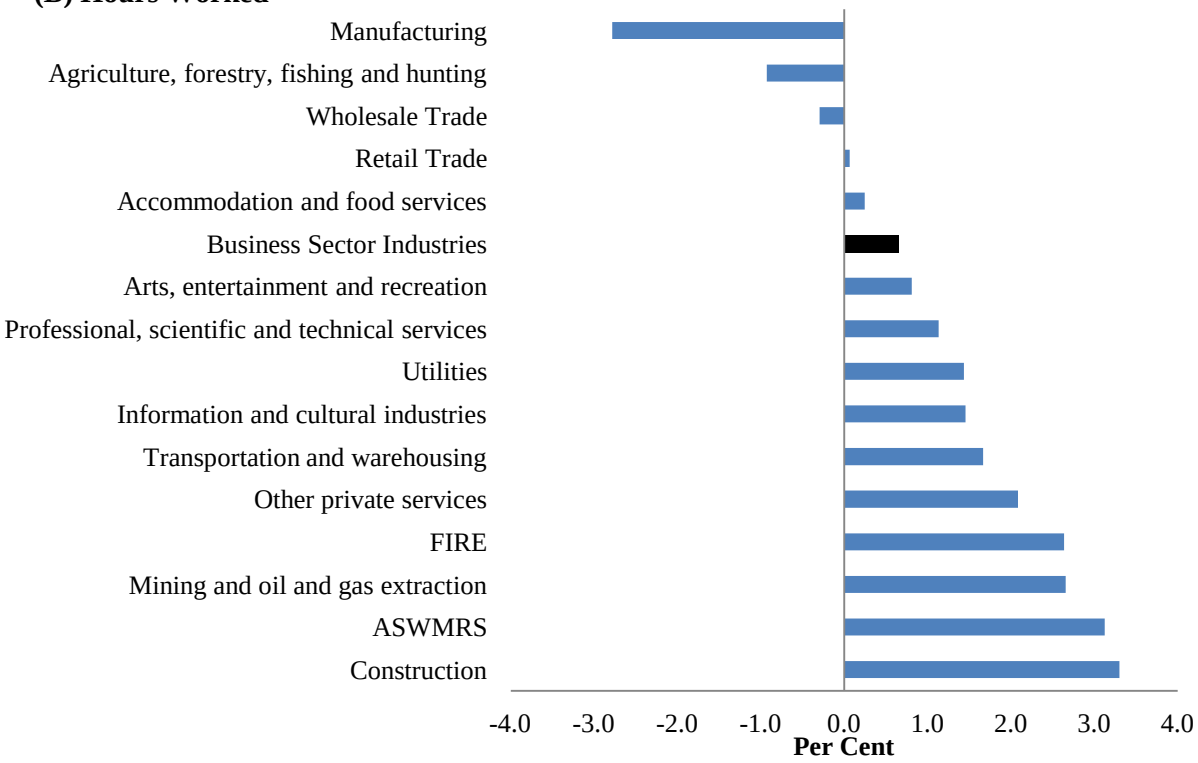
Fortunately, the net employment losses in manufacturing in Ontario were more than offset by gains in other sectors, and, as a result, total employment growth did not fall significantly from the rate experienced in the 1987-2000 period. Robust employment growth was experienced in construction (4.40 per cent per year), administrative and support, waste management and remediation Services (ASWMRS) (3.25 per cent), professional, scientific and technical services (1.80 per cent), and FIRE (2.70 per cent). In fact, these three sectors alone accounted for nearly three quarters of net employment growth.

Chart 10: Annual Business Sector Labour Input Growth in Ontario, 2000-2012

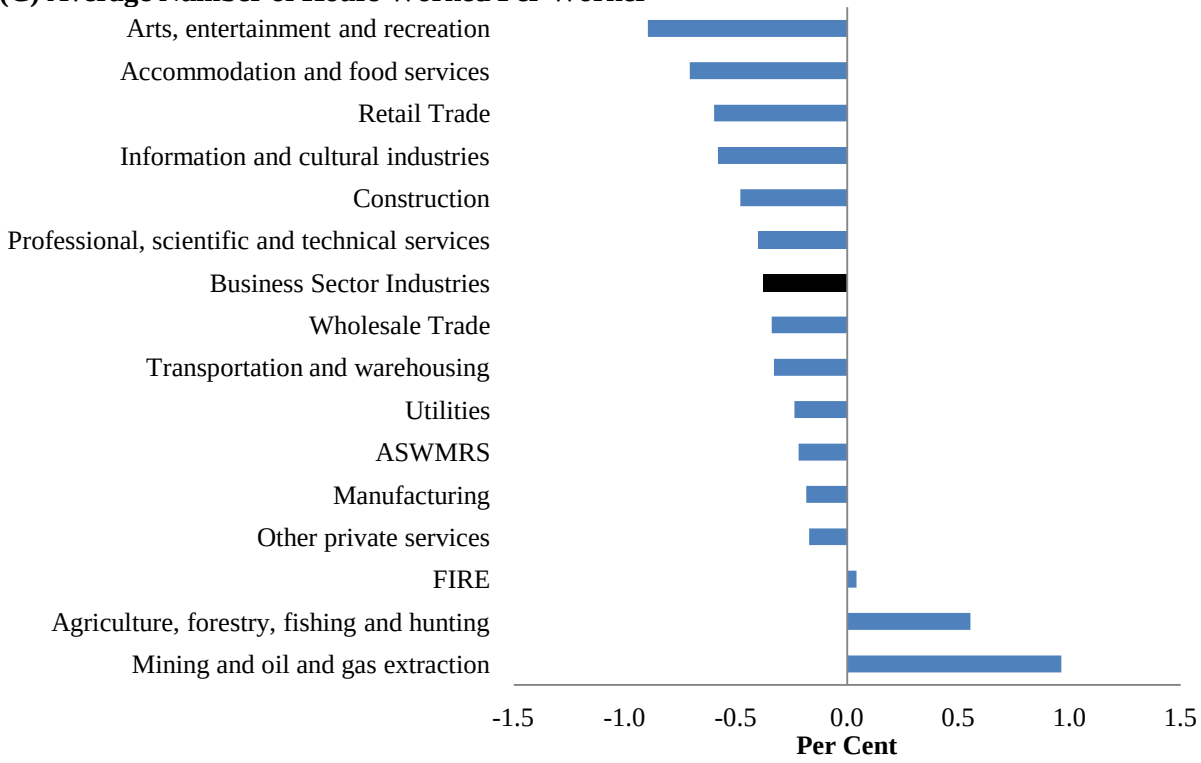
(A) Net Employment



(B) Hours Worked



(C) Average Number of Hours Worked Per Worker



Source: Calculations based on Statistics Canada data

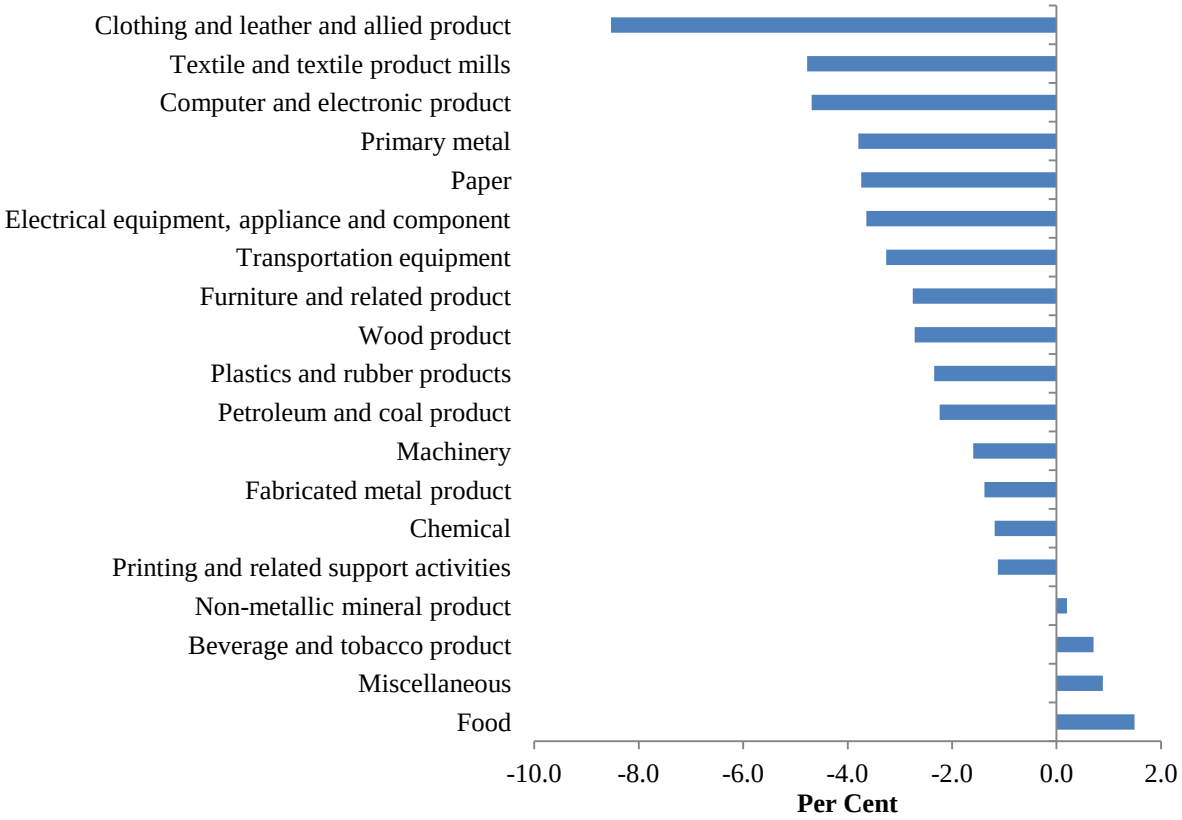
3.2.3 Three-digit NAICS Manufacturing Industries

Table 5 provides estimates of net employment for three-digit NAICS manufacturing industries for Ontario in 1987 (the first year for which data are available), 2000 and 2012; their share of business sector employment; and growth rates and contributions to total employment growth for the 1989-2000 and 2000-2012 periods, as well as changes between periods. The source for these detailed estimates is the Labour Force Survey (LFS) rather than the Survey of Employment, Payrolls and Hours (SEPH) or the Canadian Productivity Accounts (CPA), as the latter does not produce estimates at the three-digit level by province or any estimates at the two-digit level before 1997. Fortunately CPA and LFS estimates for manufacturing employment are identical in 2012 and very close in 2000.

In 2000, by far the most important manufacturing industry in Ontario in terms of employment was transportation equipment at 19.5 per cent of total business sector employment, followed by fabricated metal products (9.6 per cent), food manufacturing (7.7 per cent), machinery (7.7 per cent), chemicals (5.3 per cent), primary metal (5.5 per cent), and computer and electronics products (7.8 per cent). The major change in the relative importance of these industries between 2000 and 2012 was the rise in the share of the food industry in business sector employment to 12.4 per cent, the fall in transportation equipment to 16.9 per cent, and the fall in clothing and leather and allied products to 1.30 per cent.

Of the nineteen three-digit NAICS manufacturing industries, only four – that is, food manufacturing, beverage and tobacco, miscellaneous manufacturing, and non-metallic mineral products – had a higher level of employment in 2012 compared to 2000 (Chart 11). In other words, the employment decline in manufacturing in Ontario, like the decline in output, has been pervasive, with fifteen industries having lower levels of employment in 2012 compared to 2000. For example, employment fell by 8.5 per cent per year in clothing and leather and 4.8 per cent per year in textile and textile product mills. Other industries that experienced large declines were electrical equipment (-3.6 per cent per year), computer and electronic products (-4.7 per cent per year), paper (-3.7 per cent per year), primary metal (-3.8 per cent per year), furniture and related products (-2.8 per cent per year), and wood (-2.7 per cent per year). In contrast to the relatively limited output fall in the transportation equipment (-1.0 per cent per year), the province's most important manufacturing industry, employment in this industry fell at a 3.3 per cent average rate in 2000-2012, the seventh-worst performance of the nineteen manufacturing industries.

Chart 11: Annual Employment Growth by Manufacturing Sector Industry (three-digit NAICS), Ontario, 2000-2012



Source: CSLS calculations based on Statistics Canada data

Table 5: Employment by Manufacturing Sector Industry (three-digit NAICS), Ontario, 1987, 2000, and 2012

	Levels (Thousands)			Shares of Manufacturing (Per Cent)			Growth Rate (Per Cent)			Contributions to Change (Per Cent)		
	1987	2000	2012	1987	2000	2012	1987-2000	2000-2012	Change in Growth Rate	1987-2000	2000-2012	Changes in Contribution
Manufacturing (LFS)	881	982	739	100.0	100.0	100.0	0.84	-2.34	-3.18	100. 0	100.0	--
Food	75	76	92	8.57	7.72	12.44	0.03	1.49	1.46	0.33	-6.63	-6.96
Beverage and tobacco product	14	11	12	1.60	1.14	1.66	-1.78	0.71	2.49	-2.90	-0.44	2.46
Textile and textile product mills	25	17	9	2.87	1.73	1.21	-3.02	-4.78	-1.75	-8.19	3.29	11.48
Clothing and leather and allied product	39	31	10	4.43	3.11	1.30	-1.87	-8.53	-6.66	-8.37	8.63	17.00
Wood product	19	26	18	2.14	2.63	2.45	2.47	-2.71	-5.18	6.92	3.20	-3.72
Paper	39	36	22	4.38	3.69	2.99	-0.49	-3.74	-3.25	-2.34	5.83	8.17
Printing and related support activities	34	37	32	3.91	3.80	4.37	0.64	-1.12	-1.76	2.93	2.10	-0.83
Petroleum and coal product	10	8	6	1.19	0.85	0.84	-1.69	-2.24	-0.54	-2.05	0.88	2.93
Chemical	46	52	45	5.25	5.32	6.05	0.95	-1.18	-2.13	5.94	3.08	-2.86
Plastics and rubber products	50	68	50	5.66	6.94	6.77	2.43	-2.34	-4.77	18.00	7.44	-10.56
Non-metallic mineral product	27	25	26	3.07	2.56	3.49	-0.56	0.20	0.76	-1.88	-0.27	1.60
Primary metal	60	54	32	6.83	5.46	4.39	-0.87	-3.79	-2.92	-6.37	8.73	15.10
Fabricated metal product	89	94	78	10.10	9.58	10.62	0.43	-1.38	-1.81	5.03	6.41	1.38
Machinery	60	76	61	6.86	7.69	8.29	1.73	-1.60	-3.33	14.87	5.87	-8.99
Computer and electronic product	54	77	41	6.08	7.83	5.58	2.83	-4.69	-7.52	23.05	14.71	-8.34
Electrical equipment, appliance and component	40	31	19	4.53	3.12	2.56	-2.02	-3.64	-1.63	-9.16	4.83	13.98
Transportation equipment	142	192	125	16.18	19.54	16.87	2.32	-3.26	-5.58	48.67	27.66	-21.01
Furniture and related product	39	47	33	4.40	4.81	4.44	1.54	-2.76	-4.29	8.37	5.93	-2.45
Miscellaneous	17	24	27	1.94	2.48	3.70	2.77	0.89	-1.88	7.17	-1.22	-8.40

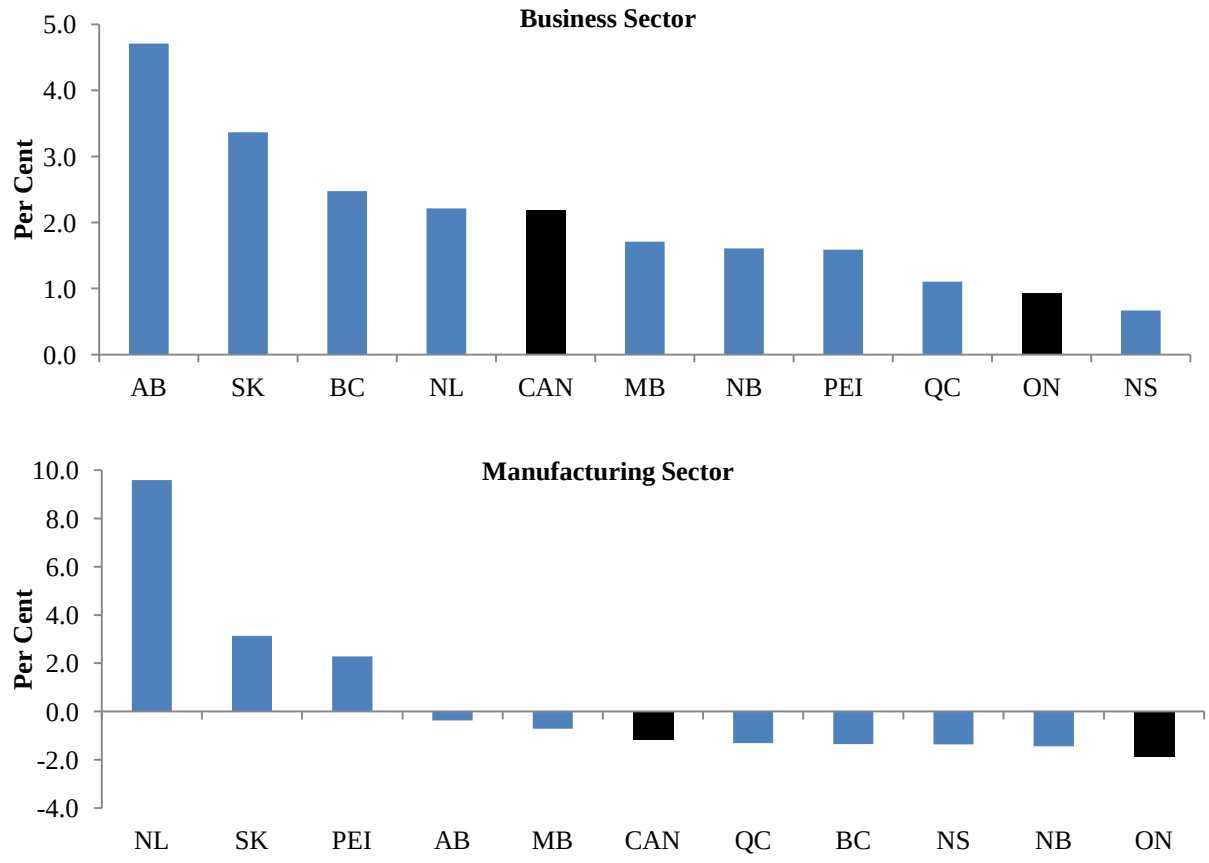
Source: CSLS calculations based on Statistics Canada data

3.3 Capital Inputs

3.3.1 Business Sector

Ontario's business sector real net capital stock grew at a compound annual rate of 0.93 per cent, from $344,950 million (2007 dollars) in 2000 to $385,483 million in 2012. This is significantly smaller than Canada's real net capital stock growth of 2.19 per cent per year, and the rate of growth of 2.76 per cent per year for the ROC. It also represents a slowdown from the rate of growth of 2.50 per cent per year in the 1987-2000 period. Ontario experienced the second lowest rate of growth of net business sector capital stock between 2000 and 2012 among the provinces (Chart 12). Only Nova Scotia was lower. In terms of manufacturing net capital stock growth in 2000-2012, Ontario ranked last among the provinces.

Chart 12: Annual Growth in Net Capital Stocks for Canada and the Provinces, 2000-2012



Source: CSLS calculations based on Statistics Canada data (CANSIM table 031-0002)

3.3.2 Two-Digit NAICS Industries

Table 6 provides estimates of net capital stock for two-digit NAICS business sector industries for Ontario in 1987 (the first year for which data are available), 2000, and 2012; their share of business sector net capital stock; and growth rates and contributions to total net capital stock growth for the 1987-2000 and 2000-2012 periods, as well as changes between periods. Table 7 provides similar data for the ROC.

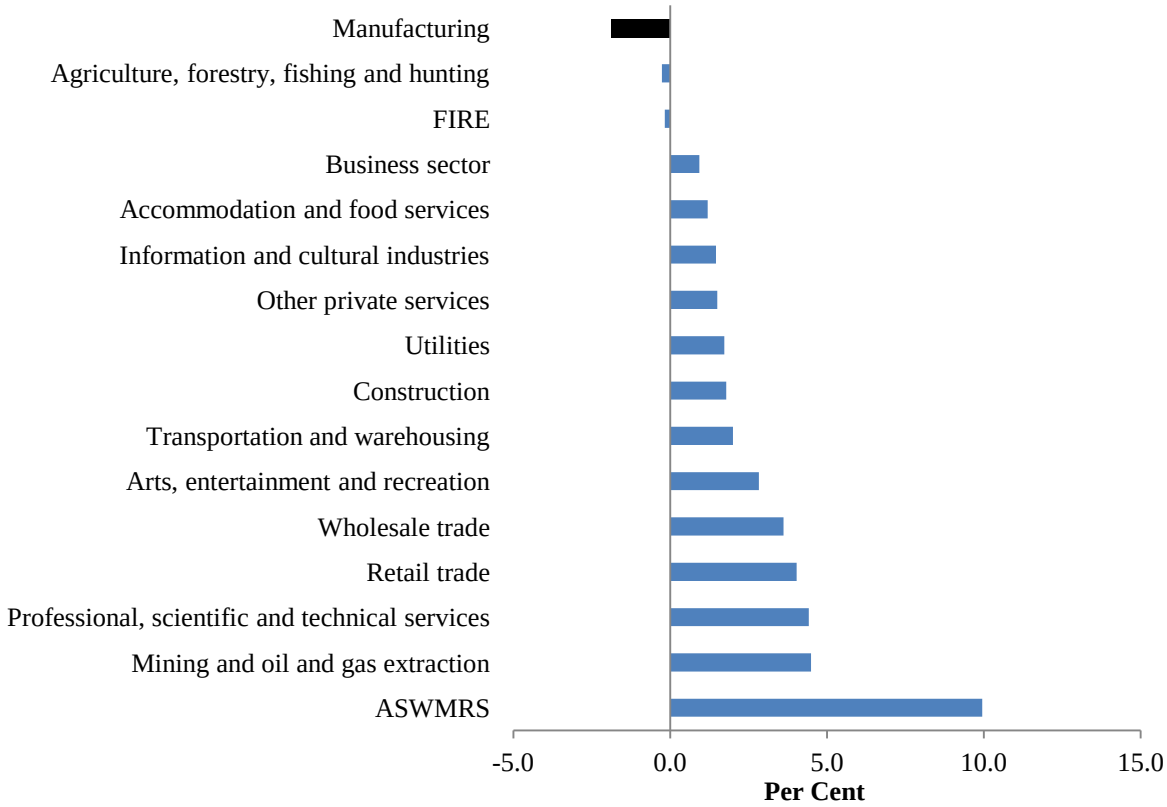
Following the pattern set by output and employment, the most important industry development in terms of net capital stock in Ontario between 2000 and 2012 was in manufacturing. After experiencing modest growth in net capital stock between 1987 and 2000 (0.86 per cent per year), this sector experienced a fall in net capital stock of 1.87 per cent per year from 2000 to 2012, the largest fall by far among the two-digit NAICS industries (Chart 13).

Manufacturing net capital stock as a share of Ontario's business sector net capital stock fell significantly, 6.2 percentage points, from 21.7 per cent in 2000 to 15.5 per cent in 2012, in contrast to a smaller 5.1 percentage point decline between 1987 and 2000.

The decline in net capital stock in Ontario's manufacturing sector was not just in absolute terms. The net capital stock of Ontario's manufacturing sector fell by $15 billion (2007 dollars) between 2000 and 2012, contributing -39.4 per cent to the change in province's business sector net capital stock in the period. No other sector experienced such a large a decline. The capital stock aspect of the structural shift was evident in the ROC (Table 7), but again the size of the shift was small compared to the one experienced by Ontario.[11]

[11] The fall in the share of net capital stock in manufacturing in the ROC in 2000-2012 was 4.2 percentage points, compared to 6.3 percentage points in Ontario; net capital stock growth in manufacturing was -0.42 per cent per year in 2000-2012 in the ROC, compared to -1.87 per cent in Ontario; and the contribution of manufacturing to business sector net capital stock growth in 2000-2012 in the ROC was -2.4 per cent, compared to -39.4 per cent in Ontario.

Chart 13: Annual Growth in Net Capital Stocks, Business Sector (two-digit NAICS), Ontario, 2000-2012



Source: CSLS calculations based on Statistics Canada data (CANSIM 031-0002)

Table 6: Net Capital Stocks by Business Sector Industry (two-digit NAICS), Ontario, 1987, 2000 and 2012

	Levels (Millions, 2007 dollars)			**Shares of Business Sector (Per Cent)**			**Growth Rate (Per Cent)**			**Contributions to Change (Per Cent)**		
	1987	2000	2012	1987	2000	2012	1987-2000	2000-2012	Change in Growth Rate	1987-2000	2000-2012	Changes in Contribution
Business sector industries	250,200	344,950	385,483	100.00	100.00	100.00	2.50	0.93	-1.57	100.00	100.00	
Agriculture, forestry, fishing and hunting	13,608	11,939	11,563	5.44	3.46	3.00	-1.00	-0.27	0.73	-1.86	-0.97	0.89
Mining and oil and gas extraction	9,904	8,361	14,165	3.96	2.42	3.67	-1.29	4.49	5.79	-1.72	15.01	16.74
Utilities	52,585	53,724	65,995	21.02	15.57	17.12	0.17	1.73	1.56	1.27	31.74	30.47
Construction	2,830	6,304	7,801	1.13	1.83	2.02	6.35	1.79	-4.56	3.88	3.87	0.00
Manufacturing	67,124	75,002	59,775	26.83	21.74	15.51	0.86	-1.87	-2.73	8.79	-39.39	-48.18
Wholesale Trade	4,167	9,600	14,690	1.67	2.78	3.81	6.63	3.61	-3.02	6.06	13.17	7.10
Retail Trade	9,018	14,794	23,769	3.60	4.29	6.17	3.88	4.03	0.15	6.45	23.21	16.77
Transportation and warehousing	22,310	31,592	40,069	8.92	9.16	10.39	2.71	2.00	-0.71	10.36	21.93	11.57
Information and cultural industries	11,437	21,154	25,186	4.57	6.13	6.53	4.84	1.46	-3.38	10.84	10.43	-0.41
FIRE	49,330	85,964	84,212	19.72	24.92	21.85	4.36	-0.17	-4.54	40.89	-4.53	-45.42
Professional, scientific and technical services	546	6,018	10,110	0.22	1.74	2.62	20.27	4.42	-15.85	6.11	10.59	4.48
ASWMRS	415	1,126	3,512	0.17	0.33	0.91	7.98	9.95	1.96	0.79	6.17	5.38
Arts, entertainment and recreation	2,308	4,980	6,960	0.92	1.44	1.81	6.10	2.83	-3.27	2.98	5.12	2.14
Accommodation and food services	7,795	9,241	10,652	3.12	2.68	2.76	1.32	1.19	-0.13	1.61	3.65	2.04
Other private services	2,909	5,137	6,146	1.16	1.49	1.59	4.47	1.51	-2.96	2.49	2.61	0.12

Source: CSLS Calculation based on Statistics Canada Data (CANSIM 031-0002)

Table 7: Net Capital Stocks by Business Sector Industry (two-digit NAICS), Rest of Canada, 1987, 2000 and 2012

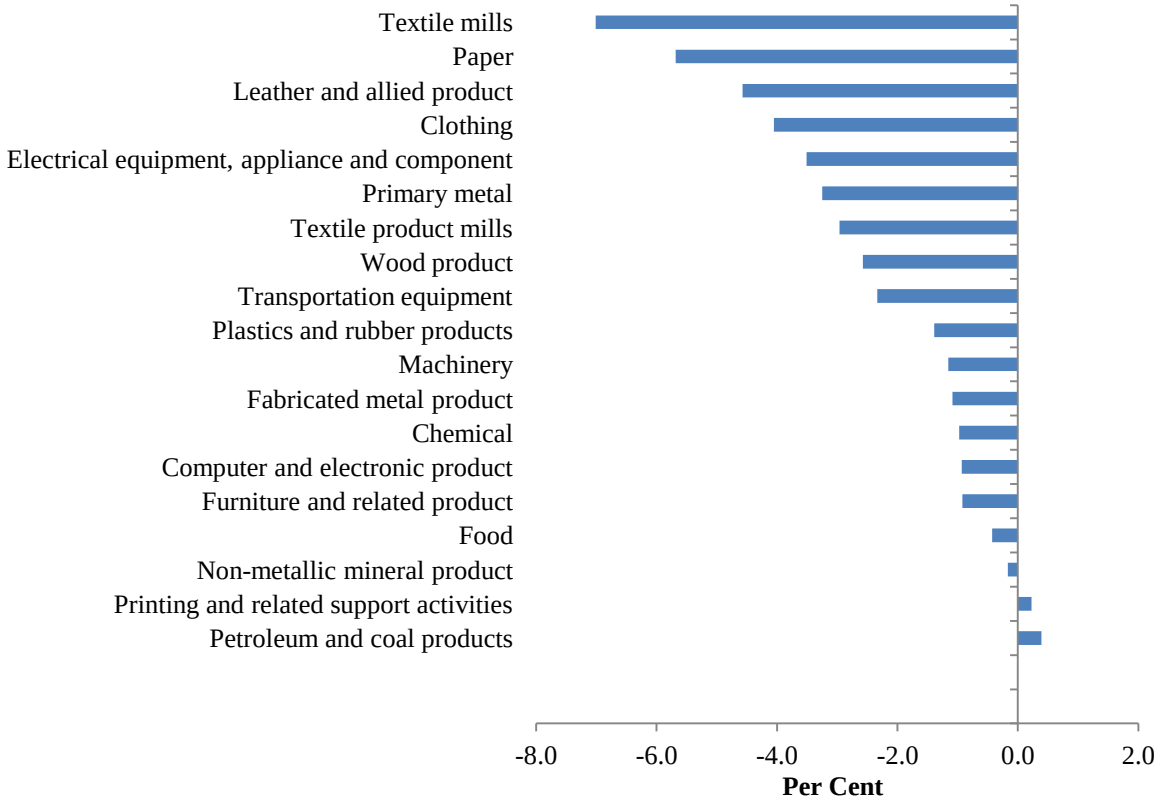
	Levels (Millions, 2007 dollars)			**Shares of Business Sector (Per Cent)**			**Growth Rate (Per Cent)**			**Contributions to Change (Per Cent)**		
	1987	2000	2012	1987	2000	2012	1987-2000	2000-2012	Change in Growth Rate	1987-2000	2000-2012	Changes in Contribution
Business sector industries	534,559	692,274	959,816	100.00	100.00	100.00	2.01	2.76	0.75	100.00	100.00	
Agriculture, forestry, fishing and hunting	38,904	36,678	35,214	7.28	5.30	3.67	-0.45	-0.34	0.11	-1.53	-0.55	0.98
Mining and oil and gas extraction	117,098	158,096	323,243	21.91	22.84	33.68	2.34	6.14	3.81	28.20	61.88	33.68
Utilities	120,381	119,537	154,096	22.52	17.27	16.05	-0.05	2.14	2.19	-0.58	12.95	13.53
Construction	6,141	8,722	17,029	1.15	1.26	1.77	2.74	5.73	3.00	1.78	3.11	1.34
Manufacturing	70,061	89,305	82,906	13.11	12.90	8.64	1.88	-0.62	-2.50	13.24	-2.40	-15.63
Wholesale Trade	5,538	12,772	20,193	1.04	1.84	2.10	6.64	3.89	-2.75	4.98	2.78	-2.20
Retail Trade	13,864	25,299	39,864	2.59	3.65	4.15	4.74	3.86	-0.87	7.87	5.46	-2.41
Transportation and warehousing	56,559	73,269	88,783	10.58	10.58	9.25	2.01	1.61	-0.40	11.49	5.81	-5.68
Information and cultural industries	20,633	31,866	34,219	3.86	4.60	3.57	3.40	0.60	-2.80	7.73	0.88	-6.85
FIRE	71,463	98,384	102,485	13.37	14.21	10.68	2.49	0.34	-2.15	18.52	1.54	-16.98
Professional, scientific and technical services	839	6,491	15,674	0.16	0.94	1.63	17.04	7.62	-9.42	3.89	3.44	-0.45
ASWMRS	766	1,942	5,636	0.14	0.28	0.59	7.42	9.29	1.87	0.81	1.38	0.58
Arts, entertainment and recreation	3,354	5,445	9,079	0.63	0.79	0.95	3.80	4.35	0.56	1.44	1.36	-0.08
Accommodation and food services	8,167	12,130	18,411	1.53	1.75	1.92	3.09	3.54	0.45	2.73	2.35	-0.37
Other private services	3,964	6,143	9,285	0.74	0.89	0.97	3.43	3.50	0.08	1.50	1.18	-0.32

Source: CSLS Calculation based on Statistics Canada Data (CANSIM 031-0002)

3.3.3 Three-digit Manufacturing Industries

Chart 14 provides a breakdown of the growth in net capital stock for all three-digit NAICS manufacturing industries. The most striking observation is the overwhelming downward trend: with the exception of printing and related support activities and petroleum and coal products manufacturing, all industries saw their net capital stock diminish between 2000 and 2012. Within the textile mills industry, the sector with the most intense decrease in net capital stock, this decline occurred at a rate of 7.0 per cent per year.

Chart 14**:** Annual Growth in Net Capital Stocks, Manufacturing Industries (three-digit NAICS), Ontario, 2000-2012



Source: CSLS calculations based on Statistics Canada data
Note: Data for the miscellaneous manufacturing and beverage and tobacco, leather and allied product manufacturing industries were suppressed to meet the confidentiality requirements of the Statistics Act.

Table 8: Net Capital Stocks by Manufacturing Industry (three-digit NAICS), Ontario, 1987, 2000 and 2012

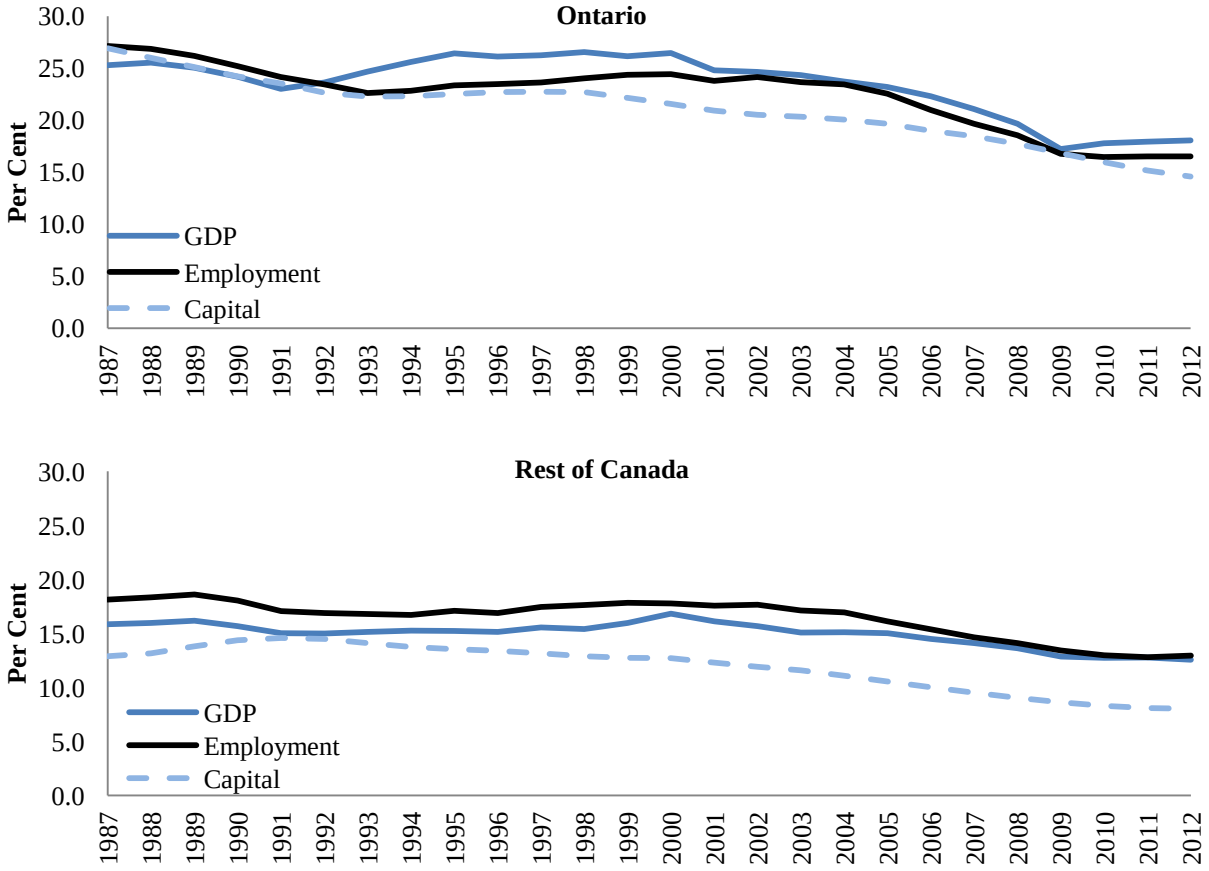
	Levels (Millions, 2007 dollars)			Shares of Business Sector (Per Cent)			Growth Rate (Per Cent)			Contributions to Change (Per Cent)		
	1987	2000	2012	1987	2000	2012	1987-2000	2000-2012	Change in Growth Rate	1987-2000	2000-2012	Changes in Contribution
Manufacturing	67,124	75,002	59,775	100.00	100.00	100.00	0.86	-1.87	-2.73	100.00	100.00	0.00
Food manufacturing	4,569	4,958	4,710	6.81	6.61	7.88	0.63	-0.43	-1.06	4.94	1.63	-3.30
Textile mills	1,359	1,188	497	2.03	1.58	0.83	-1.03	-7.01	-5.98	-2.18	4.54	6.72
Textile product mills	270	198	138	0.40	0.26	0.23	-2.35	-2.96	-0.62	-0.91	0.39	1.31
Clothing manufacturing	286	262	159	0.43	0.35	0.27	-0.66	-4.05	-3.39	-0.30	0.67	0.97
Wood product manufacturing	1,033	1,288	942	1.54	1.72	1.58	1.71	-2.57	-4.29	3.24	2.27	-0.97
Paper manufacturing	4,562	4,981	2,468	6.80	6.64	4.13	0.68	-5.68	-6.36	5.32	16.50	11.18
Printing and related support activities	999	1,071	1,100	1.49	1.43	1.84	0.53	0.23	-0.31	0.91	-0.19	-1.10
Petroleum and coal products manufacturing	2,930	1,959	2,053	4.37	2.61	3.44	-3.05	0.39	3.44	-12.33	-0.62	11.71
Chemical manufacturing	10,189	9,337	8,304	15.18	12.45	13.89	-0.67	-0.97	-0.30	-10.82	6.78	17.60
Plastics and rubber products manufacturing	2,067	3,052	2,581	3.08	4.07	4.32	3.04	-1.39	-4.43	12.50	3.10	-9.40
Non-metallic mineral product manufacturing	2,304	2,187	2,144	3.43	2.92	3.59	-0.40	-0.17	0.23	-1.48	0.28	1.76
Primary metal manufacturing	10,736	8,322	5,601	15.99	11.10	9.37	-1.94	-3.25	-1.31	-30.64	17.87	48.51
Fabricated metal product manufacturing	3,534	3,430	3,008	5.26	4.57	5.03	-0.23	-1.09	-0.86	-1.32	2.77	4.09
Machinery manufacturing	2,454	3,525	3,067	3.66	4.70	5.13	2.83	-1.15	-3.98	13.60	3.01	-10.59
Computer and electronic product manufacturing	3,162	4,090	3,655	4.71	5.45	6.11	2.00	-0.93	-2.93	11.78	2.86	-8.92
Electrical equipment, appliance and component manufacturing	1,430	1,723	1,123	2.13	2.30	1.88	1.44	-3.51	-4.95	3.72	3.94	0.23
Transportation equipment manufacturing	12,900	20,264	15,260	19.22	27.02	25.53	3.54	-2.34	-5.87	93.47	32.86	-60.61
Furniture and related product manufacturing	577	746	668	0.86	0.99	1.12	2.00	-0.92	-2.92	2.15	0.52	-1.63
Beverage and tobacco product, leather and allied product manufacturing	x	x	x	..	..	..	..	..	..	..	..	..
Miscellaneous manufacturing	x	x	x	..	..	..	..	..	..	..	..	..

Source: CSLS Calculation based on Statistics Canada data
Note: Data for the miscellaneous manufacturing and beverage and tobacco, leather and allied product manufacturing industries were suppressed to meet the confidentiality requirements of the Statistics Act.

3.4 Summary

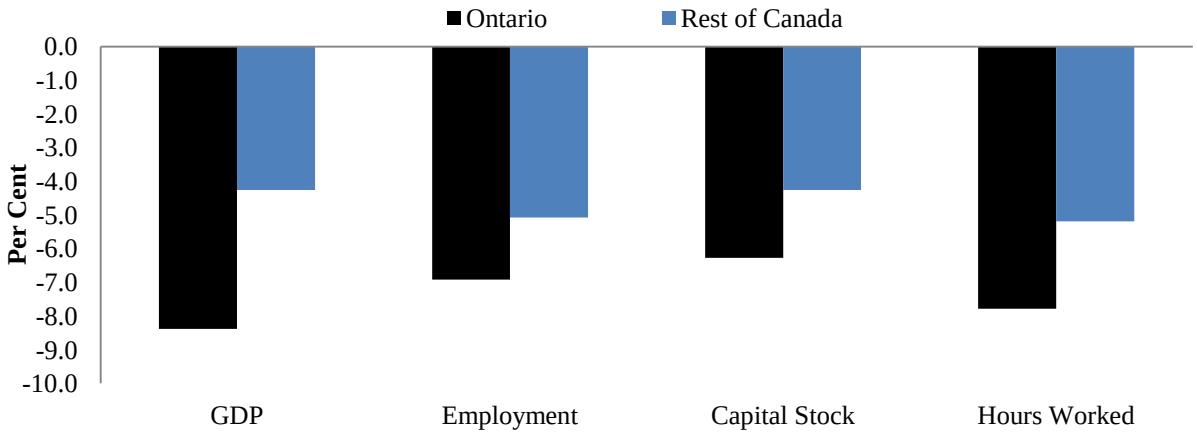
Chart 15 summarizes trends in manufacturing's share of business sector real output, employment, and net capital stock for Ontario and the ROC from 1987 to 2012. In both cases, the line becomes steeper after 2000, especially for Ontario. Indeed, it is likely that in no earlier decade has Ontario experienced such a decline in the relative importance of a major sector. And it is not just in relative terms, but in absolute terms that the province's manufacturing sector has declined significantly. Chart 16 reveals that, while the manufacturing industry's share of business sector GDP, employment and capital stock has fallen, this decline was significantly more pronounced in Ontario than it was for the rest of Canada.

Chart 15: GDP, Employment and Net Capital Stock Shares of Business Sector, Manufacturing Industries, 1987-2012



Source: CSLS calculations based on Statistics Canada data

Chart 16: Changes in Manufacturing Sector GDP, Employment, and Capital as Shares of Business Sector for Ontario and the Rest of Canada, 2000 and 2012



Source: CSLS calculations based on Statistics Canada data

4. Productivity Trends in Ontario

This section of the report provides a detailed examination of labour, capital and multifactor productivity growth rates and levels in Ontario and the ROC. The first part examines labour productivity trends at the business sector, the two-digit NAICS level and the three-digit NAICS level, with comparisons made to OECD countries for the aggregate economy and with the Great Lake States for two-digit industries. The second part looks at capital productivity at the business sector and two-digit NAICs level. The third section examines multifactor productivity trends at the business sector and two-digit level. Lastly, we will also perform a growth accounting exercise to determine how different factors are influencing labour productivity growth. Contributions to labour productivity growth were broken down into three factors: capital intensity, labour quality, and multifactor productivity.

4.1 Labour Productivity

4.1.1 Business Sector

4.1.1.1 Labour Productivity Growth

Labour productivity, defined as real GDP (at basic prices) per hour worked, in Ontario's business sector grew at a compound annual rate of 0.51 per cent between 2000 and 2012, below the national average of 0.77 per cent and the Canada excluding Ontario average of 0.98 per cent. Among the ten provinces, only Alberta had a worse performance (Chart 17, panel two).

Ontario's labour productivity performance in the 1987-2000 period was significantly stronger than in the 2000-2012 period. From 1987 to 2000, output per hour in the Ontario business sector advanced at an average annual rate of 1.89 per cent, above the national average of 1.77 per cent and the Canada excluding Ontario average of 1.48 per cent. The province enjoyed the fourth fastest labour productivity growth rate among the provinces, surpassed by only Saskatchewan, Newfoundland and Labrador, and Prince Edward Island (Chart 17, panel one).

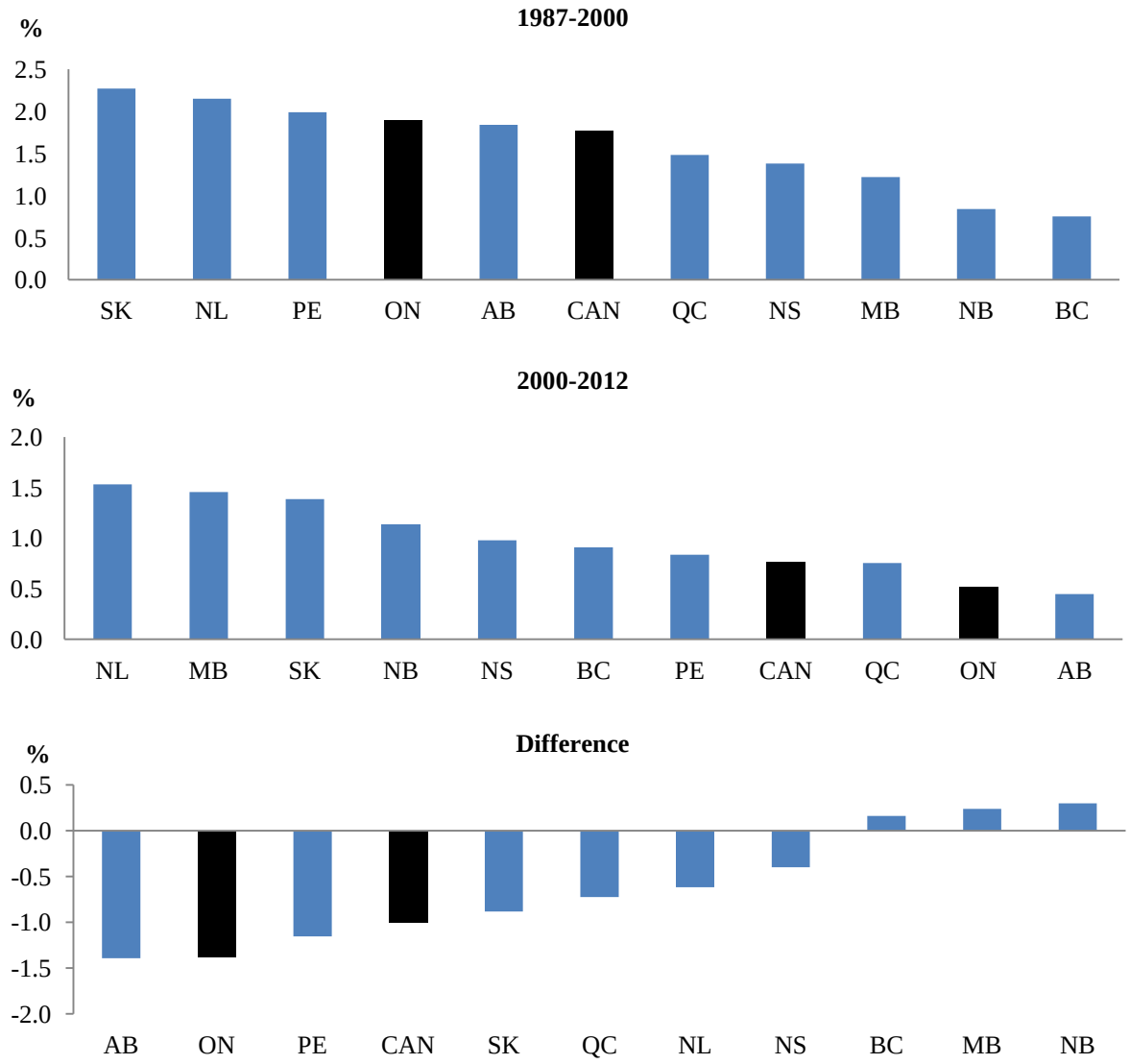
Given these respective trends, it is not surprising that Ontario had the second largest slowdown in labour productivity growth between the 1987-2000 and 2000-2012 periods, 1.38 percentage points (Chart 17, panel three). The national slowdown was 1.00 percentage point and that for Canada excluding Ontario was only 0.50 percentage point.

Being the largest province and having experienced the largest slowdown in labour productivity growth, Ontario accounted for 53.7 per cent of the slowdown in aggregate business sector labour productivity growth in Canada between 1987-2000 and 2000-2012 (Table 9). Following Ontario, Quebec and Alberta contributed 18.1 and 13.4 per cent to the slowdown in aggregate business sector labour productivity growth in Canada, respectively.

Chart 18 provides annual rates of business sector labour productivity growth for Ontario and the ROC from 2000 to 2012. Ontario had weaker labour productivity growth than the ROC

in eight of the thirteen years. Chart 18 also indicates that labour productivity growth in Ontario has slowed down significantly since 2007.

Chart 17: Labour Productivity Growth, Canada and Provinces, Business Sector



Source: CSLS Calculations based on Statistics Canada CANSIM Table 383-0011

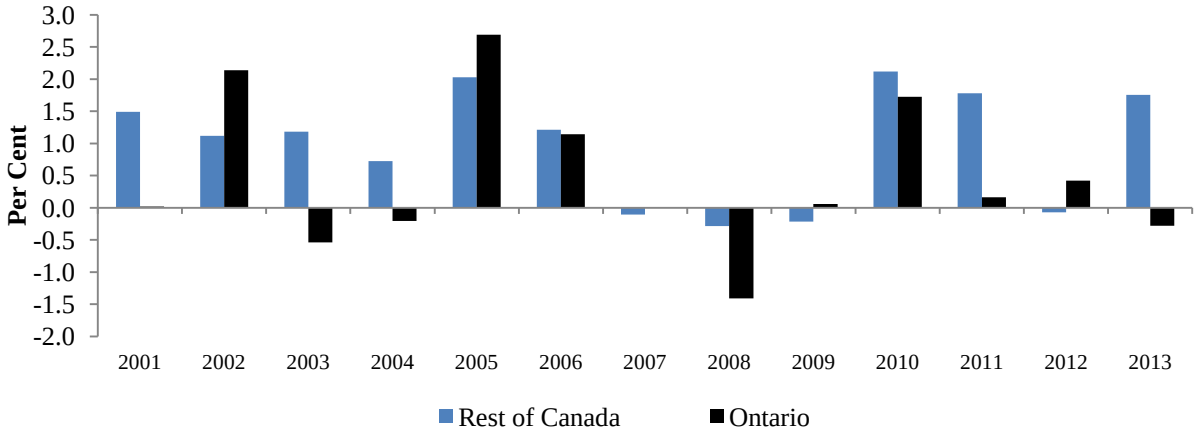
Table 9: Measuring Provincial Contributions to Aggregate Business Sector Labour Productivity Growth in Canada, 1987-2012

	Compound Annual Growth			Average Share of Hours Worked			Contribution to Canada's Growth			
	(Per Cent)	(Per Cent)	(Percentage Point)	(Per Cent)	(Per Cent)	(Percentage Point)	(Percentage Point)	(Percentage Point)	(Percentage Point)	(Per Cent)
	87-00	00-12	87-00 to 00-12	87-00	00-12	87-00 to 00-12	87-00	00-12	87-00 to 00-12	
Canada	1.77	0.77	-1.00	100.00	100.00	0.00	1.77	0.77	1.00	100.00
Newfoundland	2.15	1.53	-0.62	1.31	1.16	-0.15	0.03	0.02	0.01	1.04
Prince Edward Island	1.99	0.84	-1.16	0.39	0.38	-0.02	0.01	0.00	0.00	0.47
Nova Scotia	1.38	0.98	-0.40	2.66	2.49	-0.18	0.04	0.02	0.01	1.23
New Brunswick	0.84	1.14	0.30	2.19	2.04	-0.16	0.02	0.02	0.00	-0.48
Quebec	1.48	0.76	-0.72	24.71	24.23	-0.48	0.36	0.18	0.18	18.13
Ontario	1.89	0.51	-1.38	38.98	38.88	-0.10	0.74	0.20	0.54	53.68
Manitoba	1.22	1.46	0.24	3.70	3.37	-0.33	0.05	0.05	0.00	-0.39
Saskatchewan	2.27	1.39	-0.88	3.34	2.89	-0.45	0.08	0.04	0.04	3.56
Alberta	1.84	0.45	-1.39	10.12	11.71	1.59	0.19	0.05	0.13	13.35
British Columbia	0.75	0.91	0.16	12.59	12.86	0.27	0.09	0.12	-0.02	-2.27

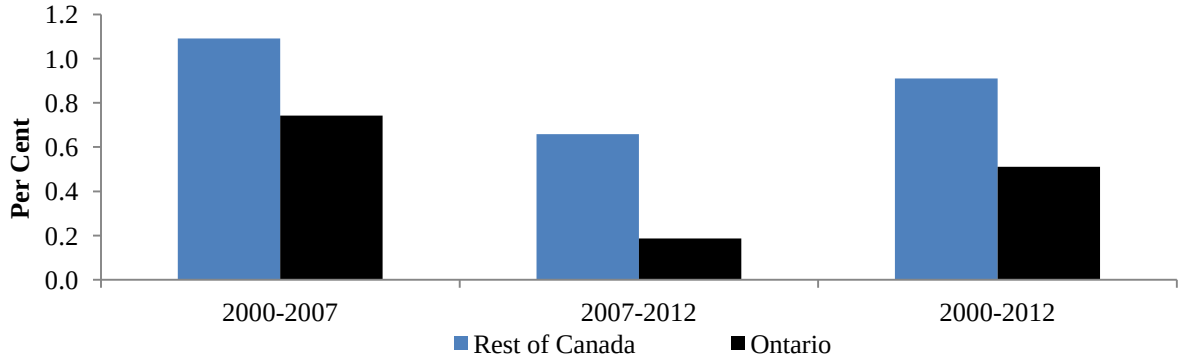
Source: CSLS calculations based on Statistics Canada data

Chart 18**:** Annual Real Labour Productivity Growth, Business Sector, Ontario and Rest of Canada, 2000-2012

(A) *Annual Growth Rates, Per Cent*



(B) *Compound Annual Growth Rates, Per Cent*



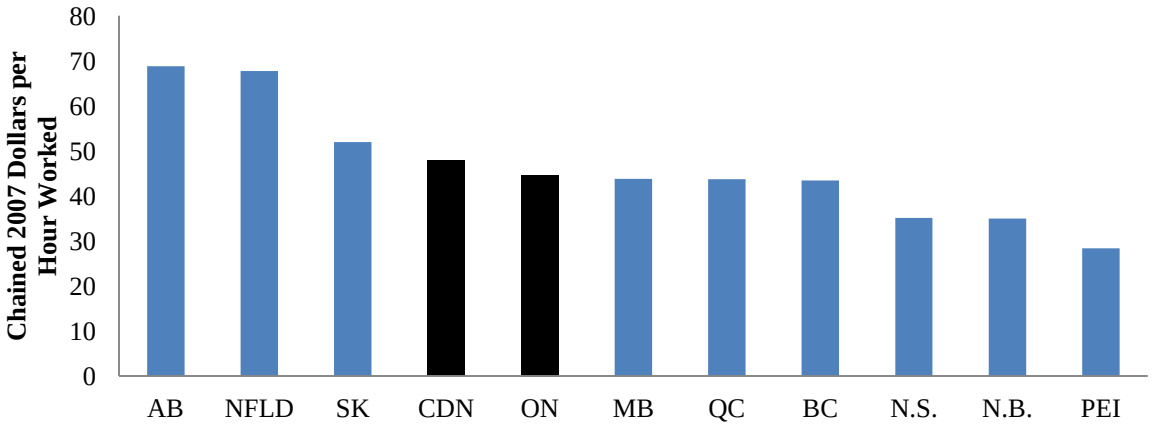
Source: CSLS calculations based on Statistics Canada data

4.1.1.2 Labour Productivity Levels

In absolute terms, the average value of output per hour worked in the Ontario business sector was $44.71 (2007 dollars) in 2012 (Chart 19). Ontario ranked fourth among the provinces, behind Alberta, Newfoundland and Labrador and Saskatchewan and below the national average of $47.82. The three oil-producing provinces – namely, Alberta, Newfoundland and Labrador, and Saskatchewan – were the most productive provinces. The high levels of value added per hour worked in oil and gas production raised the average labour productivity level for the oil-producing provinces, and, in turn, raised the national average for labour productivity.

Labour productivity levels by province, in absolute terms and relative to the national average, are sensitive to whether labour productivity is measured in nominal or real terms, and, if the latter, which reference or base year is used. This issue is explored in Box 1.

Chart 19: Real Labour Productivity Levels, Business Sector, Canada and Provinces, 2012

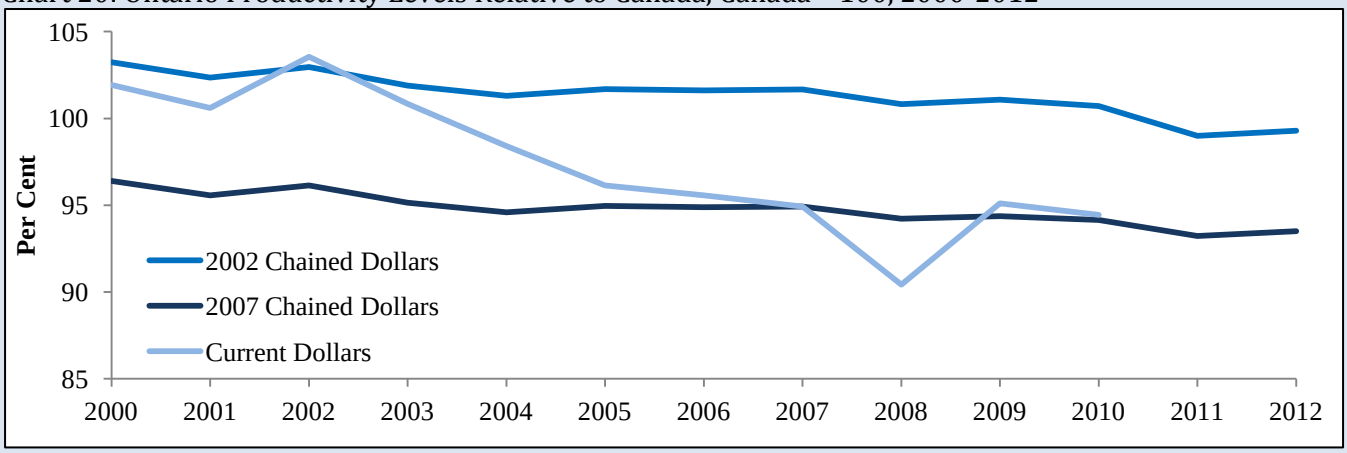


Source: CSLS calculations based on Statistics Canada data

Box 1: Comparing Productivity Levels Measured in 2002 and 2007 Chained Dollars

Labour productivity levels by province, in absolute terms and relative to the national average, are sensitive to whether labour productivity is measured in nominal or real terms, and if the latter, which reference or base year is used. Chart 20 illustrates the different results for Ontario's productivity level relative to Canada according to 2002 and 2007 chained dollars. We see that, when measured in 2002 dollars, Ontario's productivity levels are higher than those of Canada as a whole from 2000 to 2010, only dipping slightly below the national level in 2011 and 2012. On the other hand, Ontario's productivity levels, when measured in 2007 dollars, are roughly seven to eight percentage points lower than the national level overall.

Chart 20: Ontario Productivity Levels Relative to Canada, Canada – 100, 2000-2012

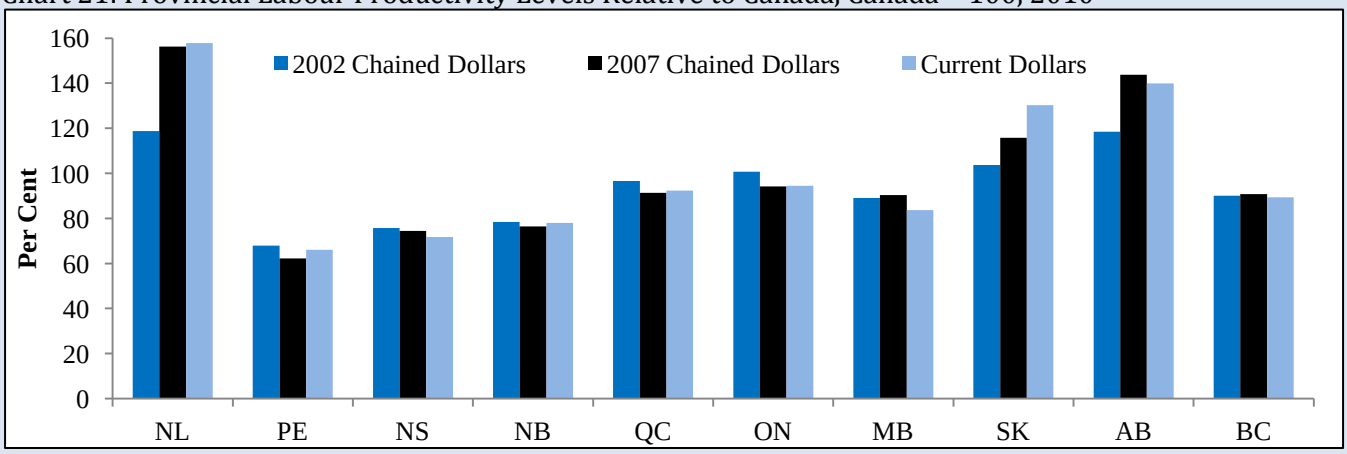


Source: CSLS calculations based on Statistics Canada data

Because the prices used as weights in the 2002 chained dollar figures differ from the prices used as weights in the 2007 chained dollar figures, the relative weight of some provinces' output will be depressed, while other provinces' weights increase. For example, the rise in oil prices between 2002 and 2007 would have increased the weight of oil within the 2007 basket of goods compared to the 2002 basket of goods, which favours the output (and consequently the productivity) levels of oil-producing provinces over provinces that specialize in other industries.

As we see in Chart 21, Ontario saw its relative productivity level fall between the 2002 and 2007 chained dollar estimates. However, Saskatchewan, Alberta, and to a greater extent Newfoundland and Labrador all saw their relative productivity greatly increase. This supports the idea that oil-producing provinces' productivity contribution is increased using the 2007 measure, which assigns oil a greater weight in the basket of goods.

Chart 21: Provincial Labour Productivity Levels Relative to Canada, Canada = 100, 2010



Source: CSLS calculations based on Statistics Canada data

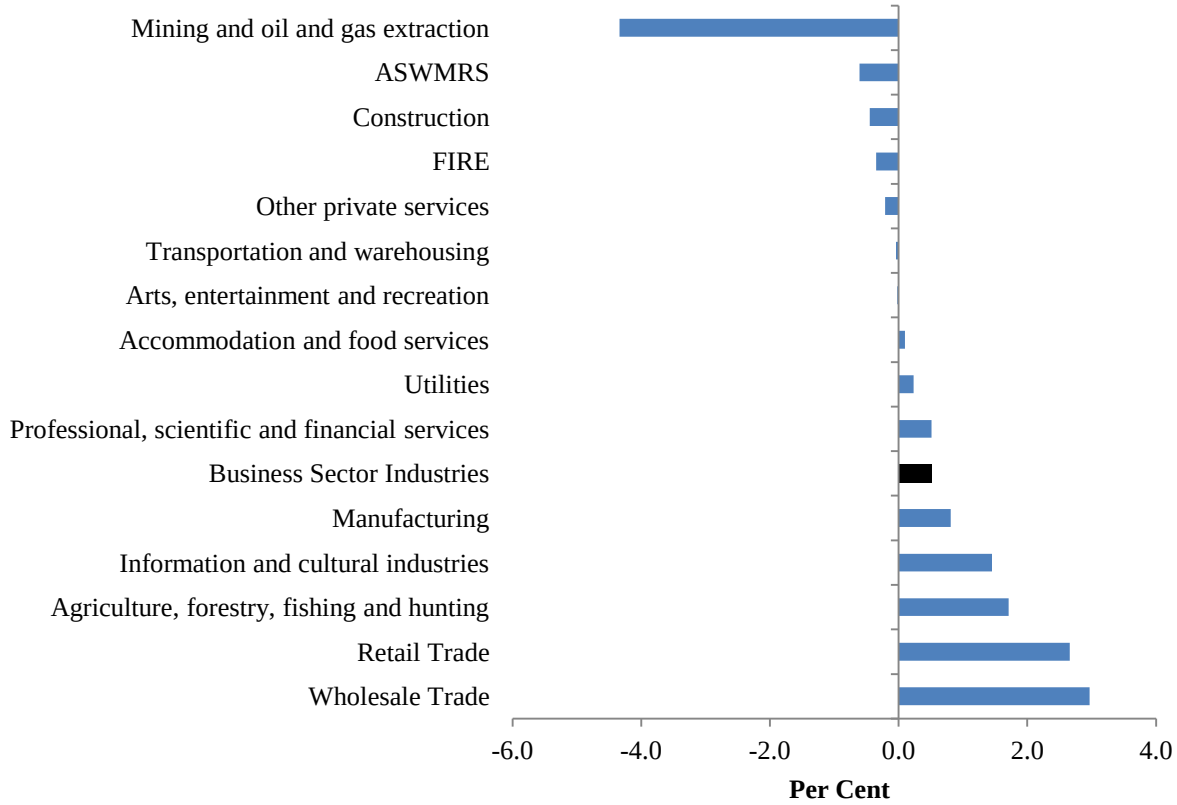
4.1.2 Two-Digit NAICS Industries

Table 10 provides estimates of labour productivity levels (2007 dollars) for two-digit NAICS business sector industries for Ontario in 1987 (the first year for which data are available), 2000, and 2012; industry levels relative to the Ontario business sector average and to the national industry average, and growth rates for the 1987-2000 and 2000-2012 periods, as well as changes between periods. Table 11 provides similar data for the ROC. This section will first discuss productivity growth rates and then productivity levels.

4.1.2.1 Labour Productivity Growth Rates

From 2000 to 2012, the two two-digit NAICS sectors in Ontario that experienced the highest labour productivity growth were wholesale trade (2.97 per cent per year) and retail trade (2.66 per cent per year) (Chart 22). The sector with the lowest growth rate was mining and oil and gas extraction (-4.34 per cent per year). Six other industries had negative labour productivity growth: ASWMRS (-0.61 per cent), construction (-0.45 per cent), FIRE (-0.35 per cent), other private services (-0.21 per cent), transportation and warehousing (-0.04 per cent), and arts, entertainment and recreation (-0.02 per cent).

Chart 22: Labour Productivity Growth, Business Sector, Ontario, 2000-2012



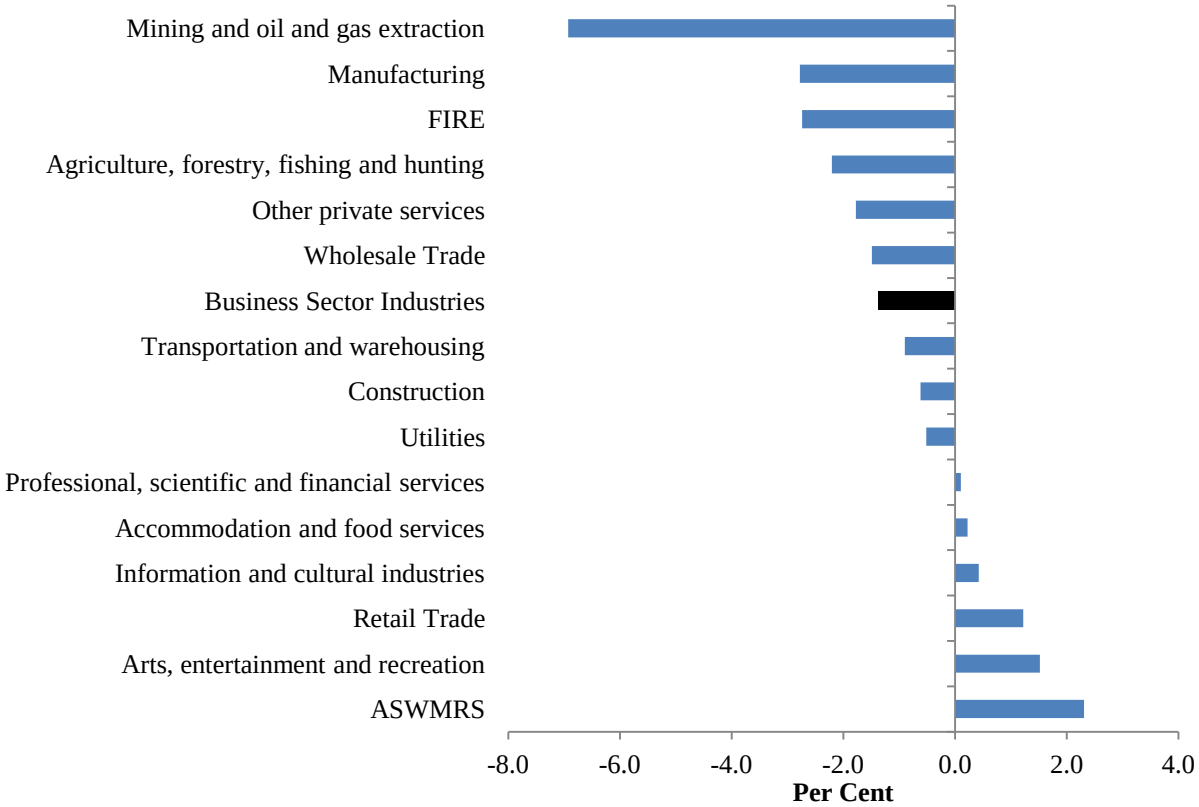
Source: CSLS calculations based on Statistics Canada data

Ontario's manufacturing labour productivity grew at a compound annual rate of 0.81 from 2000 to 2012, above the business sector average of 0.51 per cent and fifth strongest among fifteen two-digit NAICS industries. From this perspective, manufacturing productivity was not a drag on the province's aggregate labour productivity performance. However, relative to other provinces, Ontario's manufacturing productivity growth was weak, ranking eighth (Table 12).

As noted in the previous section, labour productivity growth in Ontario in the 2000-2012 period was characterized by its slow growth and the major deceleration from that experienced in the 1987-2000 period. Ten of fifteen two-digit NAICS industries experienced slower labour productivity growth after 2000. As shown in Chart 23, the largest fall-off was in mining (6.93 percentage points), followed by manufacturing (2.78 percentage points), and FIRE (2.74 percentage points). The labour productivity slowdown in manufacturing experienced by Ontario was the third largest of the ten provinces (Chart 24).

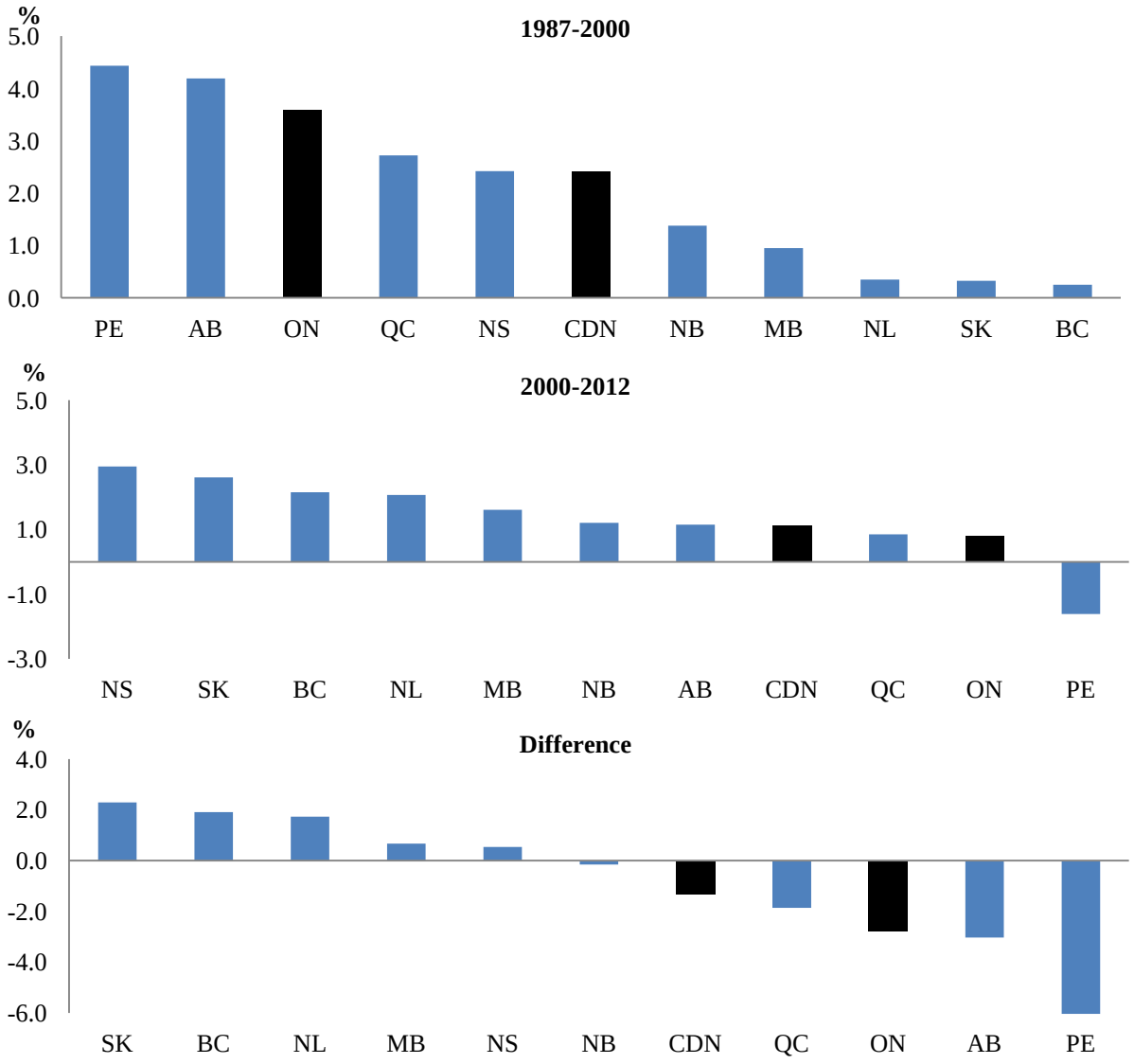
As we will demonstrate later in the report, the labour productivity growth slowdown experienced by manufacturing and FIRE from 1987-2000 to 2000-2012 drove the aggregate labour productivity growth slowdown.

Chart 23: Change in Labour Productivity Growth Rates between 1987-2000 and 2000-2012, Business Sector, Ontario



Source: CSLS calculations based on Statistics Canada data

Chart 24: Labour Productivity Growth, Manufacturing Sector, Canada and the Provinces



Source: CSLS calculations based on Statistics Canada data

4.1.2.2 Labour Productivity Levels

Table 10 shows that there are extremely large variations in labour productivity levels across industries in Ontario, reflecting differences in capital intensity, human capital intensity, and economic rent. In 2012, output per hour in mining and oil and gas extraction in Ontario was $153.78, over eight times the level in accommodation and food services ($18.87).

As noted earlier, output per hour in the Ontario business sector was only 93.5 per cent of the national average in 2012 due to the high productivity levels in the oil-producing provinces. Of the fifteen two-digit manufacturing industries, Ontario's labour productivity level exceeded the national average in six industries (Table 10).

The two-digit NAICS industry in Ontario with the highest labour productivity level relative to the national average was manufacturing. In 2012, output per hour in manufacturing in Ontario was 128.3 per cent of the national average, down from 135.2 per cent in 2000. The relative decline since 2000 reflected the slower manufacturing growth rate in Ontario relative to the national average (0.81 per cent versus 1.11 per cent). Ontario ranked second among the provinces in terms of its productivity level in manufacturing, the same as in 2012. Alberta was number one in both years.

Box 2: Sensitivity of Ontario's Labour Productivity Growth and Level Ranking to Industrial Structure

Provinces differ greatly in industrial structure. This means each province has two business sector ranks in terms of productivity growth rates and levels: an equally weighted rank and an industry composition weighted rank. The industry composition weighted rank, which will be referred throughout this report simply as the business sector rank, takes into account the province's output, labour input, and capital input, which is basically a sum of the output and inputs of the business sector industries in the province. Thus, it gives more weight to the sectors that comprise a more significant part of the province's economy. The equally weighted market sector rank attributes equal weight to all industries. Differences between the two rankings are often found in oil and gas producing provinces where that one sector raises the market-weighted ranking relative to the equally-weighted ranking.

As noted earlier, Ontario ranked ninth among the ten provinces for business sector labour productivity performance for the 2000-2012 period. However, as shown in Table 12, when the rankings of the fifteen two-digit industries are averaged and the growth rates of each industry given equal weight, Ontario falls to last. When market weights were used, the level of output per hour worked in Ontario's business sector ranked fourth in Canada in both 2000 and 2012. The ranking rises to third in both years when equally weighted ranks are used.

Table 10: Labour Productivity by Business Sector Industry (two-digit NAICS), Ontario, 1987, 2000 and 2012

	Levels (Chained 2007 Dollars)			Growth (Compounded Annually)			Relative to Business Sector (Business Sector = 100)			Relative to Canada (Canada = 100)		
	1987	2000	2012	1987-2000	2000-2012	Change	1987	2000	2012	1987	2000	2012
Business Sector Industries	32.97	42.05	44.71	1.89	0.51	-1.38	100.00	100.00	100.00	93.94	96.86	93.50
Agriculture, forestry, fishing and hunting	11.77	19.40	23.77	3.92	1.71	-2.21	35.71	46.13	53.18	74.02	83.81	73.35
Mining and oil and gas extraction	188.06	262.05	153.78	2.58	-4.34	-6.93	570.47	623.14	343.99	73.29	70.08	65.93
Utilities	111.92	123.39	126.89	0.75	0.23	-0.52	339.49	293.42	283.85	81.94	82.40	72.31
Construction	34.83	35.56	33.67	0.16	-0.45	-0.62	105.64	84.57	75.32	88.16	92.71	87.97
Manufacturing	30.79	48.67	53.59	3.58	0.81	-2.78	93.41	115.74	119.89	106.63	135.19	128.25
Wholesale Trade	22.27	39.30	55.84	4.46	2.97	-1.49	67.56	93.46	124.91	78.75	98.01	103.14
Retail Trade	17.52	21.10	28.90	1.44	2.66	1.22	53.15	50.18	64.65	91.91	101.18	103.97
Transportation and warehousing	34.17	38.20	38.00	0.86	-0.04	-0.90	103.65	90.83	85.00	111.51	106.09	92.20
Information and cultural industries	57.85	66.10	78.58	1.03	1.45	0.42	175.49	157.18	175.77	154.85	98.19	92.35
FIRE	63.44	86.21	82.64	2.39	-0.35	-2.74	192.44	205.00	184.85	109.09	104.91	101.16
Professional, scientific and financial services	38.84	40.96	43.53	0.41	0.51	0.10	117.81	97.40	97.38	121.82	107.61	103.14
ASWMRS	38.94	26.49	24.62	-2.92	-0.61	2.31	118.12	62.98	55.07	120.47	108.24	95.22
Arts, entertainment and recreation	29.34	23.98	23.93	-1.54	-0.02	1.52	88.99	57.02	53.53	110.26	99.79	101.75
Accommodation and food services	18.91	18.63	18.87	-0.11	0.10	0.22	57.37	44.31	42.20	101.83	101.07	98.42
Other private services	25.45	31.17	30.40	1.57	-0.21	-1.78	77.20	74.13	68.01	130.91	116.08	99.55

Source: CSLS calculations based on Statistics Canada data
*FIRE: Finance, insurance, rental and leasing
**ASWMRS: Administrative and support, waste management and remediation services

Table 11: Labour Productivity by Business Sector Industry (two-digit NAICS), Rest of Canada, 1987, 2000 and 2012

	Levels (Chained 2007 Dollars)			Growth (Compounded Annually)			Relative to Business Sector (Business Sector = 100)			Relative to Canada (Canada = 100)		
	1987	2000	2012	1987-2000	2000-2012	Change	1987	2000	2012	1987	2000	2012
Business Sector Industries	36.62	44.34	49.84	1.48	0.98	-0.50	100.00	100.00	100.00	104.35	102.14	104.24
Agriculture, forestry, fishing and hunting	17.43	24.33	35.61	2.60	3.22	0.63	47.60	54.87	71.44	109.61	105.13	109.86
Mining and oil and gas extraction	271.78	389.46	241.31	2.81	-3.91	-6.72	742.14	878.27	484.14	105.92	104.15	103.46
Utilities	151.44	162.82	207.56	0.56	2.04	1.48	413.52	367.19	416.42	110.87	108.74	118.27
Construction	43.26	40.10	40.67	-0.58	0.12	0.70	118.14	90.42	81.60	109.52	104.52	106.26
Manufacturing	37.15	43.31	51.39	1.19	1.44	0.25	101.45	97.67	103.11	128.65	120.29	122.98
Wholesale Trade	34.56	40.80	52.88	1.29	2.18	0.90	94.36	92.01	106.08	122.17	101.75	97.66
Retail Trade	20.08	20.69	27.17	0.23	2.30	2.06	54.83	46.67	54.51	105.32	99.23	97.74
Transportation and warehousing	28.96	34.99	43.08	1.47	1.75	0.28	79.08	78.91	86.43	94.50	97.19	104.53
Information and cultural industries	27.16	68.25	90.66	7.35	2.39	-4.95	74.16	153.91	181.89	72.69	101.38	106.55
FIRE	54.27	78.66	80.87	2.90	0.23	-2.66	148.20	177.39	162.25	93.33	95.73	99.00
Professional, scientific and financial services	27.04	35.54	41.19	2.13	1.24	-0.89	73.82	80.15	82.64	84.80	93.38	97.59
ASWMRS	27.67	22.89	26.99	-1.45	1.38	2.83	75.56	51.62	54.15	85.60	93.54	104.40
Arts, entertainment and recreation	24.31	24.07	23.25	-0.08	-0.29	-0.21	66.39	54.27	46.64	91.38	100.15	98.85
Accommodation and food services	18.40	18.32	19.33	-0.03	0.45	0.48	50.24	41.32	38.77	99.05	99.39	100.82
Other private services	16.25	24.56	30.63	3.23	1.86	-1.37	44.38	55.38	61.46	83.60	91.44	100.30

Source: CSLS Calculations based on Statistics Canada, CANSIM Table 383-0011 and 383-0029
*FIRE: Finance, insurance, rental and leasing
**ASWMRS: Administrative and support, waste management and remediation services

Table 12: Ontario's Provincial Ranking for Labour Productivity, Business Sector (two-digit NAICS), 2000-2012

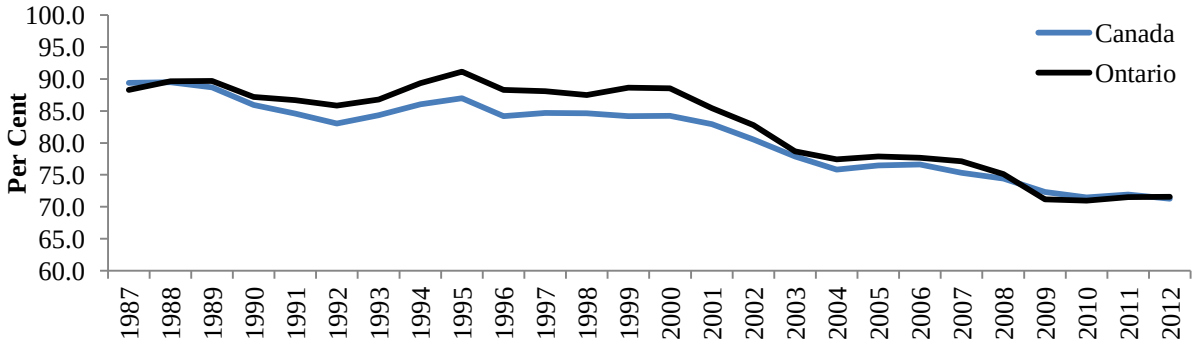
	2000-2012 Growth	2000 Levels	2012 Levels
Business sector industries	9	4	4
Agriculture, forestry, fishing and hunting	9	6	9
Mining and oil and gas extraction	6	7	7
Utilities	5	7	7
Construction	9	5	7
Manufacturing	8	2	2
Wholesale trade	3	4	4
Retail trade	6	3	3
Transportation and warehousing	7	4	5
Information and cultural industries	8	5	7
FIRE	9	2	2
Professional, scientific and technical services	7	2	2
ASWMRS	7	3	4
Arts, entertainment and recreation	3	5	2
Accommodation and food services	7	2	4
Other private services	10	1	3
Absolute Equally Weighted Average Rank	6.9	3.9	4.5
Equally-Weighted Business Sector Rank	10	3	3

4.1.3 Comparing Ontario with United States and the Great Lake States

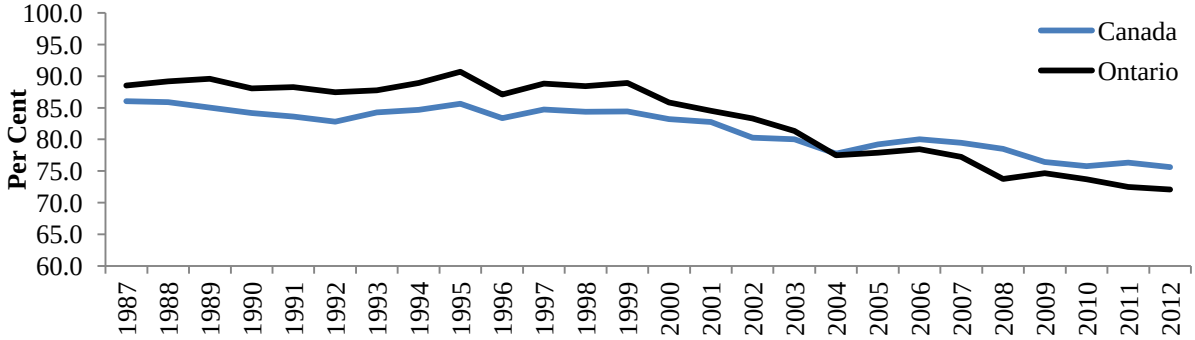
It is well known that Canada's labour productivity gap with the United States has widened significantly since 2000. This is also true for Ontario. Ontario's labour productivity gap with the United States has widened significantly between 1987 and 2012 (Chart 25). In real terms, labour productivity in Ontario's business sector declined relative to the United States from 88.3 per cent in 1987 to 71.6 per cent in 2012. In nominal terms, labour productivity in Ontario's business sector declined relative to the United States from 88.5 per cent in 1987 to 72.1 per cent in 2012. Although Ontario had a significantly smaller labour productivity gap than Canada as a whole in the 1990s, its advantage relative to the ROC diminished over the 2000-2012 period due to its slower rate of labour productivity growth. In fact, when measured in nominal terms, Ontario's labour productivity gap with the United States was larger than the Canadian average following 2004.

Chart 25: Relative Productivity Levels in the Business Sector, United States = 100, Canada and Ontario, 1987-2012

(A) Real



(B) Nominal



Source: CSLS Aggregate Income and Productivity Database

Table 13 presents estimates of labour productivity growth for the private sector and fourteen roughly comparable two-digit NAICS industries for Ontario, the United States and the eight Great Lake states (Illinois, Indiana, Michigan, New York, Ohio, Minnesota, Pennsylvania, and Wisconsin) for the 2000-2012 period. Because of methodological differences between Canada and the United States in the construction of real output and employment estimates at the state and provincial level, these estimates are exploratory in nature and should be interpreted with caution.

Turning first to a productivity comparison between Ontario and the United States, the following observations can be made:

- Ontario's business sector labour productivity growth was only one-third of the U.S. average over the 2000-2012 period: 0.51 per cent per year versus 1.63 per cent per year.

- Among the thirteen two-digit NAICS industries for which estimates are available for both countries, the United States outperformed Canada in eight industries in 2000-2012. The largest were in manufacturing (4.50 per cent versus 0.81 per cent), information (7.48 per cent versus 1.45 per cent), mining and logging (1.05 per cent versus -4.34 per cent), and financial services (2.18 per cent versus -0.35 per cent).

- Ontario outperformed the United States by a significant margin in other services (-0.21 per cent versus -2.10 per cent), wholesale trade (2.97 per cent versus 1.86 per cent) and retail trade (2.66 per cent versus 1.24 per cent).

With respect to our comparison of labour productivity growth rates between Ontario and the eight Great Lake states (Illinois, Indiana, Michigan, New York, Ohio, Minnesota, Pennsylvania, and Wisconsin), the key highlights are as follows:

- For the private sector, all eight Great Lake states had considerably stronger labour productivity growth than Ontario.

- Out of the thirteen industries for which data are available, each of the eight Great Lake states enjoyed higher labour productivity growth than Ontario in eight industries: mining and logging, manufacturing, transportation and utilities, information, financial activities, professional, scientific and technical services, ASWMRS, and arts, entertainment and recreation.

Table 14 presents estimates of labour productivity levels for the private sector and manufacturing for Canada, the United States and eight Great Lake states for 2000 and 2012.[12]

- In terms of PPP-adjusted estimates, Ontario's private sector labour productivity level of $74,773 per worker (2009 US dollars) in 2012 was well below that of the United States ($118,351) and that of all eight Great Lake states.

- Reflecting the higher private sector labour productivity growth in the United States than in Ontario over the 2000-2012 period (1.63 per cent versus 0.51 per cent per year), Ontario's private sector labour productivity relative to the United States fell from 73.6 per cent in 2000 to 63.2 per cent in 2012.

- Ontario's PPP-adjusted labour productivity level for manufacturing of $81,723 per worker (2009 US dollars) in 2012 was well below that of the United States ($157,895) and that of all eight Great Lake states.

- Again reflecting the higher manufacturing labour productivity growth in the United States than in Ontario over the 2000-2012 period (4.50 per cent per cent versus 0.81 per cent per year), Ontario's manufacturing labour productivity relative with the United States fell from 83.5 per cent in 2000 to 51.8 per cent in 2012.

[12] Because of methodological differences between Canada and the United States in the construction of real output and employment estimates at the state and province level, and the lack of official purchasing power parity (PPP) estimates at the industry level for Canada and the United States, these estimates are exploratory in nature and should be interpreted with even greater caution than the growth rate estimates.

Table 13: Compound Annual Labour Productivity Growth, U.S. and Great-Lake States, 2000-2012

	2000-2012 Growth Rate (Per Cent)									
	U.S.	**Illinois**	**Indiana**	**Michigan**	**Minnesota**	**New York**	**Ohio**	**Pennsylvania**	**Wisconsin**	**Ontario**
Mining and Logging**	1.05	1.08	1.45	3.18	5.05	-0.88	-0.89	-3.15	2.65	-4.34
Construction	-0.92	-1.71	-1.00	-3.29	-1.42	-1.06	-2.03	-2.14	-1.87	-0.45
Manufacturing	4.50	4.43	4.60	3.53	4.80	4.20	2.75	1.93	2.82	0.81
Wholesale Trade	1.86	2.13	2.00	1.74	2.33	2.54	2.38	2.61	2.08	2.97
Retail Trade	1.24	2.32	1.94	1.68	1.32	1.98	1.48	1.42	1.07	2.66
Transportation and Utilities**	0.66	1.13	1.20	1.24	1.65	1.13	0.84	0.15	1.41	-0.04
Information**	7.48	7.23	7.11	5.87	7.78	7.33	7.08	9.70	8.13	1.45
Financial Activities	2.18	1.53	1.72	0.21	1.46	2.67	0.73	2.39	1.23	-0.35
Professional, Scientific and Technical Service	1.08	1.40	1.73	0.60	1.69	1.18	1.27	1.26	1.58	0.51
ASWARS	2.73	2.58	1.87	1.45	2.09	1.88	2.78	1.53	1.44	-0.61
Leisure and Hospitality	..	0.76	0.15	0.71	0.06	0.53	0.42	0.56	0.67	..
Arts, Entertainment and Recreation	0.69	0.80	0.29	0.35	0.75	0.44	1.01	1.95	0.56	-0.02
Accommodation and Food Services	-0.59	0.85	0.40	1.03	-0.35	0.64	0.34	-0.20	0.68	0.10
Other Services	-2.10	-1.33	-1.28	-1.99	-1.94	-1.23	-1.88	-2.67	-2.03	-0.21
Total Private Sector***	1.63	1.40	1.72	0.86	1.55	1.50	0.97	1.07	1.40	0.51

Source: CSLS Calculations based on Bureau of Economic Analysis CES, and Bureau of Labour Statistics Data
*U.S. and the Great-Lake States labour productivity growth were derived from calculations based on per work basis
** These sectors are not comparable to Ontario's because the aggregation of these sectors is different
***Total Private Sector excludes government activities, which is comparable to Ontario's business sector

Table 14: Labour Productivity Comparison, United States, the Great Lake States, and Ontario, 2000 and 2012

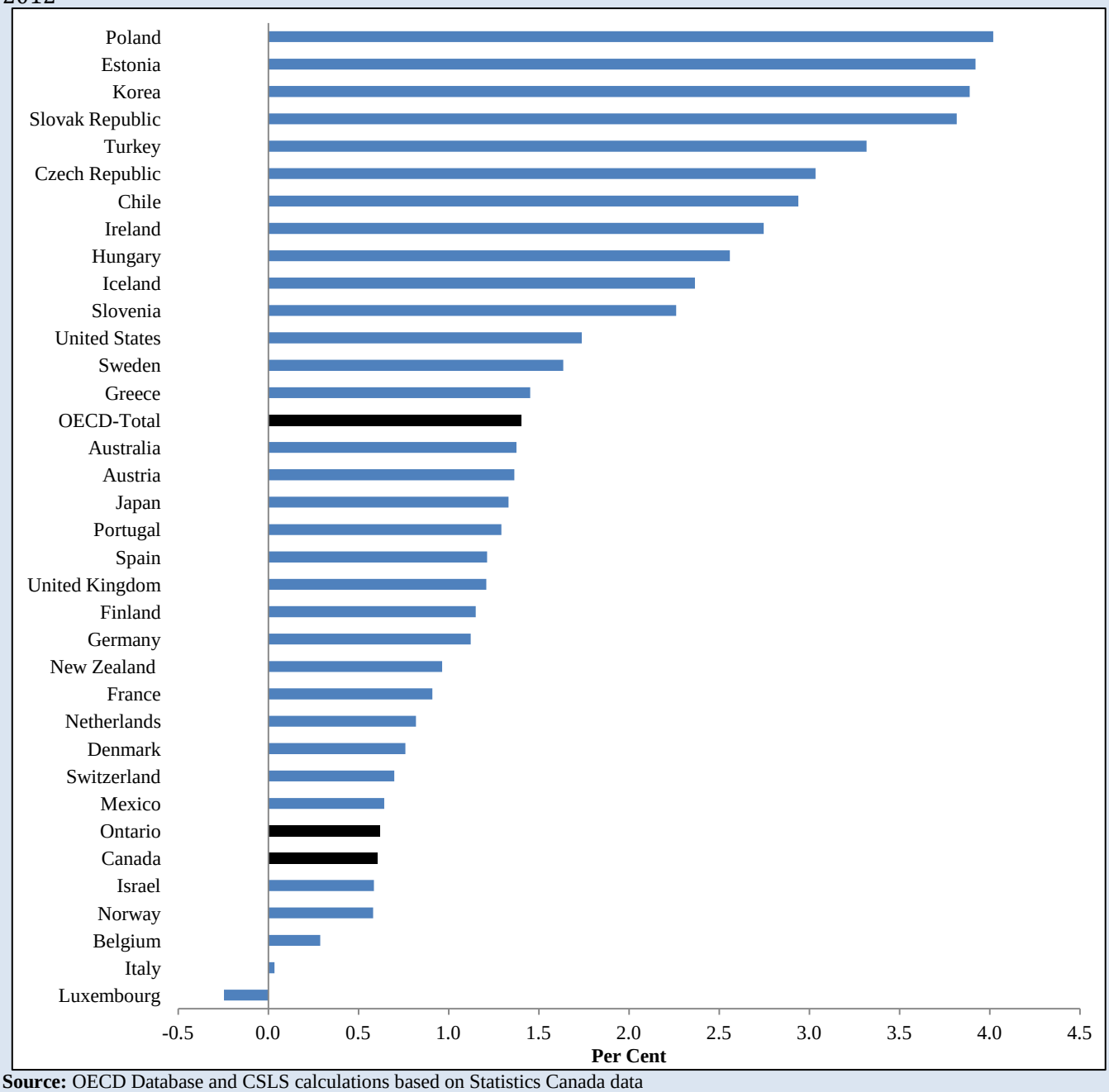
		Absolute Levels (Chained 2009 U.S. Dollars per Worker)				Relative to U.S. (Per cent)			
		Total Private Sector		Manufacturing		Total Private Sector		Manufacturing	
		2000	2012	2000	2012	2000	2012	2000	2012
U.S.		97,489	118,351	93,070	157,895	100.00	100.00	100.00	100.00
Illinois		92,624	109,408	81,505	137,127	95.01	92.44	87.57	86.85
Indiana		76,513	93,850	88,339	151,519	78.48	79.30	94.92	95.96
Michigan		82,449	91,341	78,261	118,694	84.57	77.18	84.09	75.17
Minnesota		82,485	99,247	69,941	122,800	84.61	83.86	75.15	77.77
New York		106,626	127,544	75,553	123,768	109.37	107.77	81.18	78.39
Ohio		78,493	88,169	82,458	114,209	80.51	74.50	88.60	72.33
Pennsylvania		81,606	92,734	85,063	107,024	83.71	78.36	91.40	67.78
Wisconsin		72,412	85,517	71,210	99,473	74.28	72.26	76.51	63.00
Ontario	*Adjusted for PPP*	71,790	74,773	77,740	81,723	73.64	63.18	83.53	51.76
	Adjusted for Market Exchange Rate	58,126	89,984	62,943	98,348	59.62	76.03	67.63	62.29
	Unadjusted (CDN Dollars)	86,339	89,927	93,495	98,286				

Source: CSLS Calculations based on Bureau of Economic Analysis CES, Bureau of Labour Statistics, and Statistics Canada Data
*Labour productivity is calculated on a per worker basis
**Adjusted using PPP data from OECD data, refer to appendix for data on PPP (Nominal GDP PPP 2009: 0.83 US/CAN)
***Adjusted using market exchange rate from UBC Sauder School of Business database (2000: 0.67 USD/CDN, 2012: 1.00 USD/CDN), refer to appendix for data on Market Exchange Rate

Box 3: Comparing Ontario's Productivity Performance with OECD Countries

In an international comparison with OECD countries, Ontario's total economy labour productivity growth is ranked 29th, at 0.62 per cent per year, behind the OECD average of 1.40 per cent per year. Ontario's productivity growth for the *total economy* is slightly ahead of that of Canada; this indicates that Ontario's non-business sector labour productivity must be growing at a faster rate than the national average in order to compensate for its lagging business sector labour productivity growth.

Chart 26: Average Annual Labour Productivity Growth, Total Economy, OECD Countries and Ontario, 2000-2012



Source: OECD Database and CSLS calculations based on Statistics Canada data

4.1.4 Three and Four-digit-NAICS Industries

4.1.4.1 Three-Digit Industries

Table 15 provides estimates of labour productivity levels (2007 dollars) for three-digit NAICS business sector industries for Ontario in 1987 (for selected industries), 2000 and 2012; industry levels relative to the Ontario business sector average and to the national industry average; and productivity growth rates for the 2000-2012 periods.

Between 2000 and 2012, only nine of nineteen manufacturing industries at the three-digit NAICS level experienced positive labour productivity growth, which is unsurprising given that total manufacturing labour productivity growth was a mere 0.81 per cent per year. Nonetheless, some manufacturing industries performed very well. The two industries that led in labour productivity growth over the period were primary metal and transportation equipment. Labour productivity in the primary metal industry grew at a compounded annual rate of 3.96 per cent. The transportation equipment industry grew at a compound annual rate of 2.88 per cent. Petroleum and coal products and paper also performed well, with labour productivity growth rates of 2.42 per cent and 1.66 per cent respectively.

On the other hand, labour productivity decreased by 5.41 per cent per year in beverage and tobacco, followed by 3.32 per cent per year in clothing and leather, 2.08 per cent per year in furniture, 1.44 per cent per year in textiles and 1.34 per cent per year in miscellaneous manufacturing.

4.1.4.2 Four-Digit Industries

Table 16 provides labour productivity levels in Ontario in 2000 and 2012 and growth rates for the 2000-2012 period for thirty-five four-digit manufacturing industries in descending order of productivity growth. The salient feature of this table is the diversity of labour productivity growth rates, ranging from a high of 11.64 per cent per year in spring and wire products to a low of -4.73 per cent per year in soap, cleaning compound and toilet preparation. The rapid productivity growth in primary metals is reflected in the average annual increase of 8.41 per cent in steel product manufacturing from purchased steel and the average annual advance of 2.98 per cent in iron and steel mills and ferro-alloy manufacturing. The robustness of productivity growth in transportation equipment was due to an average annual increase of 3.06 per cent in motor vehicle parts manufacturing, an average annual increase of 1.83 per cent in motor vehicle manufacturing and an average annual increase of 1.43 per cent in aerospace products and parts manufacturing.

Table 17 provides labour productivity levels for fourteen three-digit non-manufacturing NAICS industries for Ontario in 2000 and 2012 and growth rates for the 2000-2012 period. Again the diversity of productivity growth rate is large, from 7.44 per cent per year in support activities for agriculture and forestry and 7.29 per cent in waste management and remediation services to -4.87 per cent in support services for mining and oil and gas extraction and -5.00 per cent in forestry and logging.

Table 15: Labour Productivity by Manufacturing Sector Industry (three-digit NAICS), Ontario, 1987, 2000 and 2012

	Levels (Chained 2007 Dollars)			Growth (Compounded Annually)			Relative to Manufacturing (Manufacturing = 100)			Relative to Canada (Canada = 100)		
	1987	2000	2012	1987-2000	2000-2012	Change	1987	2000	2012	1987	2000	2012
Manufacturing	30.79	48.67	53.39	3.58	0.81	-2.78	100.00	100.00	100.00	106.63	135.19	128.25
Food manufacturing	..	52.89	51.58	..	-0.21	..	..	108.67	96.60	..	115.03	110.73
Beverage and tobacco product manufacturing	..	214.94	110.34	..	-5.41	..	..	441.64	206.66	..	179.68	103.70
Textile and textile product mills	38.95	40.55	34.06	0.31	-1.44	-1.75	126.48	83.32	63.80	120.06	105.91	90.68
Clothing and leather and allied product manufacturing*	..	32.21	21.47	..	-3.32	..	..	66.18	40.21	..	..	89.03
Wood product manufacturing	..	31.41	29.76	..	-0.45	..	..	64.54	55.74	..	92.99	65.57
Paper manufacturing	..	46.46	56.62	..	1.66	..	..	95.46	106.05	..	101.34	94.45
Printing and related support activities	42.23	41.49	44.86	-0.14	0.65	0.79	137.13	85.25	84.03	117.48	120.62	122.72
Petroleum and coal product manufacturing	..	93.37	124.35	..	2.42	..	..	191.83	232.92	..	50.52	70.87
Chemical manufacturing	..	69.69	65.87	..	-0.47	..	..	143.19	123.37	..	94.77	100.24
Plastics and rubber products manufacturing	..	36.07	42.92	..	1.46	..	..	74.10	80.39	..	100.77	101.41
Non-metallic mineral product manufacturing	..	42.97	42.57	..	-0.08	..	..	88.28	79.73	..	99.86	89.12
Primary metal manufacturing	37.53	55.30	88.17	3.03	3.96	0.94	121.89	113.63	165.14	..	93.23	92.79
Fabricated metal product manufacturing	..	37.56	36.74	..	-0.18	..	..	77.17	68.82	..	100.62	93.51
Machinery manufacturing	36.53	43.95	46.02	1.43	0.38	-1.05	118.63	90.31	86.19	105.81	108.85	90.98
Computer and electronic product manufacturing	..	47.38	48.54	..	0.20	..	..	97.34	90.91	..	81.39	98.88
Electrical equipment, appliance and component manufacturing	..	45.99	48.40	..	0.43	..	..	94.49	90.65	..	93.27	93.44
Transportation equipment manufacturing	..	53.95	75.83	..	2.88	..	..	110.86	142.03	..	101.11	113.83
Furniture and related product manufacturing	..	37.17	28.86	..	-2.08	..	..	76.36	54.06	..	114.48	108.18
Miscellaneous manufacturing	32.66	38.20	32.51	1.21	-1.34	-2.55	106.06	78.49	60.89	116.85	115.78	100.70

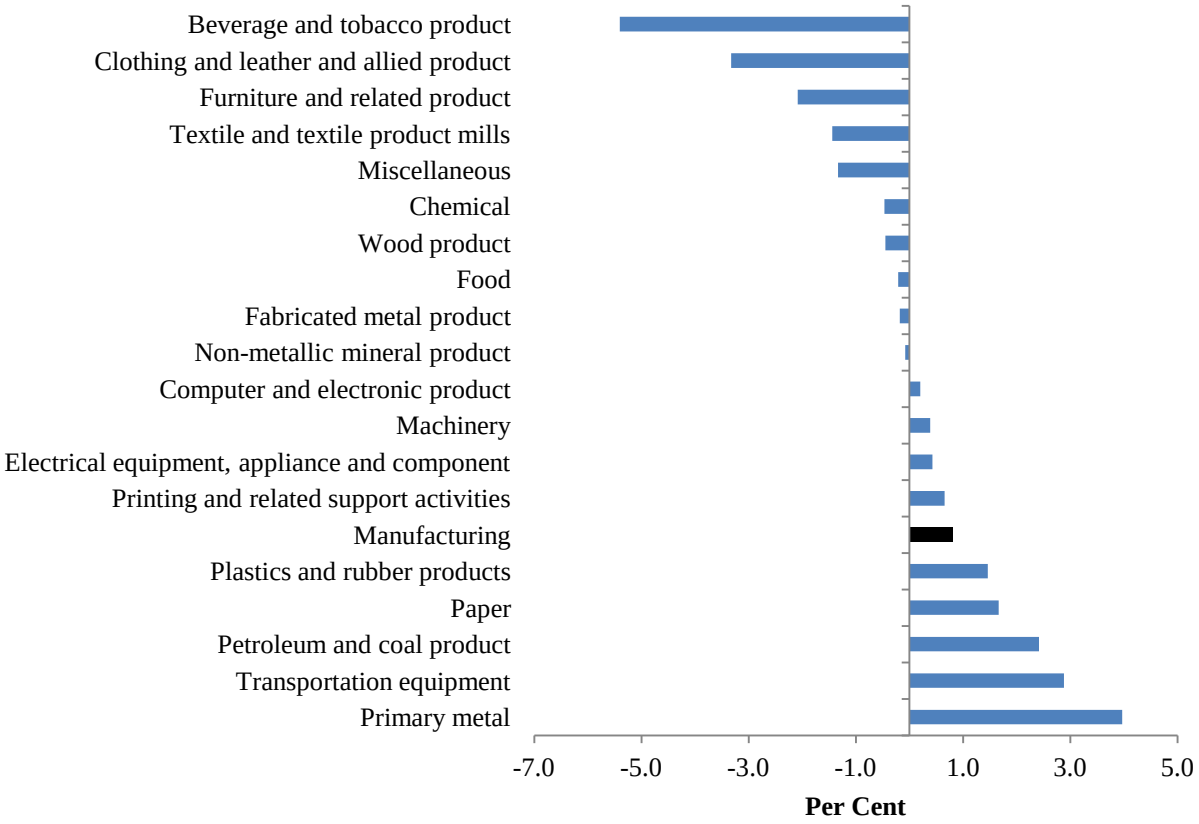
Source: CSLS Calculations based on Statistics Canada data CANSIM Table 379-0030 and 383-0030
*Data were imputed by calculation of the residual GDP in the manufacturing sector

Table 16: Labour Productivity for Select Manufacturing Industries (four-digit NAICS), Ontario, 2000-2012

	2000	2012	2000-2012 Growth Rate
	2007 Chained Dollars		Per Cent
Spring and wire product [3326]	12.24	45.89	11.64
Electric lighting equipment [3351]	16.52	48.91	9.47
Steel product from purchased steel [3312]	31.62	83.37	8.41
Rubber product [3262]	17.69	45.85	8.26
Hardware [3325]	22.75	47.58	6.34
Commercial and service industry machinery [3333]	43.37	78.31	5.05
Converted paper product [3222]	34.22	56.92	4.33
Pharmaceutical and medicine [3254]	39.79	58.35	3.24
Motor vehicle parts [3363]	41.88	60.15	3.06
Iron and steel mills and ferro-alloy [3311]	50.29	71.57	2.98
Computer and peripheral equipment [3341]	44.24	62.25	2.89
Medical equipment and supplies [3391]	34.51	47.83	2.76
Basic chemical [3251]	45.28	62.09	2.67
Household appliance [3352]	38.68	50.08	2.18
Motor vehicle [3361]	86.30	107.25	1.83
Aerospace product and parts [3364]	49.87	59.14	1.43
Communications equipment [3342]	52.65	58.42	0.87
Metalworking machinery [3335]	30.34	33.10	0.73
Plastic product [3261]	40.68	42.53	0.37
Forging and stamping [3321]	37.40	38.66	0.28
Veneer, plywood and engineered wood product [3212]	37.12	38.11	0.22
Architectural and structural metals [3323]	32.86	32.15	-0.18
Other electrical equipment and component [3359]	48.04	46.53	-0.26
Cement and concrete product [3273]	48.26	43.96	-0.77
Office furniture (including fixtures) [3372]	33.64	30.26	-0.88
Agricultural, construction and mining machinery [3331]	59.28	52.80	-0.96
Electrical equipment [3353]	58.08	48.96	-1.41
Pulp, paper and paperboard mills [3221]	69.11	57.99	-1.45
Machine shops, turned product, and screw, nut and bolt [3327]	46.02	38.43	-1.49
Sawmills and wood preservation [3211]	37.60	28.10	-2.40
Paint, coating and adhesive [3255]	92.31	67.45	-2.58
Coating, engraving, heat treating and allied activities [3328]	28.17	20.13	-2.76
Household and institutional furniture and kitchen cabinet [3371]	36.32	25.45	-2.92
Other miscellaneous [3399]	40.26	24.77	-3.97
Soap, cleaning compound and toilet preparation [3256]	134.88	75.40	-4.73

Source: CSLS Calculations based on Statistics Canada, CANSIM Table 379-0030 and 383-0030

Chart 27: Labour Productivity Growth, Manufacturing Industries (three-digit NAICS), Ontario, 2000-2012



Source: CSLS calculations based on Statistics Canada data

Table 17: Labour Productivity for Selected Industries (three-digit NAICS), Ontario, 2000-2012

	2000	2012	2000-2012 Growth Rate
	2007 Chained Dollars		Per Cent
Crop production [BS111]	23.52	33.82	3.07
Forestry and logging [BS113]	69.64	37.64	-5.00
Support activities for agriculture and forestry [BS115]	14.36	33.96	7.44
Mining and quarrying (except oil and gas) [BS212]	183.08	200.56	0.76
Support activities for mining and oil and gas extraction [BS213]	131.80	72.40	-4.87
Natural gas distribution, water, sewage and other systems [BS221A]	260.66	185.30	-2.80
Truck transportation [BS484]	26.89	30.63	1.09
Warehousing and storage [BS493]	28.43	26.62	-0.54
Publishing industries (except internet) [BS511]	42.06	58.88	2.84
Telecommunications [BS517]	74.61	105.87	2.96
Depository credit intermediation and monetary authorities [BS52B]	100.85	83.82	-1.53
Administrative and support services [BS561]	22.07	22.92	0.32
Waste management and remediation services [BS562]	29.22	67.95	7.29
Food services and drinking places [BS722]	19.09	16.38	-1.27

Source: CSLS calculations based on Statistics Canada data CANSIM Table 379-0030 and 383-0030

4.2 Capital Productivity

Capital productivity is defined as real GDP per unit of capital input. Capital input is determined by growth in net capital stock and changes in the composition (average asset lives) of capital stock. Assets with shorter lives such as computers produce more capital services per dollar invested than assets with longer asset lives, such as structures. Thus, a shift toward shorter-lived assets means that capital services grows at a faster rate than capital stock. With the increased importance on ICT in investment, this has in fact been the case in recent years.

Estimates of capital *services* for the Ontario business sector and two-digit NAICS industries are available from Statistics Canada in index form only from 1997 to 2010. This means that estimates for the 1989-1997 and 2011-2012 periods cannot be constructed. However, capital *stock* estimates are available for both periods. Given the importance of having as long a time series as possible, two sets of capital stock estimates for Ontario will be presented, the first for the 1997-2000 and 2000-2010 period based on capital services and the second for the 1987-2000 and 2000-2012 period based on capital stock.

4.2.1 Business Sector

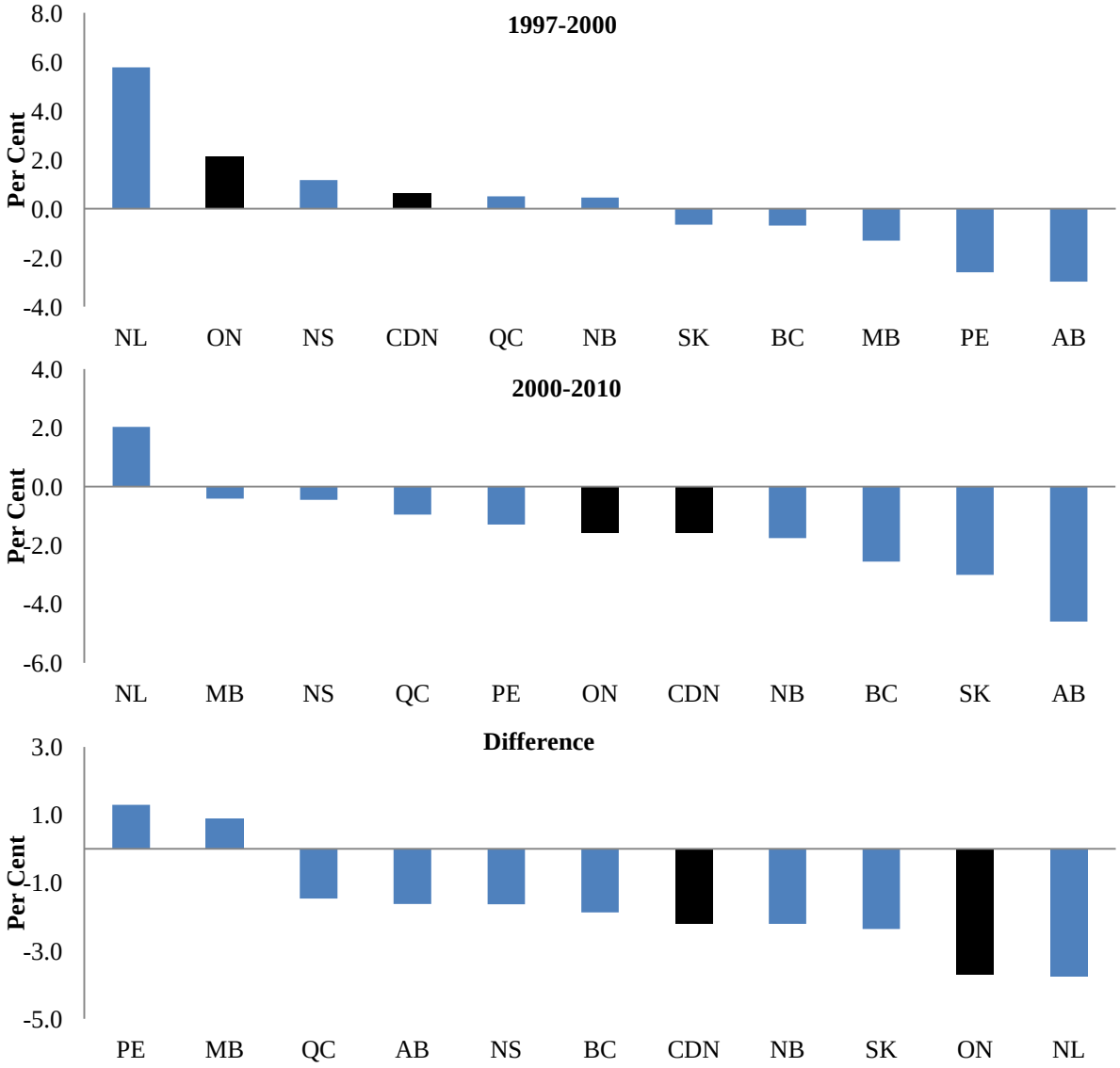
4.2.1.1 Capital-services based estimates

Capital productivity in the Ontario business sector advanced 2.12 per cent in the 1997-2000 period, well above the national average of 0.59 per cent and second among the provinces (only Newfoundland and Labrador had higher growth. During this period, output growth of 7.55 per cent per year significantly exceeded capital input growth of 5.32 per cent.

Capital productivity growth in Ontario's business sector actually fell 1.56 per cent per year from 2000 to 2010 (Chart 28) as capital input growth of 2.56 per cent outpaced output of 0.97 per cent growth (Table 18). Ontario's capital productivity growth rate was sixth among the provinces and slightly below the national average.

The divergent capital productivity growth in Ontario between 1997-2000 and 2000-2010 translated into a considerable slowdown in capital productivity growth, 3.68 percentage points, the largest experienced by any province except for Newfoundland and Labrador.

Chart 28: Capital Productivity Growth (Services-based), Business Sector, Canada and the Provinces



Source: CSLS calculations based on Statistics Canada data

Table 18: Capital Productivity Growth (Services-based), Business Sector, Ontario and Canada, 1997-2010

	Real GDP Growth			Capital Input Growth			Capital Productivity Growth		
	1997-2000	2000-2010	Change	1997-2000	2000-2010	Change	1997-2000	2000-2010	Change
	Ontario								
Business sector industries	7.55	0.97	-6.58	5.32	2.56	-2.76	2.12	-1.56	-3.68
Agriculture, forestry, fishing and hunting	5.39	0.34	-5.05	-0.27	-0.79	-0.53	5.68	1.13	-4.55
Mining and oil and gas extraction	2.66	-4.33	-6.99	-1.56	3.85	5.41	4.25	-7.88	-12.13
Utilities	-0.80	1.03	1.84	-1.06	2.60	3.65	0.28	-1.52	-1.80
Construction	6.15	2.59	-3.56	10.49	3.11	-7.38	-3.94	-0.50	3.45
Manufacturing	7.83	-2.93	-10.76	2.27	-0.63	-2.90	5.45	-2.34	-7.79
Wholesale trade	9.61	2.35	-7.26	3.74	5.12	1.38	5.68	-2.64	-8.32
Retail trade	6.70	3.26	-3.44	6.77	6.39	-0.38	-0.07	-2.95	-2.89
Transportation and warehousing	4.97	1.52	-3.45	5.00	3.27	-1.74	0.00	-1.70	-1.70
Information and cultural industries	12.36	2.89	-9.47	11.23	1.31	-9.92	1.02	1.56	0.54
FIRE	6.79	2.67	-4.12	8.80	2.98	-5.82	-1.85	-0.29	1.56
Professional, scientific and technical services	14.78	1.56	-13.22	21.79	3.05	-18.75	-5.73	-1.46	4.27
ASWMRS	7.90	2.76	-5.13	-0.03	10.16	10.19	7.88	-6.70	-14.57
Arts, entertainment and recreation	4.74	1.41	-3.33	4.06	2.19	-1.88	0.64	-0.77	-1.41
Accommodation and food services	7.64	-0.09	-7.73	-5.16	0.96	6.12	13.47	-1.05	-14.52
Other private services	5.83	1.95	-3.89	12.68	7.58	-5.10	-6.06	-5.23	0.83
	Canada								
Business sector industries	5.96	1.57	-4.38	5.33	3.41	-1.92	0.59	-1.78	-2.37
Agriculture, forestry, fishing and hunting	5.18	0.97	-4.21	0.48	0.51	0.03	4.68	0.46	-4.22
Mining and oil and gas extraction	1.94	0.74	-1.20	4.85	7.04	2.20	-2.77	-5.89	-3.12
Utilities	-0.17	1.17	1.33	-0.55	1.83	2.38	0.39	-0.65	-1.04
Construction	4.82	4.31	-0.52	5.11	4.98	-0.13	-0.27	-0.64	-0.37
Manufacturing	7.84	-1.94	-9.77	4.42	-0.27	-4.69	3.27	-1.67	-4.94
Wholesale trade	7.00	2.90	-4.11	5.87	3.59	-2.28	1.07	-0.67	-1.74
Retail trade	5.71	3.57	-2.15	5.59	4.63	-0.96	0.12	-1.02	-1.14
Transportation and warehousing	4.52	1.49	-3.02	8.08	2.42	-5.66	-3.30	-0.90	2.39
Information and cultural industries	9.40	3.23	-6.17	7.51	3.04	-4.47	1.76	0.18	-1.58
FIRE	4.64	2.71	-1.93	6.40	3.13	-3.28	-1.66	-0.40	1.26
Professional, scientific and technical services	11.63	2.43	-9.20	21.24	10.70	-10.54	-7.92	-7.47	0.46
ASWMRS	6.66	3.20	-3.46	11.36	9.61	-1.76	-4.22	-5.85	-1.62
Arts, entertainment and recreation	4.48	1.17	-3.31	10.59	5.11	-5.48	-5.52	-3.74	1.78
Accommodation and food services	4.34	0.93	-3.41	10.65	0.88	-9.76	-5.70	0.04	5.74
Other private services	3.78	2.09	-1.69	10.89	4.72	-6.17	-6.41	-2.52	3.90

Source: CSLS calculations based on Statistics Canada data

4.2.1.2 Capital-stock based estimates

Estimates of business sector capital productivity based on capital stock for the Ontario business sector are shown in Table 19 for the longer 1987-2000 and 2000-2012 periods. The differences with the capital productivity estimates presented above reflect both the different time periods covered and the different definitions of capital input. (In the 1997-2000 period, capital stock increased by 2.55 per cent compared to 5.32 per cent for capital services, while the respective figures for the 2000-2010 period were 0.93 per cent and 2.56 per cent).

Between 2000 and 2012, Ontario's capital productivity increased at a 0.30 per cent average annual rate, compared to a 0.83 per cent increase in 1987-2000. The decline of 0.53 points is smaller than the change between the 1997-2000 and 2000-2010 periods, reflecting Ontario's stronger economy during 1997-2000.

4.2.2 Two-digit NAICS Industries

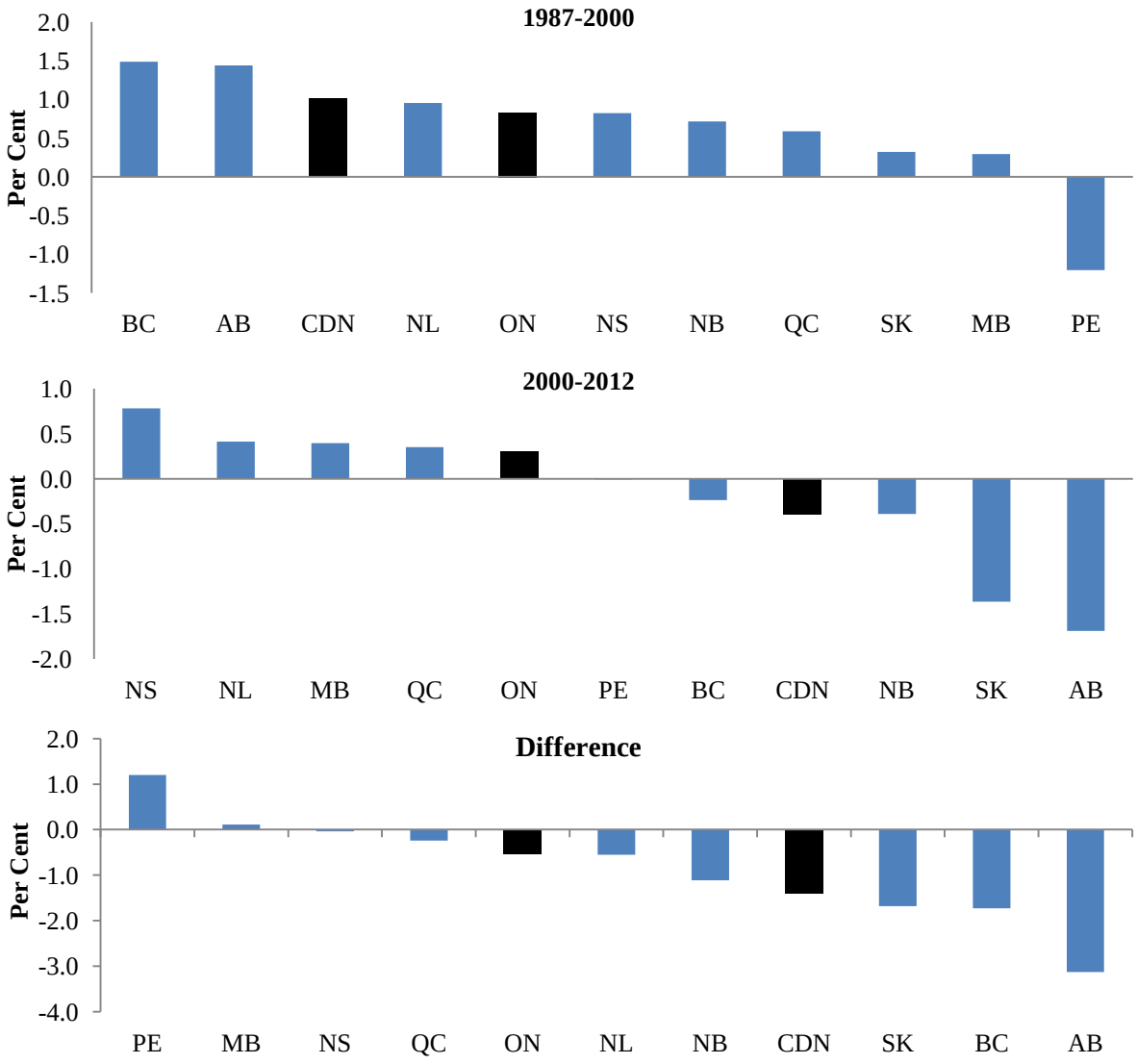
4.2.2.1 Capital-services based estimates

Table 18 provides estimates of the growth rates of real output, capital input based on capital services, and capital productivity for two-digit NAICS industries in Ontario for the 1997-2000 and 2000-2010 periods and changes between periods. In Ontario, thirteen of the fifteen industries experienced a fall in capital productivity in the 2000-2010 period. Ten of the fifteen industries experienced a fall in capital productivity growth between 1997-2000 and 2000-2010, with the exceptions being construction, information, FIRE, professional, scientific and financial services, and other private services. The largest declines were in ASWMRS, accommodation and food services, and mining and oil and gas extraction.

4.2.2.2 Capital-stock based estimates

Table 19 provides estimates of the levels of capital productivity in 1987, 2000 and 2012, for two-digit NAICS industries in Ontario and the ROC and growth rates for the 1987-2000 and 2000-2012 periods. In Ontario, ten of the fifteen industries experienced a fall in capital productivity in the 2000-2012 period. Eight of the fifteen industries experienced a fall in capital productivity growth between 1987-2000 and 2000-2012, with the exceptions being construction, retail trade, information, FIRE, professional, scientific and financial services, arts, entertainment and recreation, and other private services. The largest declines were in mining and oil and gas extraction and ASWMRS.

Chart 29: Capital Productivity Growth (Stock-based), Business Sector, Canada and the Provinces



Source: CSLS calculations based on Statistics Canada data

Table 19: Capital Productivity (Stock-based) by Business Sector, Ontario and the Rest of Canada, 1987, 2000, and 2012

	Levels (Chained 2007 Dollars)			Growth (CAGR, Per Cent)			Relative to Business Sector (Business Sector = 100)			Relative to Canada (Canada = 100)		
	1987	2000	2012	1987-2000	2000-2012	Change	1987	2000	2012	1987	2000	2012
	Ontario											
Business Sector Industries	0.96	1.07	1.11	0.83	0.30	-0.53	100.00	100.00	100.00	121.64	118.85	129.18
Agriculture, forestry, fishing and hunting	0.26	0.36	0.41	2.71	1.03	-1.67	26.94	34.24	37.36	77.11	82.10	80.17
Mining and oil and gas extraction	1.08	1.12	0.53	0.29	-6.03	-6.31	112.67	105.03	48.05	170.56	169.77	144.61
Utilities	0.15	0.15	0.15	0.02	-0.06	-0.07	16.15	14.53	13.92	101.25	88.20	95.84
Construction	8.56	3.85	4.34	-5.97	1.02	6.99	894.87	360.81	393.04	124.49	84.56	95.85
Manufacturing	0.93	1.31	1.29	2.62	-0.13	-2.75	97.61	122.73	116.57	103.84	110.53	109.04
Wholesale Trade	3.07	2.85	2.55	-0.56	-0.91	-0.35	320.35	267.19	230.88	93.64	106.83	104.55
Retail Trade	1.88	1.55	1.33	-1.50	-1.26	0.25	196.81	145.14	120.25	92.55	108.80	100.90
Transportation and warehousing	0.58	0.56	0.54	-0.23	-0.37	-0.14	60.40	52.63	48.54	127.42	111.23	108.99
Information and cultural industries	0.75	0.71	0.84	-0.44	1.44	1.89	78.53	66.55	76.22	144.32	106.57	100.52
FIRE	0.80	0.77	1.02	-0.30	2.45	2.75	83.18	71.87	92.69	113.10	104.69	104.18
Professional, scientific and financial services	24.09	5.00	3.62	-11.40	-2.66	8.74	2517.48	468.71	327.24	126.88	104.03	114.21
ASWMRS	22.70	11.98	5.16	-4.80	-6.77	-1.98	2372.11	1123.86	467.10	141.56	129.60	118.90
Arts, entertainment and recreation	1.36	0.71	0.56	-4.90	-1.98	2.92	142.15	66.44	50.39	123.53	86.06	92.94
Accommodation and food services	0.99	1.10	0.99	0.79	-0.83	-1.63	103.47	102.96	89.82	71.07	85.20	91.68
Other private services	5.02	3.86	4.03	-2.01	0.36	2.37	524.85	361.90	364.45	107.22	88.53	100.36
	Rest of Canada											
Business Sector Industries	0.71	0.81	0.76	1.08	-0.61	-1.68	100.00	100.00	100.00	89.87	90.61	88.28
Agriculture, forestry, fishing and hunting	0.36	0.47	0.55	2.05	1.29	-0.76	51.08	57.89	72.63	108.01	105.83	106.51
Mining and oil and gas extraction	0.59	0.64	0.36	0.51	-4.62	-5.13	84.09	78.15	47.67	94.03	96.31	98.05
Utilities	0.15	0.18	0.16	1.53	-1.03	-2.56	21.47	22.75	21.63	99.45	105.30	101.78
Construction	6.10	5.06	4.62	-1.44	-0.75	0.69	863.15	622.18	611.46	88.71	111.16	101.90
Manufacturing	0.87	1.08	1.10	1.70	0.20	-1.50	122.56	132.76	146.23	96.32	91.15	93.48
Wholesale Trade	3.43	2.53	2.36	-2.32	-0.57	1.74	485.25	311.24	312.45	104.79	94.87	96.69
Retail Trade	2.13	1.35	1.31	-3.47	-0.24	3.23	301.80	165.98	173.45	104.85	94.85	99.46
Transportation and warehousing	0.40	0.48	0.47	1.32	-0.13	-1.46	57.22	59.06	62.53	89.18	95.16	95.94
Information and cultural industries	0.39	0.64	0.83	3.78	2.29	-1.50	55.56	78.34	110.54	75.43	95.64	99.62
FIRE	0.64	0.70	0.95	0.71	2.55	1.84	90.54	86.36	125.72	90.96	95.90	96.57
Professional, scientific and financial services	15.66	4.62	2.88	-8.96	-3.88	5.09	2215.82	568.92	380.85	82.50	96.26	90.83
ASWMRS	12.42	7.66	3.83	-3.66	-5.61	-1.95	1757.47	942.26	507.15	77.48	82.84	88.22
Arts, entertainment and recreation	0.92	0.93	0.63	0.04	-3.15	-3.19	130.55	114.18	83.63	83.81	112.75	105.41
Accommodation and food services	1.78	1.43	1.14	-1.64	-1.92	-0.28	251.48	176.37	150.27	127.61	111.27	104.81
Other private services	4.44	4.77	4.00	0.57	-1.46	-2.02	627.47	587.65	530.10	94.70	109.59	99.76

Source: CSLS calculations based on Statistics Canada data

4.3 Multifactor Productivity

Due to lack of data availability for 2011 and 2012 and before 1997 from Statistics Canada, multifactor productivity (MFP) estimates in this section will be provided only for the 1997-2000 and 2000-2010 periods.

4.3.1 Business Sector

4.3.1.1 MFP Growth Rates

MFP in Ontario fell by 0.58 per cent per year between 2000 and 2010 (Chart 30), as growth in capital services (2.56 per cent) exceeded that of output (1.01 per cent). It is interesting to note that Ontario, which ranked eighth among the provinces in terms of MFP growth in 2000-2010, actually outperformed the national average (-0.82 per cent). This situation is explained by the significant MFP declines in Saskatchewan and Alberta, given large capital investments in natural resource industries in these provinces.

In the 1997-2000 period, MFP advanced at a robust 2.84 per cent in the Ontario business sector, the third fastest of all provinces as output growth (8 per cent) greatly exceeded capital input growth (5 per cent).

Ontario experienced the second largest decline in MFP growth (-3.42 percentage points) among all provinces from 1997-2000 to 2000-2010.

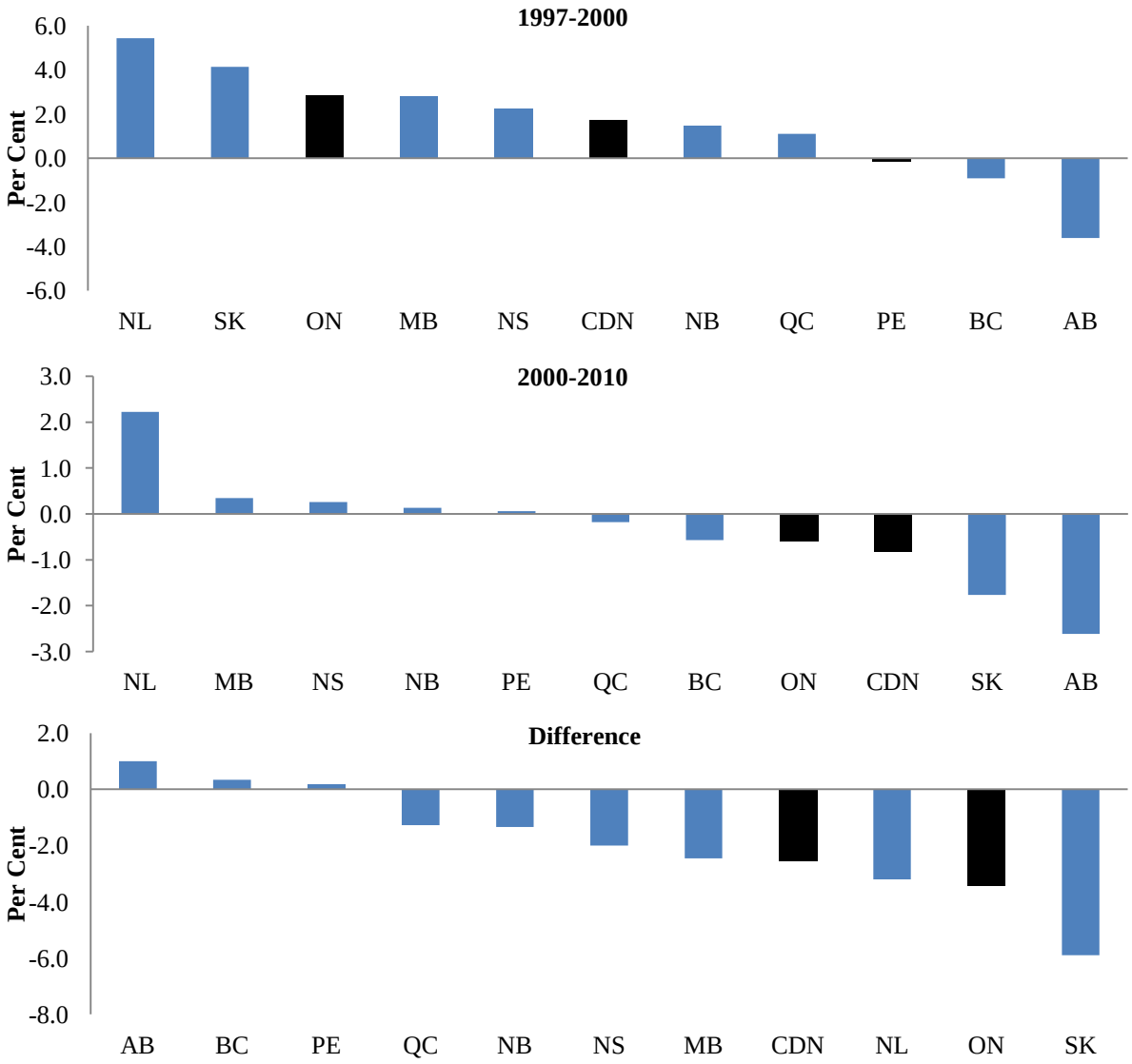
4.3.1.2 MFP Levels[13]

In terms of the level of business sector MFP, at 105.6 per cent of the national level, Ontario ranked first among the provinces in 2010 (Table 20).[14] Despite Ontario's negative MFP growth the province's relative MFP level and ranking improved from 2000 when Ontario was 104.3 per cent of the national average and ranked second; this is explained by the fact that the national MFP growth was even lower than that of Ontario over the 2000-2010 period.

[13] Absolute levels for partial productivity measures such as labour productivity and capital productivity can easily be calculated. However, an absolute level for MFP is not possible because one cannot aggregate units of labour (measured in hours) and units of capital stock (measured in dollars) into one input measure in level terms given that they are expressed in different units. Nevertheless, it is possible to calculate relative levels of MFP, which can be considered the weighted average of relative labour and capital productivity levels, where the weights are the income shares of labour and capital.

[14] When the two-digit industries are equally weighted, Ontario falls to second place for the business sector MFP level in 2010.

Chart 30: Multifactor Productivity Growth, Business Sector, Canada and Provinces



Source: CSLS calculation based on Unpublished Statistics Canada Estimates

4.3.2 Two-digit NAICS Industries

4.3.2.1 MFP Growth Rates

Table 20 provides MFP level estimates for Ontario relative to Canada at the business sector level and the two-digit NAICS industry level for 2000 and 2010; growth rates for Ontario and Canada for the 1997-2000 and 2000-2010 periods; and changes between periods.

Not surprisingly, given the fall in business sector MFP between 2000 and 2010, ten of fifteen two-digit NAICS industries experienced negative MFP growth in Ontario (Chart 31). The largest decline was in mining and oil and gas extraction (-7.41 per cent per year), followed by ASWMRS (-2.25 per cent per year). MFP in manufacturing fell by 1.21 per cent per year. The

following sectors enjoyed positive MFP growth: information and cultural industries (1.66 per cent per year), agriculture, forestry, fishing and hunting (1.24 per cent per year), wholesale trade (0.82 per cent per year), retail trade (0.51 per cent per year), and FIRE (0.12 per cent per year).

Given the very large slowdown in business sector MFP growth in Ontario between 1997-2000 and 2000-2010, it is not surprising that twelve of the fifteen industries also experienced a slowdown. The largest fall-off was in mining and oil and gas extraction (-12.32 percentage points), followed by manufacturing (-6.96 percentage points).

4.3.2.2 MFP Levels

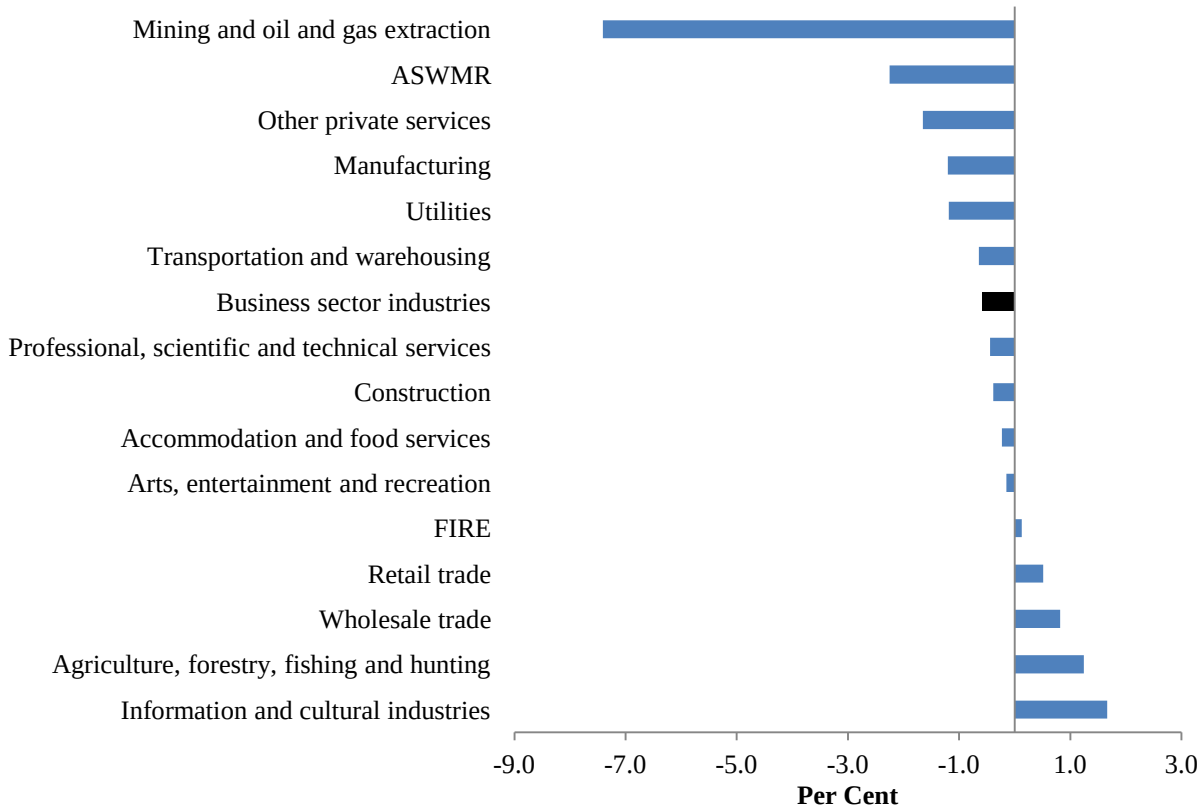
In 2010, eight industries had MFP levels above the national average (Table 20).The highest was arts, entertainment and recreation at 117.4 of the national average, followed by ASWMRS (113.1 per cent) and construction (110.2 per cent). The MFP level of manufacturing in 2010 was 99.5 per cent of the national average, down from 104.4 per cent in 2010.

Table 20: Multifactor Productivity, Business Sector, Ontario and Canada, 1997-2000 and 2000-2010

	Growth (Compounded Annually)				MFP Levels Relative to Canada			
	1997-2000	2000-2010	Change	Provincial Ranking, 2000-2010	2000	Provincial Ranking	2010	Provincial Ranking
	(per cent)	(per cent)			(Canada = 100)		(Canada = 100)	
	Ontario							
Business sector industries	2.84	-0.58	-3.42	8	104.3	2	105.60	1
Agriculture, forestry, fishing and hunting	6.02	1.24	-4.78	8	88.9	7	85.50	8
Mining and oil and gas extraction	4.91	-7.41	-12.32	10	97.7	5	77.60	9
Utilities	1.02	-1.18	-2.20	8	99.1	6	97.70	8
Construction	3.40	-0.39	-3.79	7	103.2	2	110.20	3
Manufacturing	5.75	-1.21	-6.96	9	104.4	2	99.50	5
Wholesale trade	5.59	0.82	-4.77	7	103.5	2	102.10	7
Retail trade	3.13	0.51	-2.62	8	102.8	2	98.90	5
Transportation and warehousing	0.57	-0.64	-1.22	10	106.1	2	101.20	2
Information and cultural industries	0.72	1.66	0.95	6	105.4	1	104.00	2
FIRE	0.00	0.12	0.12	10	110.5	1	98.10	7
Professional, scientific and technical services	0.70	-0.44	-1.14	1	99.3	2	110.00	1
ASWMRS	2.20	-2.25	-4.45	8	98.2	3	113.10	6
Arts, entertainment and recreation	-0.38	-0.15	0.24	4	100.4	1	117.40	1
Accommodation and food services	3.48	-0.23	-3.71	7	115	3	89.10	3
Other private services	0.51	-1.65	-2.16	7	107.7	1	107.80	3
Absolute Equally Weighted Average Rank				7.3		2.7		4.7
Equally-Weighted Business Sector Rank				10		1		2
	Canada							
Business sector industries	1.73	-0.82	-2.55	..	..	..	..	..
Agriculture, forestry, fishing and hunting	5.18	1.62	-3.55	..	..	..	..	..
Mining and oil and gas extraction	-1.18	-5.66	-4.47	..	..	..	..	..
Utilities	0.58	-1.14	-1.71	..	..	..	..	..
Construction	3.17	-0.98	-4.15	..	..	..	..	..
Manufacturing	4.64	-0.59	-5.22	..	..	..	..	..
Wholesale trade	3.60	0.86	-2.74	..	..	..	..	..
Retail trade	3.47	0.80	-2.67	..	..	..	..	..
Transportation and warehousing	-0.29	-0.20	0.09	..	..	..	..	..
Information and cultural industries	-0.26	1.83	2.08	..	..	..	..	..
FIRE	-1.15	0.22	1.36	..	..	..	..	..
Professional, scientific and technical services	0.81	-0.39	-1.20	..	..	..	..	..
ASWMRS	2.73	-1.47	-4.20	..	..	..	..	..
Arts, entertainment and recreation	-1.89	-0.40	1.50	..	..	..	..	..
Accommodation and food services	2.22	-0.16	-2.37	..	..	..	..	..
Other private services	-1.41	-1.76	-0.35	..	..	..	..	..

Source: CSLS Calculations based on Unpublished Statistics Canada Estimates

Chart 31: Multifactor Productivity Growth, Business Sector, Ontario, 2000-2010



Source: CSLS Calculations based on Unpublished Statistics Canada Estimates

4.4 Sources of Labour Productivity Growth[15]

This section uses the standard growth accounting framework to decompose labour productivity growth into three broad factors: improvements in the labour composition (the quality of labour input), capital deepening (defined as increases in the capital/labour ratio), and MFP growth. MFP growth reflects output growth that is not accounted for by combined input growth. It can also be explained by a number of different factors such as technological improvements, better organizational management, higher capacity utilization, and increasing returns to scale. It can also represent measurement errors.

Estimates of the sources of labour productivity growth are from Statistics Canada and are only available for the 1997-2010 period. The section first looks at sources of growth in the business sector and then examines sources of growth for two-digit NAICS industries.

4.4.1 Business Sector

Business sector labour productivity in Ontario grew at a compound annual rate of 0.47 per cent in the 2000-2010 period. As shown in Chart 32, capital intensity growth contributed

[15] The data discussed in this section are only available for a shorter period (1997-2010). Thus, unlike the other sections, we exclude the 1987-96 and 2011-12 periods from our analysis in this section.

0.77 percentage point to this growth, while labour composition (labour quality) contributed 0.29 percentage point. These positive contributions were offset by the decline in MFP of 0.58 percentage point.

The relative importance of the sources of labour productivity growth were very different in the 1997-2000 period when labour productivity growth was much stronger at 3.85 per cent per year. Perhaps surprisingly during this period of robust economic growth, the absolute contributions of capital intensity and labour composition were very similar (Chart 32). However, there was a substantial difference in the contribution of MFP -2.84 versus -0.58 percentage points.

This reflects the different macroeconomic conditions of the two periods. During the 1997-2000 period, Ontario was booming due to strong demand for its exports resulting from strong growth in the United States and a weak Canadian dollar. However, Ontario's economy was weaker over the 2000-2012 period due to the 2008-09 recession and the strength of the Canadian dollar. During booms when output growth is strong, labour productivity growth is also strong. As capital intensity growth and improvements in labour composition are relatively stable, the source of increased labour productivity (defined as the difference between output and labour input growth) is allocated to the residual, namely the difference between labour productivity growth and the contributions from labour composition and capital intensity growth.

4.4.2 Two-digit NAICS Industries

Table 21 and Table 22 provide estimates of the sources of labour productivity growth for the business sector and fifteen two-digit NAICS industries for Ontario and Canada for the 1997-2000 and 2000-2010 periods.

Three general observations can be made which apply to both jurisdictions and both periods.

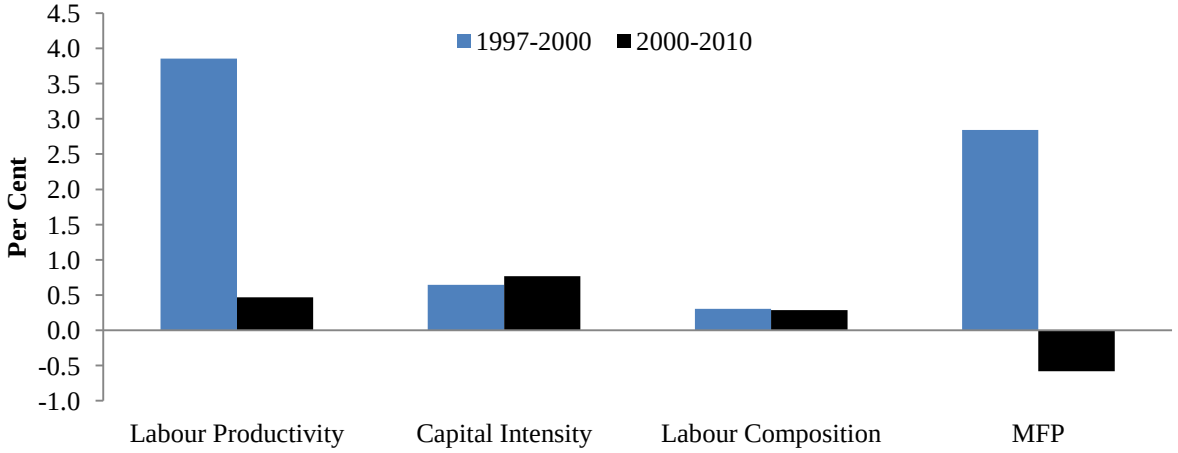
- The annual contribution of labour composition is almost always in the 0.2-0.4 percentage point range, although it is negative in a small number of industries.

- The contribution of capital intensity is almost always positive and can range widely, rising to a high of 2 percentage points.

- As an unobservable residual, MFP is the swing variable. It can range from large positive values, when labour productivity growth is high, to significant negative values, when labour productivity growth is low.

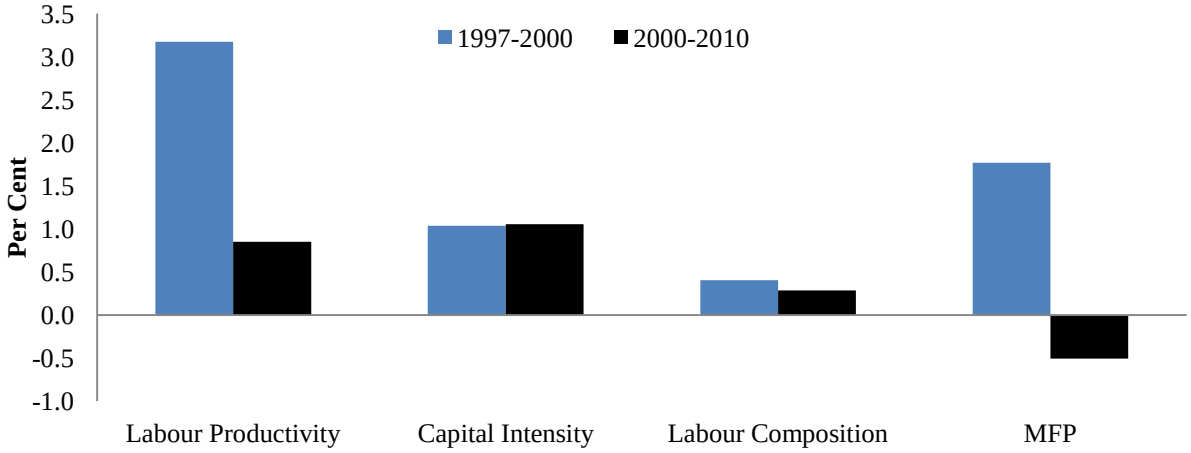
Table 21 shows that labour productivity growth in manufacturing was much weaker in Ontario than in Canada in 2000-2010: 0.04 per cent per year versus 0.88 per cent per year. This difference is attributed to MFP (-1.21 percentage points for Ontario and -0.38 percentage point for Canada) as the contributions of the other two sources of growth are identical: 0.34 percentage point for labour composition and 0.92 percentage point for capital intensity.

Chart 32: Sources of Labour Productivity Growth, Business Sector, Ontario, 1997-2000 and 2000-2010



Source: CSLS calculations based on Statistics Canada data
*Percentages do not sum up to 100 due to rounding error in the percentage points

Chart 33: Sources of Labour Productivity Growth, Business Sector, Canada, 1997-2000 and 2000-2010



Source: CSLS calculations based on Statistics Canada data

Table 21: Sources of Labour Productivity Growth, Business Sector, Ontario, 2000-2010

	Labour Productivity	MFP	Capital Intensity	Labour Composition
	Per Cent	Percentage Point Contribution		
Business sector industries	0.47	-0.58	0.77	0.29
Agriculture, forestry, fishing and hunting	1.70	1.24	0.27	0.19
Mining and oil and gas extraction	-7.15	-7.41	0.40	-0.10
Utilities	-0.91	-1.18	0.35	-0.06
Construction	-0.17	-0.39	-0.03	0.23
Manufacturing	0.04	-1.21	0.92	0.34
Wholesale trade	2.80	0.82	1.79	0.17
Retail trade	2.32	0.51	1.57	0.23
Transportation and warehousing	0.40	-0.64	0.64	0.42
Information and cultural industries	2.04	1.66	0.19	0.18
FIRE	1.01	0.12	0.70	0.18
Professional, scientific and technical services	0.02	-0.44	0.26	0.20
ASWMRS	-0.46	-2.25	1.53	0.30
Arts, entertainment and recreation	-0.26	-0.15	0.15	-0.26
Accommodation and food services	0.19	-0.23	0.23	0.18
Other private services	0.28	-1.68	1.66	0.32

Source: CSLS Calculations based on Statistics Canada CANSIM Table 383-0021 and 383-0026

Table 22: Sources of Labour Productivity Growth, Business Sector, Canada, 2000-2010

	Labour Productivity	MFP	Capital Intensity	Labour Composition
	Per Cent	Percentage Point Contribution		
Business sector industries	0.85	-0.50	1.06	0.29
Agriculture, forestry, fishing and hunting	4.02	1.70	2.01	0.26
Mining and oil and gas extraction	-2.85	-4.84	2.03	0.07
Utilities	-0.12	-0.21	0.07	0.01
Construction	-0.06	-0.48	0.26	0.16
Manufacturing	0.88	-0.38	0.91	0.34
Wholesale trade	3.23	1.62	1.37	0.22
Retail trade	2.52	1.28	0.96	0.27
Transportation and warehousing	1.08	-0.20	0.95	0.32
Information and cultural industries	2.07	1.70	0.20	0.19
FIRE	1.25	0.38	0.70	0.17
Professional, scientific and technical services	0.52	-0.54	0.61	0.46
ASWMRS	0.00	-1.10	0.88	0.25
Arts, entertainment and recreation	-0.71	-1.11	0.46	-0.06
Accommodation and food services	0.47	-0.10	0.33	0.24
Other private services	0.66	-1.51	1.90	0.32

Source: CSLS Calculations based on Statistics Canada CANSIM Table 383-0021 and 383-0026

5. Sectoral Contributions to Labour Productivity Growth

It is important to determine which sectors contribute to productivity growth and which sectors detract from it in order to target policy action to the sources of drags on productivity growth. This section examines the sectoral contributions to aggregate labour productivity growth in the business sector in Ontario, Canada and the ROC for 1987-2000 and 2000-2012. We will also examine the contributions of each industry to labour productivity growth in Ontario's manufacturing sector. The labour productivity growth contributions will be determined by two formulas, the CSLS formula and the Generalized Exactly Additive Decomposition (GEAD) formula.[16]

5.1 CSLS and GEAD Decomposition

The CSLS and GEAD formulas break down sectoral contributions to aggregate labour productivity growth into three components.[17]

- The *within-sector effect*, which measures the contribution to aggregate productivity growth due solely to the productivity increase experience by individual sectors.

- The *reallocation level effect*, which captures the contribution to aggregate labour productivity growth from labour movements from sectors with below-average labour productivity levels to sectors with above-average labour productivity levels.

- The *reallocation growth effect*, which captures the contribution to aggregate labour productivity growth from labour movements from sectors with below-average labour productivity growth to sectors with above-average labour productivity growth.

5.2 Two-digit NAICS Industries

5.2.1 Ontario

Appendix Table 10 and Appendix Table 11 present the absolute and relative contributions of the two-digit NAICS industries to business sector labour productivity growth in Ontario for the 1987-2000 and 2000-2012 periods.

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

[17] While the GEAD formula also breaks down sectoral contributions to aggregate labour productivity growth into these effects, the effects are specified in such a way to incorporate changes in relative prices, which does not happen in the CSLS formula. Despite this difference, the results of the two decomposition formula for Ontario are quite similar. For this reason, we only discuss in this section the contributions to labour productivity growth using the CSLS decomposition formula. Discussion and results from the GEAD formula are provided in Appendix I.

5.2.1.1 1987 to 2000 period

Labour productivity in Ontario grew by 1.89 per cent per year between 1987 and 2000. One finds that reallocation effects reduced the province's productivity growth 0.21 percentage point or 11 per cent as the relative importance of workers in low-productivity growth sectors such as ASWMRS increased and the relative importance of workers in high-productivity growth sectors such as manufacturing fell.

Three sectors drove business sector labour productivity growth from 1987 to 2000, accounting for nearly 90 per cent of the productivity gains (Chart 34). The most important by far was manufacturing, which contributed 0.96 percentage point or 50.9 per cent to productivity growth, followed by FIRE (0.44 percentage point or 23.1 per cent) and wholesale trade (0.27 percentage point or 14.4 per cent). In other words, manufacturing and FIRE were the engines of the Ontario economy in terms of generating the productivity gains.

5.2.1.2 2000 to 2012 period

Labour productivity growth was much weaker in 2000-2012, advancing at an average annual rate of 0.51 per cent, or around one-quarter the growth rate of 1987-2000. Reallocation effects reduced business sector labour productivity growth less in absolute terms (-0.06 percentage point), although about the same in relative terms given the lower absolute growth rate. It is interesting to note that there was actually a positive reallocation level effect (0.10 percentage point), which was more than offset by a negative reallocation growth effect (-0.16 percentage point). The positive level effect was due to the rising employment share in high-productivity FIRE, which was of greater importance than falling employment share in above-average labour productivity manufacturing.

Again three sectors drove business sector labour productivity growth from 2000 to 2012, accounting for 105 per cent of the productivity gains (Chart 34). The most important was, perhaps surprisingly, wholesale trade, which contributed 0.23 percentage point to productivity growth, or 44.7 per cent. This was followed by retail trade, which contributed 0.21 percentage point or 40.4 per cent, and FIRE with 0.11 percentage point or 20.6 per cent. The contributions of wholesale and retail trade were similar in absolute terms to that of the 1987-2000 period (0.27 and 0.12 percentage point respectively), but were much greater in relative terms because of the much weaker productivity growth. The contribution of manufacturing to labour productivity declined significantly from 0.96 to 0.08 percentage point. However, the manufacturing sector still accounted for 16.0 per cent of productivity gains despite the fall in its absolute contribution.

Appendix Table 14 provides the percentage point contributions of two-digit industries to business sector labour productivity growth in Ontario for the 1987-2000 and 2000-2012 periods, as well as the absolute and relative contributions to the change between periods in aggregate productivity growth (-1.38 percentage points). Two industries accounted for the slowdown in business sector labour productivity growth after 2000. Manufacturing was the most important, responsible for 63.9 per cent of the slowdown followed by FIRE at 24.0 per cent.

5.2.2 Rest of Canada

Appendix Table 11 and Appendix Table 13 present the absolute and relative contributions of two-digit NAICS industries to business sector labour productivity growth in the ROC (*i.e.*, Canada excluding Ontario) for the 1987-2000 and 2000-2012 periods.

5.2.2.1 1987 to 2000 period

Labour productivity grew in the ROC grew by 1.48 per cent per year between 1987 and 2000. The reallocation effects reduced productivity growth 0.39 percentage point or 26 per cent as the relative importance of workers in high-productivity growth mining and oil and gas extraction fell.

The sectoral contributions to aggregate productivity growth in the ROC were much less concentrated than in Ontario. Instead of three sectors accounting for 90 per cent of the gains, six sectors were needed (Appendix Table 10 and Chart 34). The most important was FIRE, which contributed 0.31 percentage point or 20.7 per cent to productivity growth. This was followed by mining and oil and gas extraction (0.27 percentage point or 17.9 per cent), other private services (0.21 percentage point or 14.5 per cent), information and cultural industries (0.21 percentage point or 14.0 per cent), agriculture, forestry, fishing and hunting (0.19 percentage point or 13.1 per cent), and manufacturing (0.19 percentage point or 12.8 per cent).

5.2.2.2 2000 to 2012 period

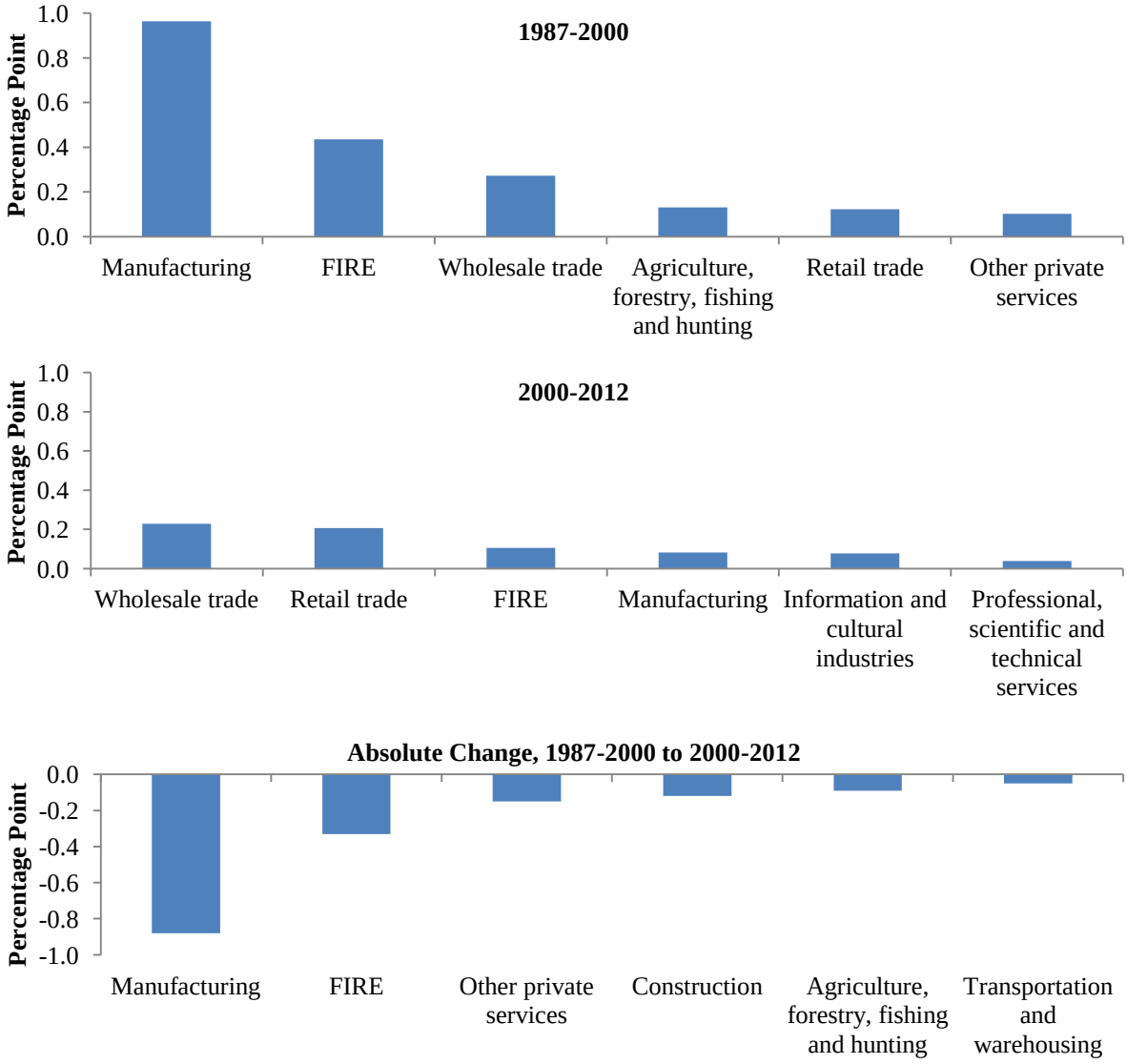
Labour productivity growth was much weaker in 2000-2012, advancing at only 0.98 per cent average annual rate, but the slowdown was much less than in Ontario (0.50 percentage point versus 1.38 percentage points). The reallocation effects were much more important and rather than reducing business sector labour productivity growth, as they had done in the 1987-2000 period for the ROC and in both periods for Ontario, they increased it. Indeed, overall reallocation effects boosted aggregate productivity growth by 0.38 percentage point or 39 per cent. There was a notable reallocation level effect (0.75 percentage point) due to the increase in the employment share in the high-productivity mining and oil and gas extraction, even though the overall contribution of this sector to productivity growth was negative, given the sector's negative productivity growth.

In the 2000-2012 period, the top six sectors contributed 0.85 percentage point to aggregate productivity growth (Chart 35). The most important was, perhaps surprisingly, manufacturing, which contributed 0.22 percentage point or 22.4 per cent to productivity growth. This was followed by agriculture, forestry, fishing and hunting (0.15 percentage point or 14.9 per cent), other private services (0.12 percentage point or 12.7 per cent), wholesale trade (0.12 percentage point or 12.6 per cent), retail trade (0.12 percentage point or 12.6 per cent), and transportation and warehousing (0.12 percentage point or 12.0 per cent).

Appendix Table 14 shows the percentage point contributions of two-digit industries to business sector labour productivity growth in the ROC in the 1987-2000 and 2000-2012 periods, as well as the absolute and relative contributions to the change between periods in aggregate

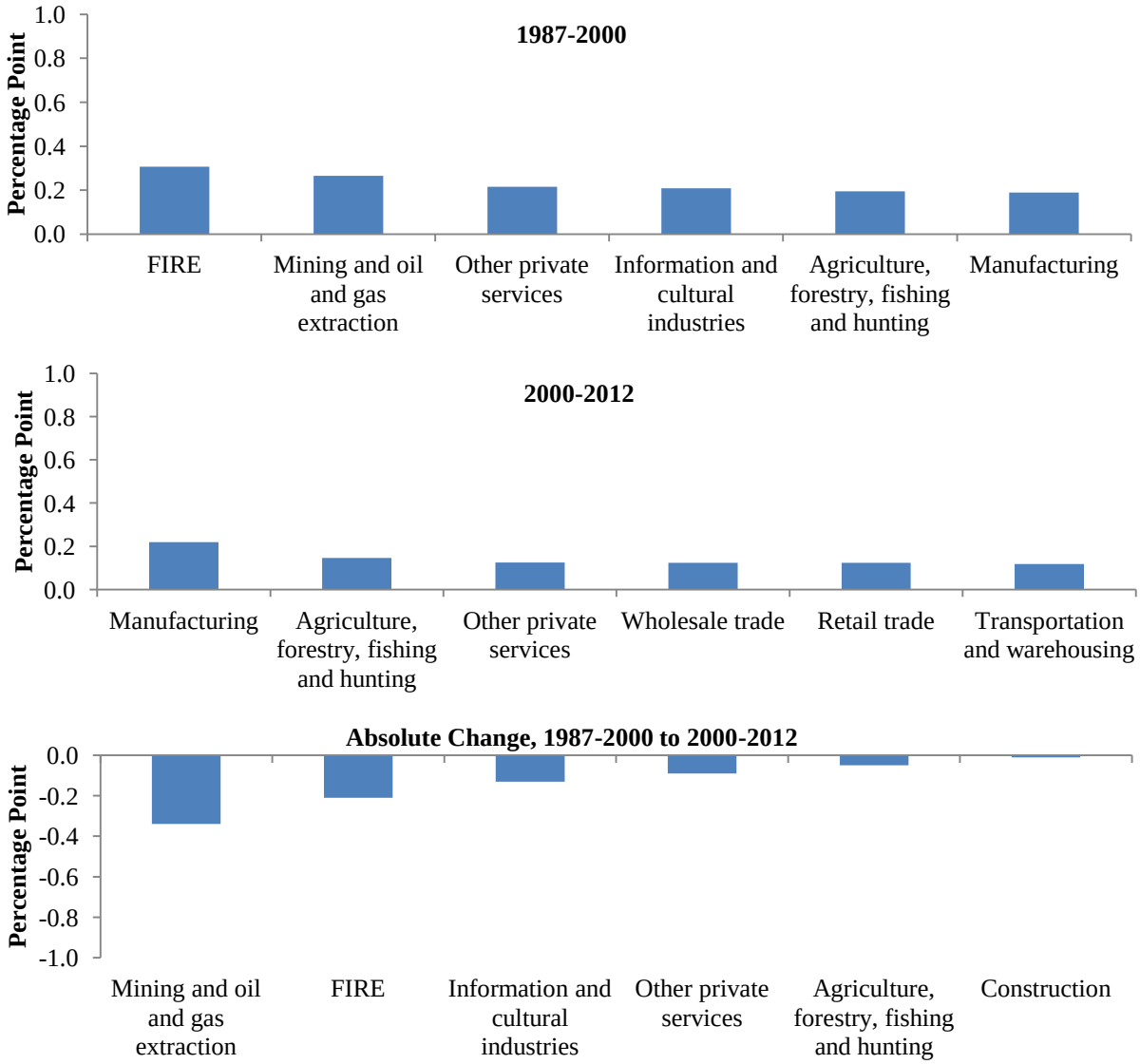
productivity growth (-0.50 percentage point). Three industries accounted for the slowdown in business sector labour productivity growth after 2000. Mining and oil and gas extraction was the most important, responsible for 68.0 per cent of the slowdown, followed by FIRE (41.2 per cent) and information and cultural industries (26.2 per cent). These three industries accounted for 135.4 per cent of the slowdown. Other industries of course negatively contributed to the slowdown through a pick-up in productivity growth.

Chart 34: Top Contributing Industries to Business Sector Labour Productivity Growth in Ontario (Percentage Points)



Source: CSLS calculations based on Statistics Canada data

Chart 35: Top Contributing Industries to Business Sector Labour Productivity Growth in the Rest of Canada (Percentage Points)



Source: CSLS calculations based on Statistics Canada data

5.3 Manufacturing

Table 23 and Table 24 present the absolute and relative contributions of the three-digit NAICS manufacturing industries to manufacturing labour productivity growth in Ontario for the 1997-2000 and 2000-2012 periods.

The manufacturing sector enjoyed very rapid labour productivity growth of 6.19 per cent per year in the 1997-2000 period. Clothing and leather and allied product manufacturing contributed 1.66 percentage points or 26.9 per cent to manufacturing productivity growth (Chart 36). This industry, combined with computer and electronic product manufacturing (14.7 per cent), fabricated metal product manufacturing (11.5 per cent) and transportation equipment (10.2 per cent), accounted for 63 per cent of the productivity gains in manufacturing in 1997-2000.

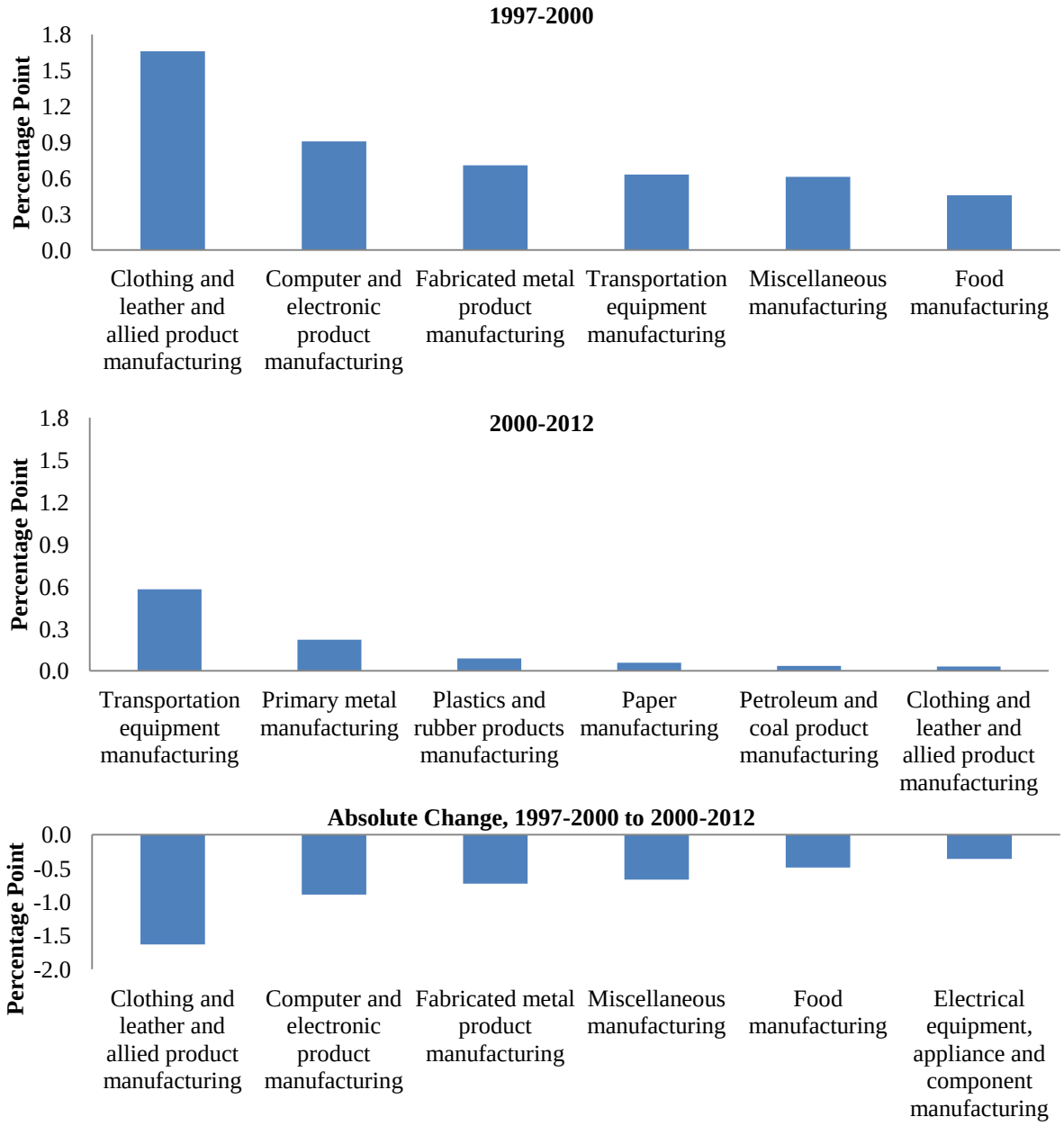
Reallocation effects on a net basis reduced manufacturing productivity growth by 0.35 percentage point or 5.7 per cent. The reduction from reallocation growth effects to labour productivity growth (-1.12 percentage points or -18.1 per cent) was greater than the boost from the reallocation level effects (0.77 percentage point or 12.4 per cent).

In the 2000-2012 period, manufacturing productivity growth was around eight times slower than in the 1997-2000 period: 0.81 per cent per year versus 6.19 per cent per year. Two sectors accounted for virtually all the productivity gains: transportation equipment contributed 0.58 percentage point or 72.0 per cent to manufacturing productivity growth, and primary metals contributed 0.22 percentage point or 27.6 per cent.

It is interesting to note that transportation equipment, the most important manufacturing industry in Ontario, did not see a significant change in its contribution to manufacturing labour productivity growth between 1997-2000 and 2000-2012 (0.63 percentage point versus 0.58 percentage point). Despite the sector's declines in output and employment in absolute terms, its contribution to productivity growth has been unchanged. The industry is a key driver of labour productivity growth in Ontario's manufacturing sector. The strong contribution from the industry is likely due to the continued operation of efficient production plants of auto manufacturers such as Toyota, General Motors, Ford, Chrysler and Honda in Southern Ontario. These firms have high capital-labour ratios, advanced technology and strong organizational management, which allow them to achieve high levels of labour productivity.

Reallocation effects on a net basis reduced manufacturing productivity growth in the 2000-2012 period by 0.06 percentage point or 6.8 per cent. The reduction from reallocation growth effects to labour productivity growth (-0.30 percentage point or -36.8 per cent) was greater than the boost from the reallocation level effects (0.24 percentage point or 30.1 per cent).

Chart 36: Top Six Contributing Industries to Manufacturing Sector Labour Productivity Growth in Ontario (Percentage Point)



Source: CSLS calculations based on Statistics Canada data

Table 23: CSLS Labour Productivity Decomposition, Manufacturing, Ontario, 1997-2000

	Within-Sector Effect	Reallocation Level Effect	Reallocation Growth Effect	Total
	Percentage Point Contribution			
Manufacturing	6.54	0.77	-1.12	6.19
Food manufacturing	0.49	-0.06	0.03	0.46
Beverage and tobacco product manufacturing	-0.43	0.40	-0.08	-0.11
Textile and textile product mills	0.16	0.00	0.00	0.16
Clothing and leather and allied product manufacturing*	1.45	0.43	-0.22	1.66
Wood product manufacturing	0.02	-0.07	-0.05	-0.10
Paper manufacturing	0.02	0.00	-0.01	0.02
Printing and related support activities	0.31	0.00	0.00	0.31
Petroleum and coal product manufacturing	0.50	-0.21	-0.09	0.20
Chemical manufacturing	-0.16	0.21	-0.07	-0.02
Plastics and rubber products manufacturing	0.15	-0.13	-0.14	-0.12
Non-metallic mineral product manufacturing	0.33	0.01	0.00	0.33
Primary metal manufacturing	0.37	-0.05	0.02	0.34
Fabricated metal product manufacturing	0.92	-0.18	-0.03	0.71
Machinery manufacturing	0.10	0.04	-0.12	0.02
Computer and electronic product manufacturing	0.94	-0.13	0.10	0.91
Electrical equipment, appliance and component manufacturing	0.37	0.01	0.00	0.38
Transportation equipment manufacturing	0.39	0.53	-0.29	0.63
Furniture and related product manufacturing	0.06	-0.10	-0.15	-0.19
Miscellaneous manufacturing	0.56	0.07	-0.03	0.61
	Per Cent Contribution			
Manufacturing	105.76	12.38	-18.14	100.00
Food manufacturing	7.88	-0.97	0.47	7.38
Beverage and tobacco product manufacturing	-6.96	6.41	-1.23	-1.78
Textile and textile product mills	2.62	-0.04	0.00	2.58
Clothing and leather and allied product manufacturing*	23.43	7.03	-3.60	26.86
Wood product manufacturing	0.33	-1.08	-0.81	-1.56
Paper manufacturing	0.32	0.06	-0.08	0.29
Printing and related support activities	4.95	0.05	0.03	5.03
Petroleum and coal product manufacturing	8.03	-3.40	-1.47	3.16
Chemical manufacturing	-2.59	3.39	-1.12	-0.32
Plastics and rubber products manufacturing	2.46	-2.17	-2.27	-1.99
Non-metallic mineral product manufacturing	5.26	0.13	0.01	5.40
Primary metal manufacturing	5.95	-0.87	0.34	5.42
Fabricated metal product manufacturing	14.88	-2.97	-0.49	11.42
Machinery manufacturing	1.65	0.68	-1.99	0.33
Computer and electronic product manufacturing	15.19	-2.09	1.55	14.65
Electrical equipment, appliance and component manufacturing	6.00	0.08	0.06	6.14
Transportation equipment manufacturing	6.36	8.55	-4.73	10.18
Furniture and related product manufacturing	0.90	-1.58	-2.40	-3.08
Miscellaneous manufacturing	9.11	1.18	-0.41	9.88

Source: CSLS calculations based on Statistics Canada data
*Values are imputed by calculating the residual GDP from the manufacturing sector

Table 24: CSLS Labour Productivity Decomposition, Manufacturing Sector, Ontario, 2000-2012

	Within-Sector Effect	Reallocation Level Effect	Reallocation Growth Effect	Total
	Percentage Point Contribution			
Manufacturing	0.86	0.24	-0.30	0.81
Food manufacturing	-0.01	0.03	-0.05	-0.03
Beverage and tobacco product manufacturing	-0.16	0.18	-0.12	-0.10
Textile and textile product mills	-0.01	0.00	0.01	-0.01
Clothing and leather and allied product manufacturing*	-0.05	0.04	0.04	0.03
Wood product manufacturing	-0.01	0.00	0.00	0.00
Paper manufacturing	0.06	0.00	-0.01	0.06
Printing and related support activities	0.02	-0.01	0.00	0.01
Petroleum and coal product manufacturing	0.05	-0.01	-0.01	0.04
Chemical manufacturing	-0.03	0.04	-0.02	-0.01
Plastics and rubber products manufacturing	0.08	0.01	0.00	0.09
Non-metallic mineral product manufacturing	0.00	-0.01	-0.01	-0.02
Primary metal manufacturing	0.30	-0.01	-0.06	0.22
Fabricated metal product manufacturing	-0.01	0.00	0.00	-0.02
Machinery manufacturing	0.03	0.00	0.00	0.03
Computer and electronic product manufacturing	0.01	0.00	0.01	0.02
Electrical equipment, appliance and component manufacturing	0.01	0.00	0.00	0.02
Transportation equipment manufacturing	0.66	-0.02	-0.06	0.58
Furniture and related product manufacturing	-0.06	0.00	0.00	-0.05
Miscellaneous manufacturing	-0.02	-0.02	-0.02	-0.06
	Per Cent Contribution			
Manufacturing	106.76	30.06	-36.82	100.00
Food manufacturing	-1.82	3.93	-5.62	-3.51
Beverage and tobacco product manufacturing	-19.89	22.78	-14.98	-12.09
Textile and textile product mills	-1.78	0.48	0.67	-0.62
Clothing and leather and allied product manufacturing	-5.80	5.01	4.71	3.92
Wood product manufacturing	-0.79	0.20	0.07	-0.52
Paper manufacturing	7.92	0.46	-1.14	7.24
Printing and related support activities	2.34	-0.65	-0.12	1.56
Petroleum and coal product manufacturing	6.16	-1.12	-0.66	4.39
Chemical manufacturing	-3.54	4.69	-1.91	-0.75
Plastics and rubber products manufacturing	9.83	1.33	-0.22	10.93
Non-metallic mineral product manufacturing	-0.20	-1.03	-0.92	-2.16
Primary metal manufacturing	37.19	-1.84	-7.80	27.55
Fabricated metal product manufacturing	-1.61	-0.50	-0.25	-2.37
Machinery manufacturing	3.38	0.12	0.06	3.56
Computer and electronic product manufacturing	1.49	0.27	0.75	2.52
Electrical equipment, appliance and component manufacturing	1.47	0.32	0.28	2.08
Transportation equipment manufacturing	82.27	-2.41	-7.83	72.04
Furniture and related product manufacturing	-7.31	0.49	0.55	-6.28
Miscellaneous manufacturing	-2.56	-2.47	-2.46	-7.49

Source: CSLS calculations based on Statistics Canada data
*Values are imputed by calculating the residual GDP from the manufacturing sector

Table 25 shows the percentage point contributions of three-digit manufacturing industries to manufacturing labour productivity growth in Ontario for 1997-2000 and 2000-2012, as well as the absolute and relative contributions to the change between periods in manufacturing productivity growth (-5.38 percentage points). One sees that clothing and leather made the largest relative contribution to the slowdown in manufacturing labour productivity growth (30.3 per cent), followed by computer and electronics (16.5 per cent), fabricated metal products (13.5 per cent), and miscellaneous manufacturing (12.5 per cent). These four industries accounted for about three-quarters of the slowdown.

Table 25: CSLS Labour Productivity Decomposition Summary, Manufacturing Sector, Ontario, 1997-2000 and 2000-2012

	1997-2000	2000-2012	Change	Contributions to Change
	Percentage Point			Per Cent
	Ontario			
Manufacturing	6.19	0.81	-5.38	100.00
Food manufacturing	0.46	-0.03	-0.49	9.01
Beverage and tobacco product manufacturing	-0.11	-0.10	0.01	-0.24
Textile and textile product mills	0.16	-0.01	-0.16	3.06
Clothing and leather and allied product manufacturing	1.66	0.03	-1.63	30.30
Wood product manufacturing	-0.10	0.00	0.09	-1.72
Paper manufacturing	0.02	0.06	0.04	-0.75
Printing and related support activities	0.31	0.01	-0.30	5.55
Petroleum and coal product manufacturing	0.20	0.04	-0.16	2.97
Chemical manufacturing	-0.02	-0.01	0.01	-0.26
Plastics and rubber products manufacturing	-0.12	0.09	0.21	-3.92
Non-metallic mineral product manufacturing	0.33	-0.02	-0.35	6.53
Primary metal manufacturing	0.34	0.22	-0.11	2.11
Fabricated metal product manufacturing	0.71	-0.02	-0.73	13.48
Machinery manufacturing	0.02	0.03	0.01	-0.15
Computer and electronic product manufacturing	0.91	0.02	-0.89	16.46
Electrical equipment, appliance and component manufacturing	0.38	0.02	-0.36	6.75
Transportation equipment manufacturing	0.63	0.58	-0.05	0.92
Furniture and related product manufacturing	-0.19	-0.05	0.14	-2.60
Miscellaneous manufacturing	0.61	-0.06	-0.67	12.48

Source: CSLS calculations based on Statistics Canada data

6. An Analysis of Ontario's Productivity Drivers: A Supply-side Perspective

The report has so far documented Ontario's productivity performance in great detail. A full account has been provided of the slowdown in the Ontario's productivity growth from 1987-2000 to 2000-2012 and relative to the ROC. However, the discussion has been largely descriptive in nature and has not provided a narrative of the root causes of the deterioration of Ontario's productivity performance. Such a discussion of the drivers of productivity is needed to develop sound public policies to improve productivity growth.

In the long run, productivity is determined by the supply-side potential of the economy and is largely driven by technological development. A slower pace of technical change will reduce potential productivity growth. The availability of capital and skills are also factors affecting this supply-side productive capacity of the economy.

But the long-run productivity potential of an economy cannot be realized without sufficient aggregate demand to ensure that the productive capacity is utilized. If there is no market for the output of a highly efficient factory, then the productivity potential of that production unit will not come to fruition. Thus, buoyant demand conditions are essential for robust productivity growth. Supply does not automatically create its own demand, although the potential is there.

From this perspective, both supply-side and demand-side factors may have contributed to the slowdown in Ontario's productivity growth after 2000. Regarding the former, the rate of increase in the potential growth of the Ontario economy may have decelerated due to negative developments related to the supply-side drivers of productivity, such as innovation, skills and investment. Regarding the latter, the rate of demand growth may have fallen off due to external or domestic factors so that industries cannot make full use of their productive potential.

This section of the report first assesses the state of the supply-side drivers of productivity growth in Ontario and then looks at the demand-side conditions in the 2000s.

According to neo-classical economic growth models, there are three key factors determining labour productivity growth. The first is the quality of labour input, which is determined by the accumulation of human capital; the greater is the human capital, the more productive is the labour input. The second is investment in physical capital, which determines the amount of machinery, equipment, and infrastructure available for each worker to use; higher ratios of capital to labour increases labour productivity. The third factor is technological change; this factor captures the effect that is not determined by human and physical capital. For example, new organizational management or production processes are types of innovation that arise not through human or physical capital, but rather through the developments of new knowledge through research. These three factors affect the labour productivity of an economy.

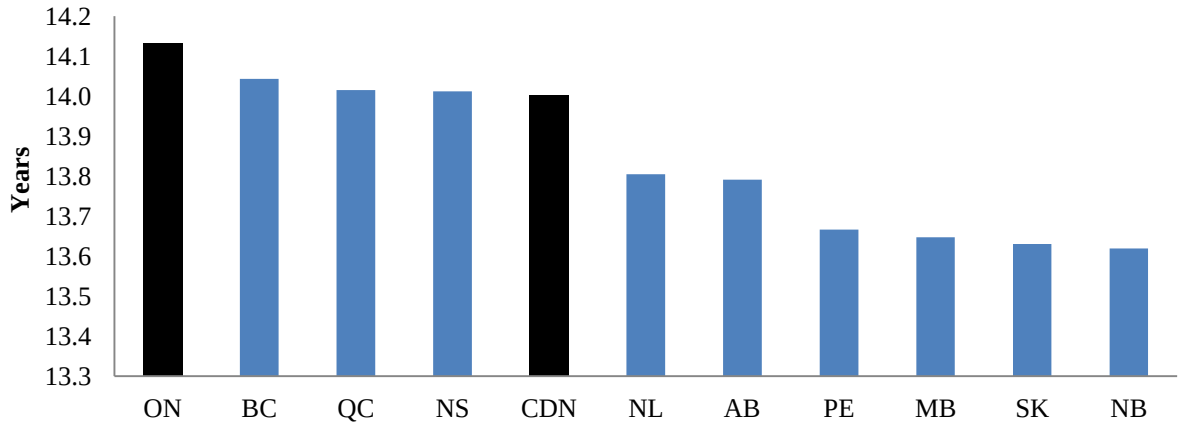
In this section, we will examine the supply-side effects on labour productivity growth through an examination of developments in human capital, innovation, and investment in Ontario. The following section looks at the demand-side of the equation.

6.1 Human Capital

6.1.1 Educational Attainment

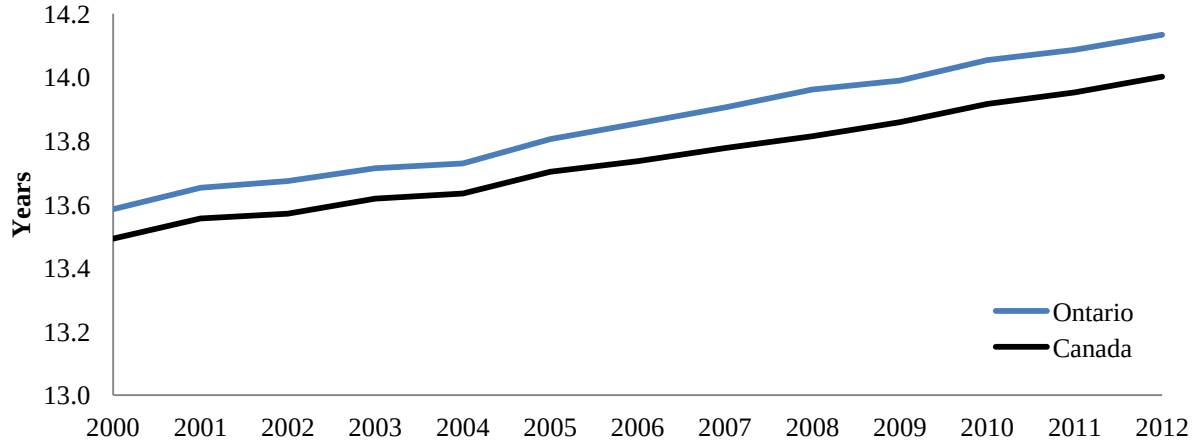
Educational attainment is a key determinant of the ability of workers to use modern technologies effectively. Ontario has the most educated workforce of any Canadian province in terms of the average years of schooling (Chart 37). In 2012, the population aged 15+ in the province had on average 14.1 years of formal educational attainment (Chart 37), which is above the Canadian average of 14.0 years. The average years of schooling among Ontario's population aged 15+ rose 0.5 years from 13.6 years in 2000 (Chart 38), an average annual increase of 0.33 per cent, which is slightly above the increase in the national average of 0.31 per cent per year.

Chart 37: Average Years of Schooling, Population Aged 15+, Canada and Provinces, 2012



Source: CSLS calculation based on Statistics Canada data

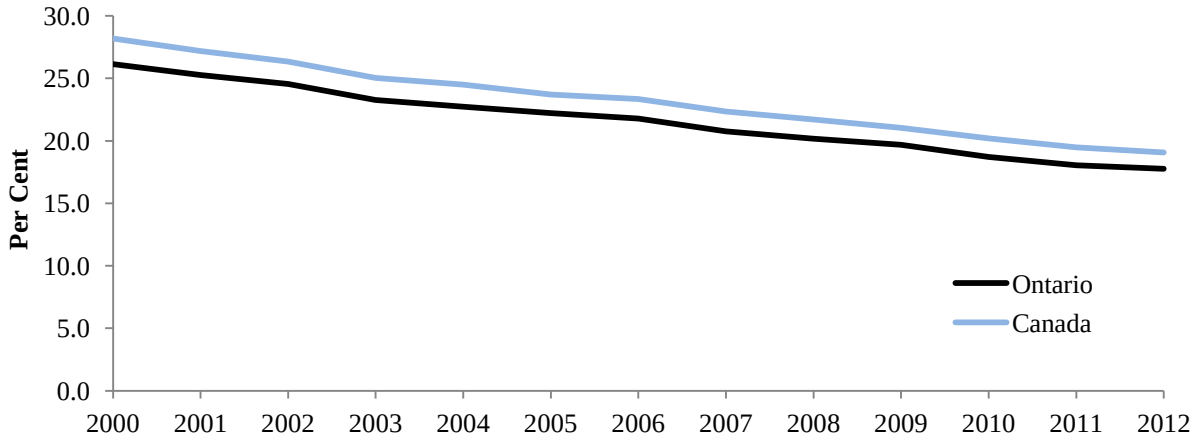
Chart 38: Average Years of Schooling, Population Aged 15+, Canada and Ontario, 2000-2012



Source: CSLS calculation based on Statistics Canada data

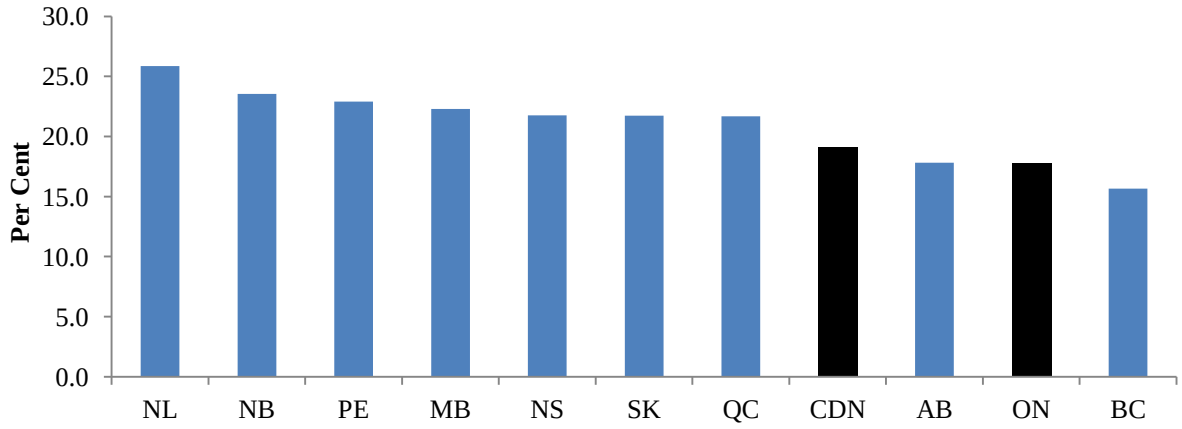
Persons without a high school education are often unqualified or unable to perform the tasks required in productive industries or occupations. Fortunately, the share of the population without a high school education is falling rapidly. The high school non-completion rate for the population aged 15+ in Ontario fell from 26.1 per cent in 2000 to 17.8 per cent in 2012 (Chart 39). Ontario had the second lowest high school non-completion rate amongst the population aged 15+ in 2012, with British Columbia being the lowest at 15.7 per cent (Chart 40).

Chart 39: High School Non-Completion Rate, Population Aged 15+, Canada and Ontario, 2000-2012



Source: CSLS calculations based on Statistics Canada data

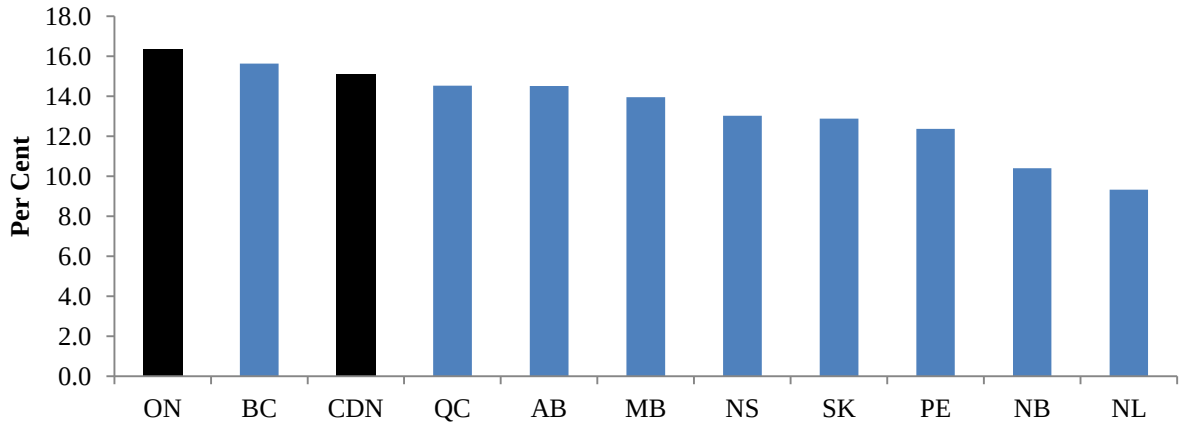
Chart 40: High School Non-Completion Rate, Population Aged 15+, Canada and Provinces, 2012



Source: CSLS calculations based on Statistics Canada data

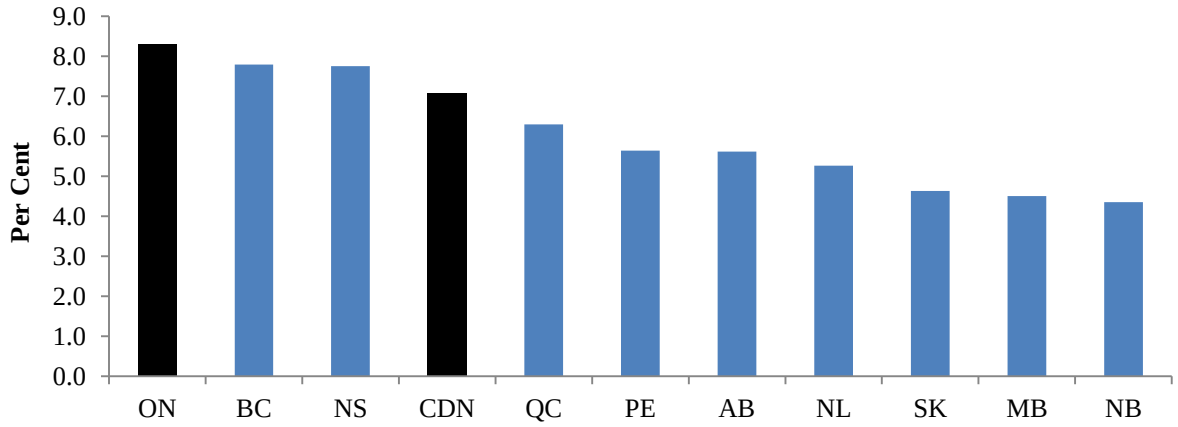
In 2012, Ontario was the province with the highest percentage of population aged 15+ with a bachelor's degree (Chart 41), and the highest proportion of the population aged 15+ with an education above the bachelor's degree level (Chart 42).

Chart 41: Percentage of Population Aged 15+ with Bachelor's Degree, Canada and the Provinces, 2012



Source: CSLS calculations based on Statistics Canada data

Chart 42: Percentage of Population Aged 15+ with Above Bachelor's Degree, Canada and the Provinces, 2012

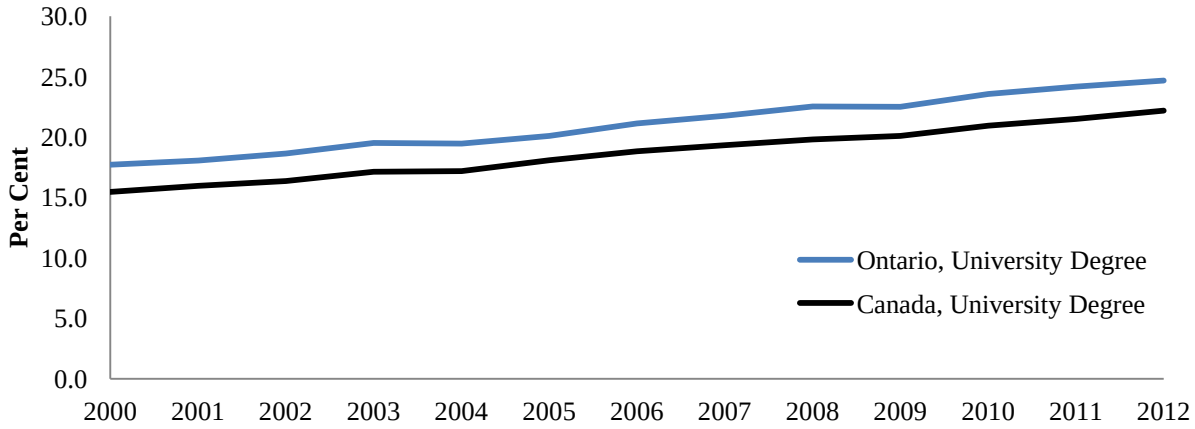


Source: CSLS calculations based on Statistics Canada data

Ontario has experienced rapid growth in terms of the percentage of the population aged 15+ with a university degree. In 2000, 17.7 per cent of the population aged 15+ had a university degree; this share increased to 24.7 per cent by 2012, an average annual increase of 2.8 per cent (Chart 43). Persons with a university degree can be broken down into those with a bachelor's degree and those with more than a bachelor's degree. The percentage of population aged 15+ with a bachelor's degree in Ontario rose from 11.6 per cent in 2000 to 16.4 per cent in 2012 (Chart 44). The percentage of population aged 15+ with more than a bachelor's degree increased from 6.2 per cent in 2000 to 8.3 per cent in 2012.

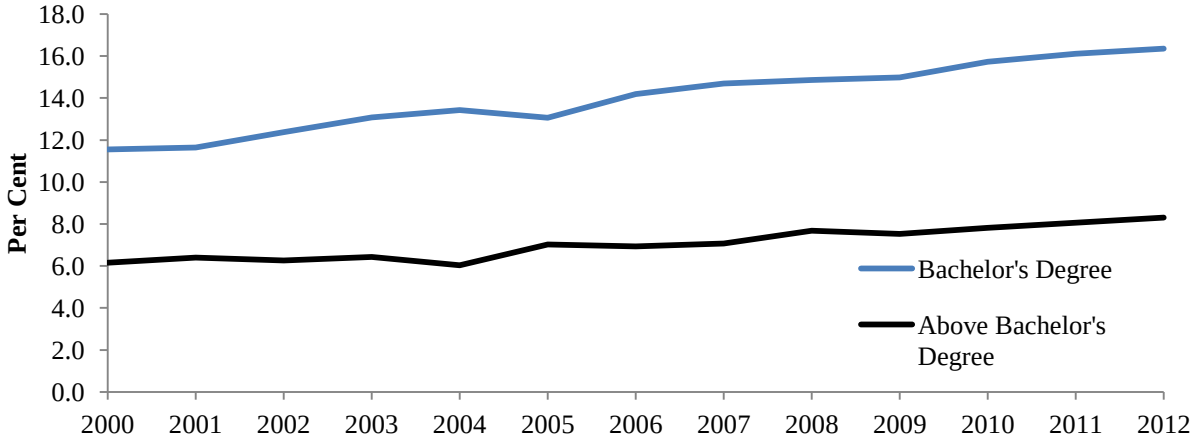
Overall, the level of educational attainment does not appear to represent a problem for Ontario from a productivity perspective.

Chart 43: Percentage of Population Aged 15+ with University Degree, Canada and Ontario, 2000-2012



Source: CSLS calculations based on Statistics Canada data

Chart 44: Percentage of Population Aged 15+ with Bachelor's Degree and Above Bachelor's Degree, Ontario, 2000-2012



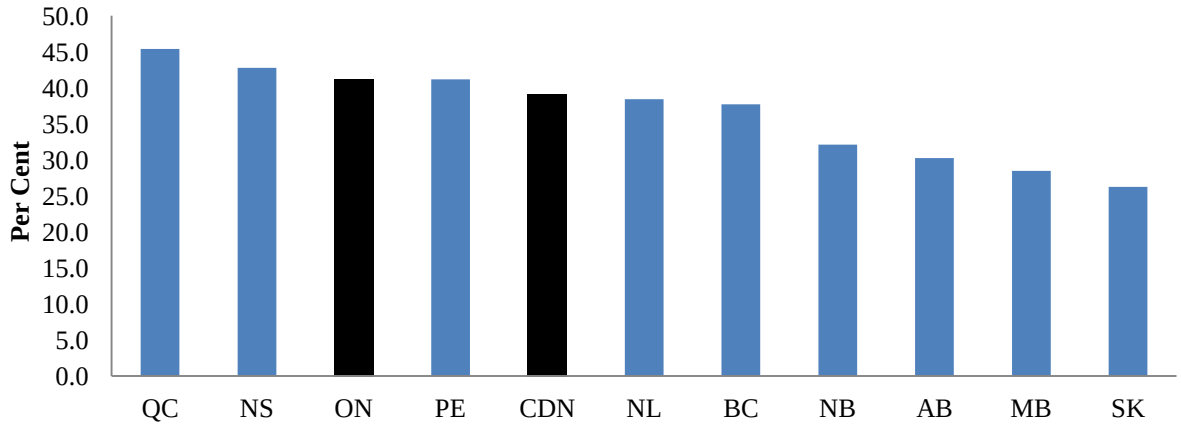
Source: CSLS calculations based on Statistics Canada data

6.1.2 Post-Secondary Enrolment

Continued advances in the average educational attainment of the population can be expected given the robust post-secondary enrolment rates in Ontario. In 2012, 41.2 per cent of persons aged 18 to 25 in the province were enrolled in post-secondary education, above the national average of 39.1 per cent, and up from 28.8 per cent in 2000 (Chart 46). In 2000-2012, the average annual growth rate for the post-secondary enrolment rate in Ontario was higher than the Canadian average (3.04 per cent versus 2.69 per cent). It is interesting to note the spike in the enrolment rate for Ontario between 2003 and 2004, from 31.9 per cent to 35.6 per cent, was likely due to the double cohort effect with the phasing out of grade 13 that year.

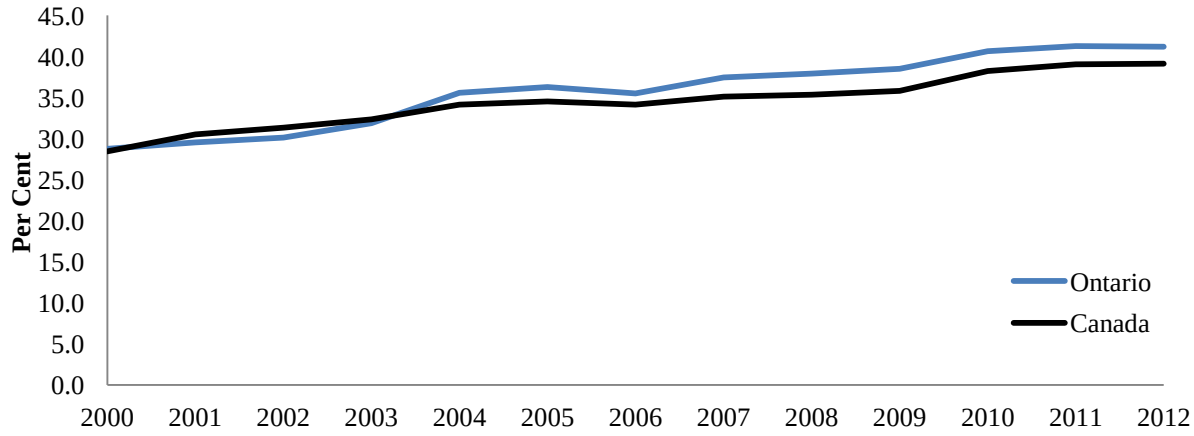
Ontario ranked third among the provinces in terms of the youth post-secondary enrolment rate, behind Quebec at 45.4 per cent and Nova Scotia at 42.7 per cent (Chart 37).

Chart 45: Post-Secondary Enrolment, 18-25 Year Olds, Canada and the Provinces, 2012



Source: CSLS Calculations based on Statistics Canada Table

Chart 46: Post-Secondary Enrolment, 18 to 25 Year Olds, Canada and Ontario, 2000-2012



Source: CSLS Calculation based on Statistics Canada Data.

6.1.3 Apprenticeship Training

An adequate supply of skilled tradespersons is essential to prevent production bottlenecks and to foster continuous output and productivity growth. The apprenticeship system trains many of these workers. This means that a well-functioning apprenticeship system that produces an adequate supply of skilled tradespersons is needed. Ontario's apprenticeship system, although not without its problems such as low completion rates, has flourished in recent years.

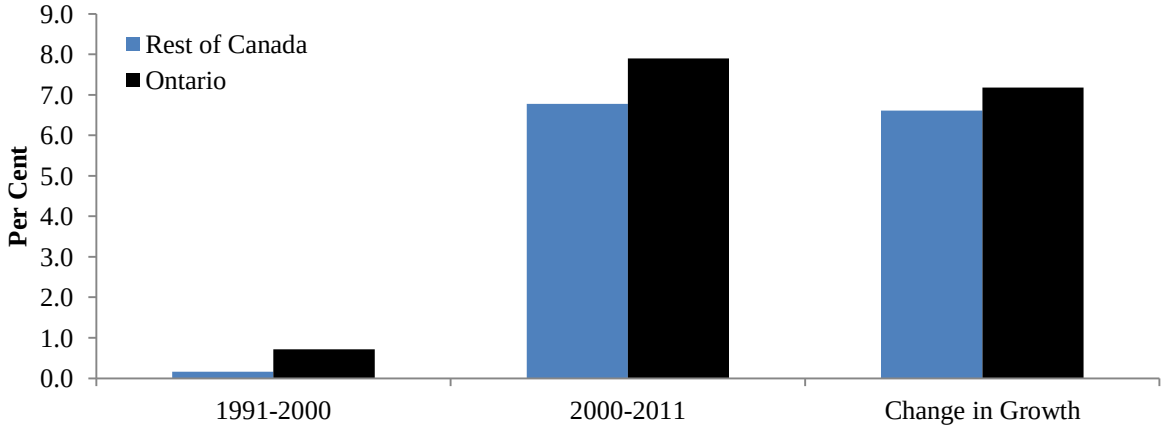
The number of participants in registered apprenticeship training programs in Ontario jumped from 66,675 in 2000 to 153,918 by 2011, an average annual rise of 7.90 per cent (Chart 47). This was much faster than the 0.72 per cent per year growth of the 1991-2000 period and superior to the ROC's growth in the 2000-2011 period of 6.78 per cent per year. This significant pick-up of enrolment in apprenticeship training programs is a very positive development as such programs allow participants to gain the necessary skills to work in high productivity sectors and move away from low productivity sectors without facing the high tuition costs of post-secondary

education. Possible reasons for the significant pick-up of enrolment in apprenticeship training programs include an increase in demand for skilled tradespersons, government incentives to encourage apprenticeships, and more awareness of the job opportunities in the skilled trades among youth.

Historically, participation in apprenticeship programs in Ontario has been somewhat low relative to participation in the ROC. In 2000, 1.08 per cent of the labour force was enrolled in apprenticeship programs, 79.0 per cent of the ROC average of 1.37 per cent (Chart 48). This situation reflected the province's industrial structure: a smaller share of workers in resource industries and a greater share in manufacturing relative to the ROC. Apprenticeship programs are particularly important in natural resource industries and less so in manufacturing.

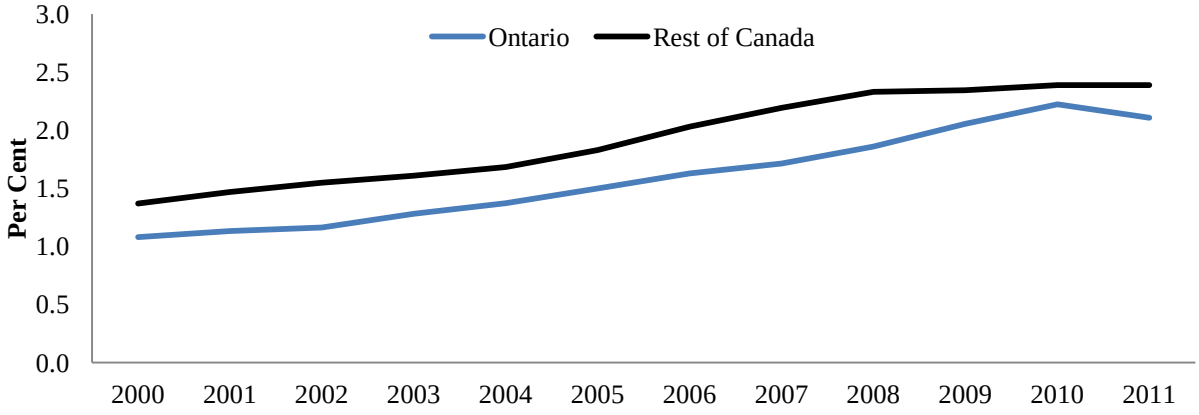
With the large increase in apprenticeship registration in Ontario since 2000, the percentage of the labour force participating in registered apprenticeship training programs has more than doubled and in 2011 rose to 2.11 per cent, 88.2 per cent of the ROC average.

Chart 47: Growth in Number of Participants in Registered Apprenticeship Training Programs, Ontario and Rest of Canada, 1991-2011



Source: CSLS calculations based on Statistics Canada data

Chart 48: Percentage of Labour Force Participating in Registered Apprenticeship Training Programs, Ontario and Rest of Canada, 2000-2012



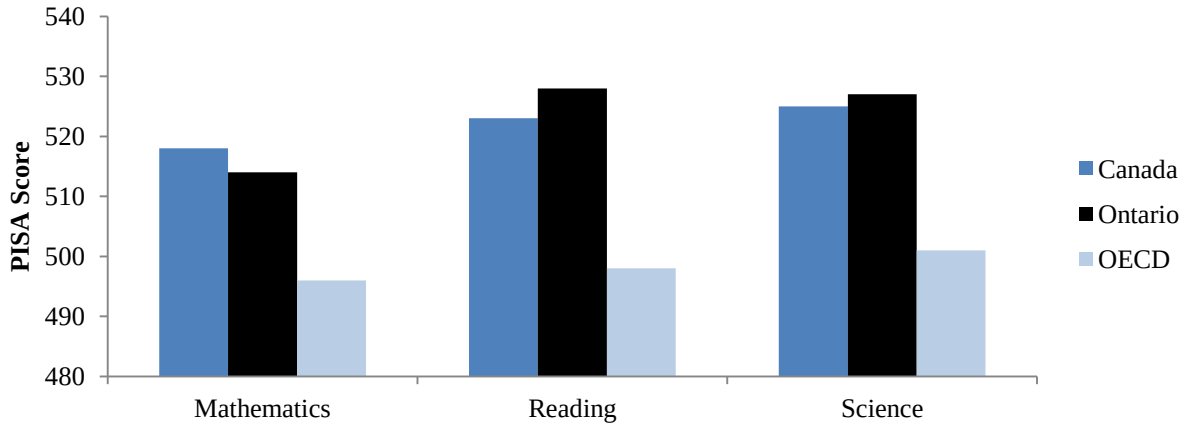
Source: CSLS calculations based on Statistics Canada data

6.1.4 Quality of High School Education

The overall quality of the workforce is directly linked to the quality of the education that the population receives at all levels of the education system. Standardized tests are one way to compare the performance of students across jurisdictions. Probably the best known such test is The Programme for International Student Assessment (PISA) developed by the OECD to measure the performance of high school students in three key areas: mathematics, science, and reading.

It is encouraging to find that Ontario students perform relatively well on PISA. In 2012, Ontario students scored well above the OECD average in mathematics, reading and science (Chart 49). The province also outperformed the national average in science and reading.

Chart 49: Average Scores of Canadian 15-Year Old Students on the PISA Test by Subject Area, OECD, Canada and Ontario, 2012



Source: OECD database

6.1.5 STEM (Science, Technology, Engineering and Mathematics)

Recent research has shown that scientists, technology professionals, engineers and mathematicians, collectively referred to as STEM workers, can contribute significantly to productivity growth.

For example, Peri, Shih and Sparber (2013) analyzed the impact of foreign STEM workers who migrated to the United States through a renewable work visa program (the H1B) and found that these workers boosted MFP growth by 0.3 percentage point in the 1990s and 0.1 percentage in the 2000s. This represented a significant 40 per cent of the MFP gains in the United States during the 1990s. Income per capita in 2010 is estimated to be 4 per cent higher than it would have been without the contribution of foreign STEM workers. STEM workers were found to be crucial in creating and adopting new technology in the United States, which is fundamental to productivity growth. There is a geographic element to this process; productivity gains tend to be local, and so an influx of STEM workers may create a virtuous cycle of innovation that is not spread evenly throughout the country. The authors found that an increase in foreign STEM workers of 1 per cent of total employment in a given city increased the wages of

native college-educated workers by 4 to 6 per cent. Workers were found to move towards human capital-intensive sectors which make greater use of creativity and problem-solving skills.

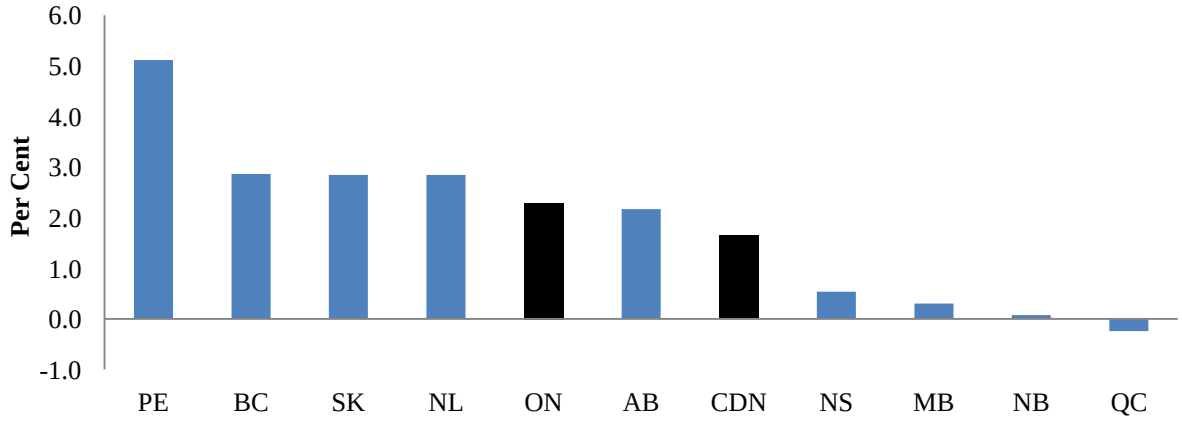
Given the importance of STEM workers for productivity growth, it is useful to examine current trends in STEM program enrolments and graduates at universities and colleges in Ontario.[18] Two key trends stand out. Enrolment growth in STEM programs in Ontario is slower than in non-STEM programs, but Ontario has more STEM students than other provinces.

In 2011, university and college enrolment in STEM programs in Ontario totaled 160,080, representing 20.4 per cent of total enrolment (Chart 50). Even though STEM enrolment grew at the fairly brisk rate of 2.29 per cent per year over the 2000-2012 period, faster enrolment growth in non-STEM programs meant that the share of STEM enrolment in total enrolment fell from 26.3 per cent in 2000. The mathematics, computer and information sciences program was the major contributor to the relative decline in STEM enrolment (Chart 51).

Ontario's rate of STEM enrolment growth from 2000 to 2011 exceeded the national average of 1.64 per cent (Chart 50), but four provinces enjoyed faster growth rates – namely, Prince Edward Island, British Columbia, Saskatchewan, and Newfoundland and Labrador.

In addition, to Ontario's above-average growth rate for STEM students, Ontario has proportionately more STEM students than the national average. Chart 52 shows that the enrolment rate for STEM was higher than the national average for all three STEM program areas throughout the 2000-2011 period, although there was a downward trend.

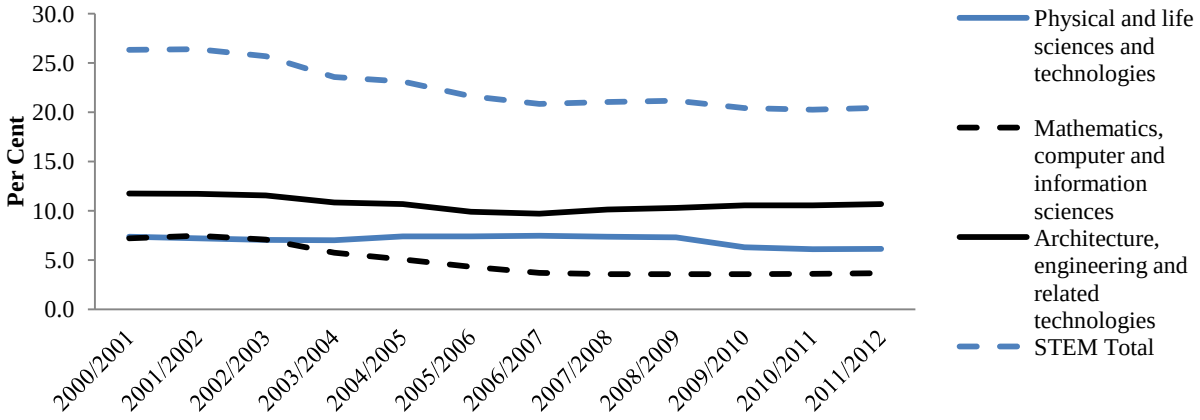
Chart 50: STEM Program Enrolment Growth, Universities and Colleges, Ontario, 2000-2012



Source: CSLS calculations based on Statistics Canada data

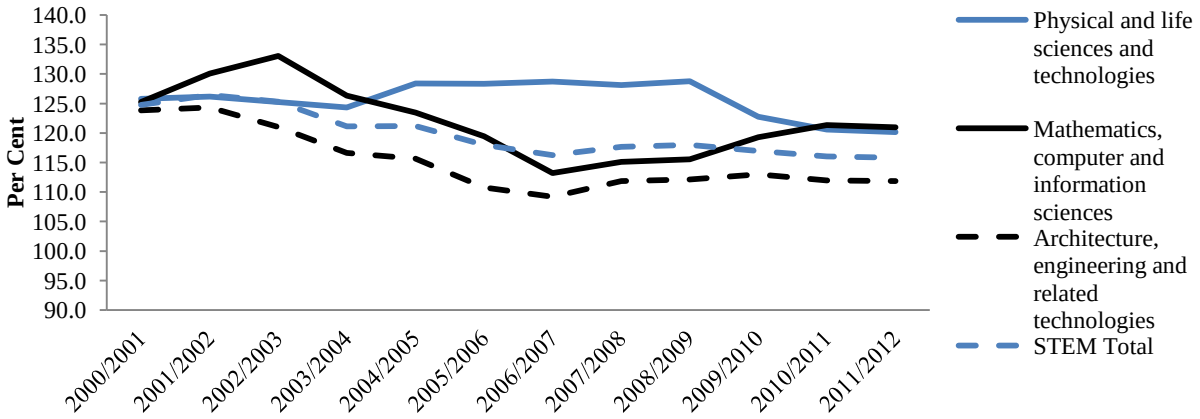
[18] The discussion of STEM degrees in this report combines graduation/enrollment data for universities and colleges. In contrast, the U.S. National Science Foundation (NSF) and the Canadian Science, Technology, and Innovation Council (STIC) look at separate trends in STEM at universities and colleges rather than aggregating results. In addition, the typical focus on STEM by the OECD and other organizations is the number of STEM graduates at an advanced degree level (particularly Ph.Ds).

Chart 51: STEM Program Enrolment as a Percentage of Total Enrolment, Universities and Colleges, Ontario, 2000-2012



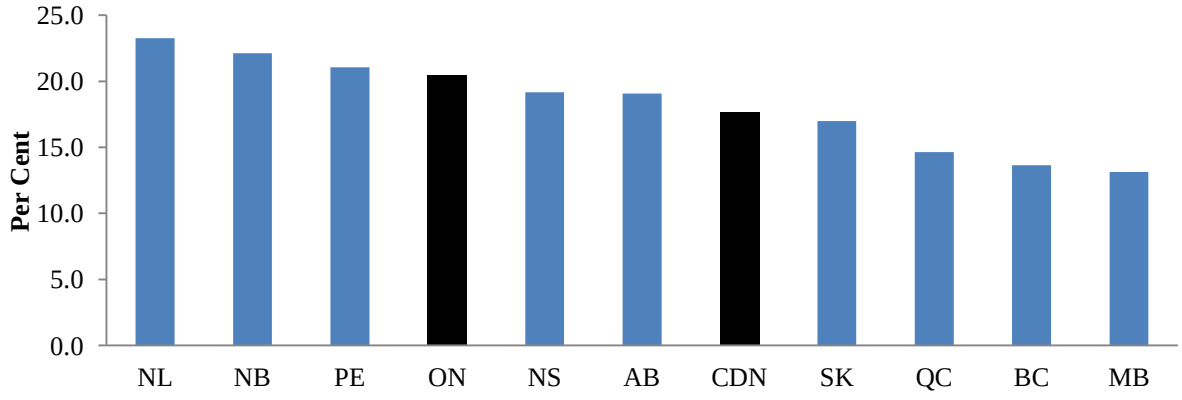
Source: CSLS calculations based on Statistics Canada data

Chart 52: Percentage of STEM Program Enrolment Relative to Canada, Universities and Colleges, Ontario, 2000-2012



Source: CSLS calculations based on Statistics Canada data

Chart 53: STEM Enrolment as a Percentage of Total Enrolment, Canada and the Provinces, 2011/2012



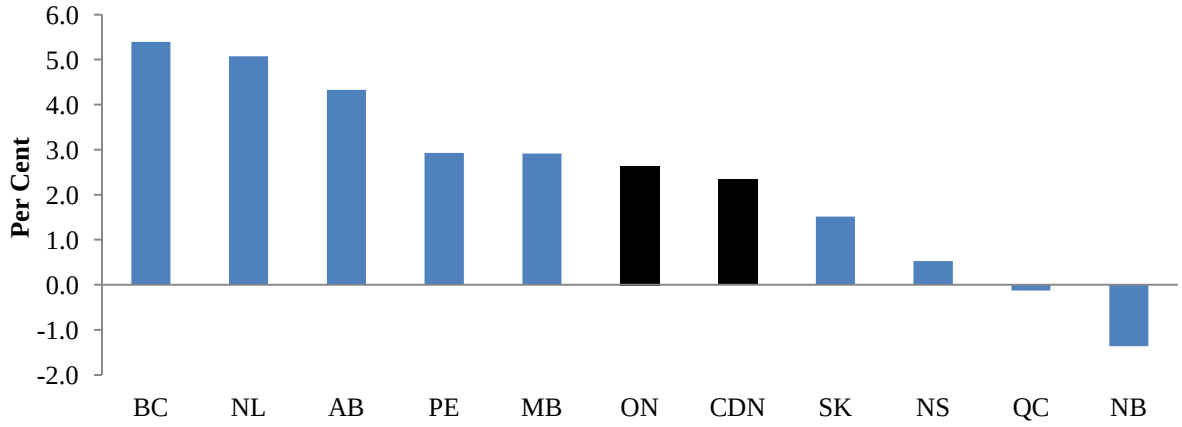
Source: CSLS calculations based on Statistics Canada data

Unsurprisingly, an analysis of STEM graduates reveals the same trends as enrolment. In 2011, university and college graduates in STEM programs in Ontario totaled 20,000, representing 19.6 per cent of total enrolment (Chart 55). Even though the number of STEM graduates grew at the robust rate of 2.64 per cent per year over the 2000-2011 period, faster enrolment growth in non-STEM graduates meant that the share of STEM graduates in total graduates fell from 23.1 per cent in 2000. The mathematics, computer and information sciences program again was the major contributor to the relative decline in STEM enrolment (Chart 51).

Ontario's rate of STEM graduate growth from 2000 to 2011 exceeded the national average of 2.34 per cent (Chart 54), but five provinces enjoyed faster growth rates – namely, British Columbia, Newfoundland and Labrador, Alberta, Prince Edward Island, and Manitoba.

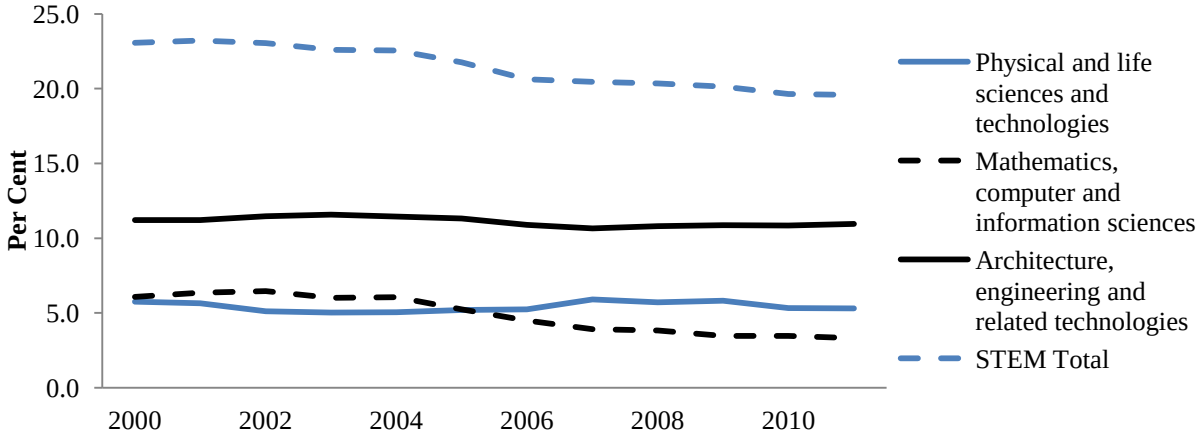
In addition to Ontario's above-average growth rate for STEM graduates, Ontario has more STEM graduates than the national average in proportional terms. Chart 56 shows that the proportion of STEM graduates in total graduates was higher than the national average for all three STEM program areas throughout the 2000-2011 period, except for architecture, engineering and related technologies after 2008. It is interesting to note that in contrast to the downward trend in STEM enrolment as a share of total enrolment in Ontario relative to the national average; this trend is upward for STEM graduates.

Chart 54: STEM Program Graduates Growth, Universities and Colleges, Ontario, 2000-2011



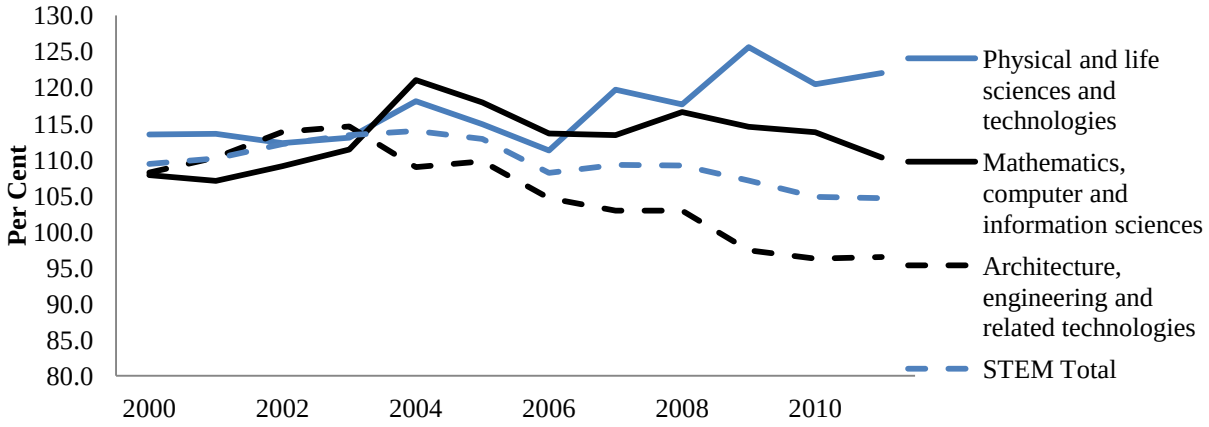
Source: CSLS calculations based on Statistics Canada data

Chart 55: STEM Program Graduates as a Percentage of Total Graduates, Universities and Colleges, Ontario, 2000-2011



Source: CSLS calculations based on Statistics Canada data

Chart 56: Percentage of STEM Program Graduates Relative to Canada, Universities and Colleges, Ontario, 2000-2011



Source: CSLS calculations based on Statistics Canada data

6.1.6 Summary

Ontario fares well relative to the other provinces in terms of human capital. In fact, Ontario is the most educated province in terms of the share of the population aged 15+ with a university degree, while it has the second lowest high school non-completion rate. In addition, Ontario has the third highest university enrolment rate among the provinces, and it has the highest average number of year of schooling.

Ontario also performed well with regard to participation in apprenticeship training programs. Ontario was above the Canadian average in terms of the share of the labour force participating in registered apprenticeship programs. In addition, Ontario experienced a 7.18 percentage point increase in the growth of the number of apprentices between 1991-2000 and 2000-2011, even larger than the increase for the ROC (6.61 percentage points).

Ontario surpassed the OECD and Canadian averages in terms of reading and science sections of PISA. In terms of the mathematics section of PISA, Ontario was higher than the OECD average but was slightly below the Canadian average.

Ontario also fared relatively well, being higher than the Canadian average, with respect to growth in STEM program enrolment and STEM graduates as well as STEM program enrolment and STEM graduates as a share of total enrolment and total graduates.

6.2 Innovation

6.2.1 Research and Development

R&D is performed by businesses, governments and the higher education sector. This section discusses trends in Ontario's performance in all three sectors in both absolute terms and as a share of GDP (referred to as R&D intensity).

6.2.1.1 Business and Enterprise Research and Development Expenditures (BERD)

Ontario's business and enterprise research and development (BERD) expenditure was $7,713 million in 2011, equivalent to 1.72 per cent of business sector GDP, the second highest BERD intensity among the provinces (Chart 58). The only province with higher BERD intensity was Quebec (1.98 per cent).

But the rate of BERD growth in Ontario has been very weak since 2000, at only 1.08 per cent per year, the slowest of all the provinces (Chart 57). This has resulted in a fall in the province's BERD intensity from a peak of 1.83 per cent in 2005 (Chart 59). Not surprisingly, it was the manufacturing sector that was responsible for Ontario's poor BERD performance.

Table 26 shows the BERD by sector in Ontario in 2000 and 2010. In 2000, manufacturing accounted for 77.9 per cent of BERD. By 2010, it has fallen to 52.7 per cent. This reflects both the absolute fall in manufacturing R&D of 23.9 per cent due to the global economic crisis, but also very large increase in R&D in other sectors, including a seven-fold increase in information and cultural industries and a 126 per cent increase in wholesale trade.[19]

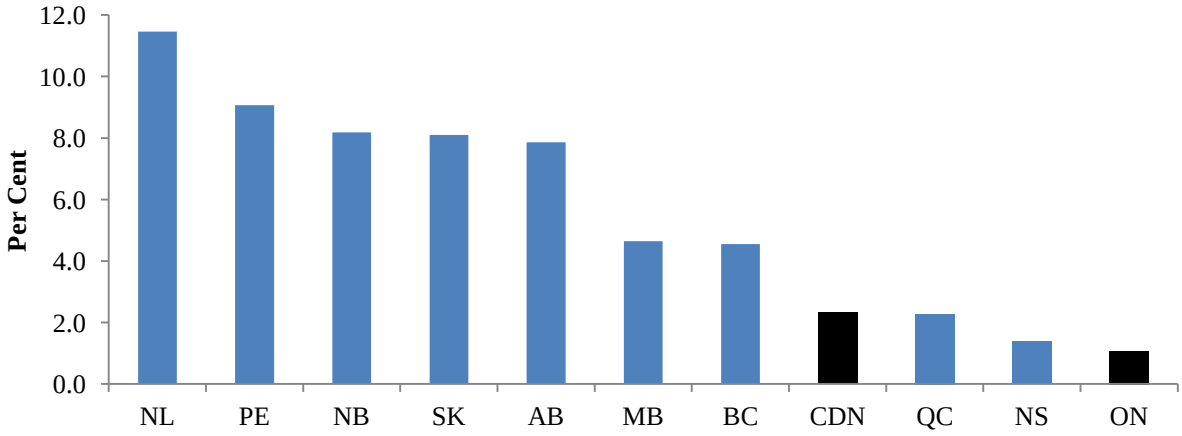
[19] Statistics Canada and the Council of Canadian Academies (2013) have noted that R&D in the wholesale trade industry often counts foreign pharmaceutical manufacturers that are classified as wholesalers. For example, the Council of Canadian Academies (2013) "questioned whether the available data underestimate the amount of IR&D undertaken in support of certain manufacturing industries. Since manufacturing increasingly takes place elsewhere in the world, IR&D is often assigned to the wholesale trade services industry because only marketing and IR&D activities remain in Canada. For example, R&D aimed at developing new drugs may be assigned to the scientific research and development or wholesale trade industries, rather than to the pharmaceutical manufacturing industry."

Table 26: Business and Enterprise Research and Development Expenditures, Ontario, 2000 to 2010

	Levels			Share of Business Sector Nominal GDP		
	2000	2010	Compounded Annual Growth Rate	2000	2010	Change in Shares
	(Millions of Current Dollars)			(Percentages)		
Agriculture, forestry, fishing and hunting	..	50	..	..	0.04	..
Mining and oil and gas extraction	..	55	..	..	0.04	..
Utilities	..	59	..	..	0.05	..
Construction	..	67	..	..	0.05	..
Manufacturing	5,345	4,066	-2.46	4.10	3.12	-2.46
Wholesale trade	329	744	7.70	0.25	0.57	7.70
Retail trade	16	30	5.88	0.01	0.02	5.88
Transportation and warehousing	..	15	..	..	0.01	..
Information and cultural industries	80	541	18.98	0.06	0.41	18.98
Finance, insurance and real estate	110	134	1.81	0.08	0.10	1.81

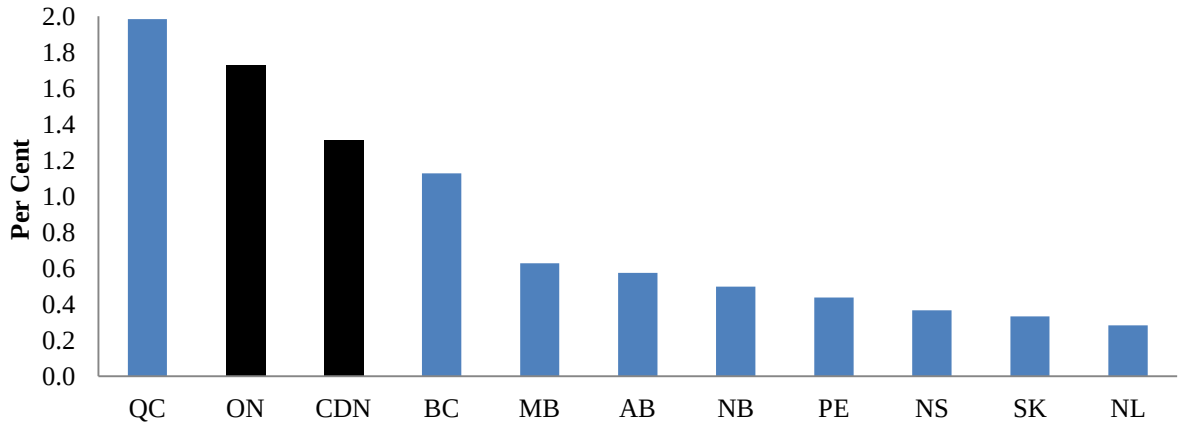
Source: CSLS Calculations based on Statistics Canada data.
*Unavailable data were suppressed by Statistics Canada for confidentiality reasons

Chart 57: Business and Enterprise Research and Development Expenditure Growth, Canada and Provinces, 2000-2011



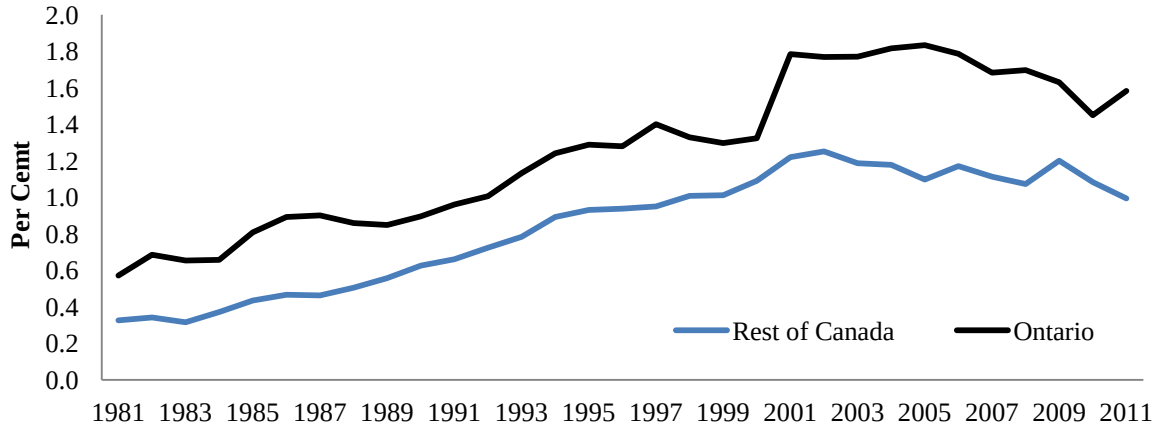
Source: CSLS Calculation based on Statistics Canada data

Chart 58: Business and Enterprise Research and Development Expenditure as a Percentage of Business Sector Nominal GDP, Canada and Provinces, 2011



Source: CSLS calculations based on Statistics Canada data
Note: Business sector nominal GDP data were imputed based on total economy nominal GDP data.

Chart 59: Business and Enterprise Research and Development Intensity, Ontario and the Rest of Canada, 1981-2011



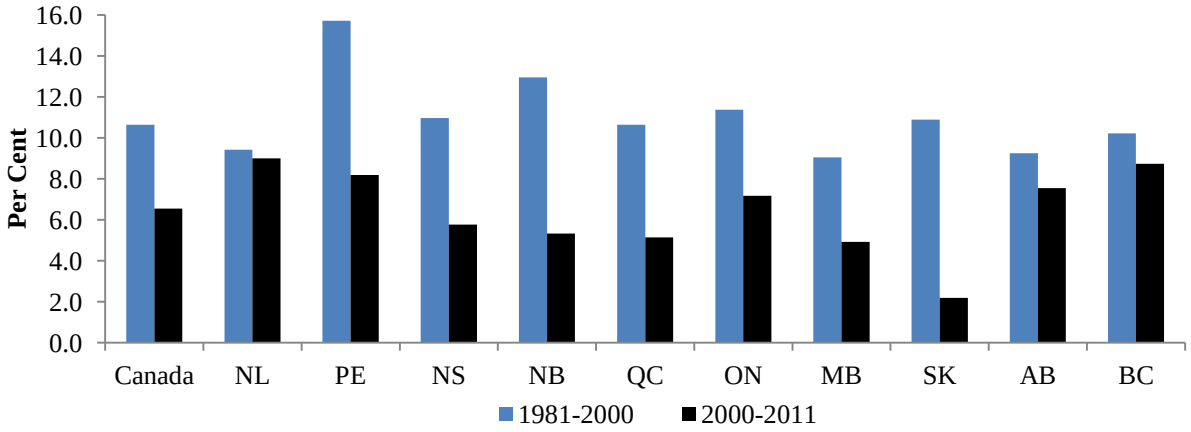
Source: CSLS calculations based on Statistics Canada data

6.2.1.2 Higher Education Research and Development Expenditures (HERD)

Unlike the declines it experienced in BERD intensity, Ontario has had a strong upward trend in higher education expenditures on research and development (HERD) intensity. In 2011, HERD intensity (HERD/total economy GDP) in Ontario was 0.76 per cent, up from 0.52 per cent in 2000 and 0.23 per cent in 1981 (Chart 61). Ontario's HERD intensity rose from 98 per cent of the national average in 1981 to 115 per cent in 2011 (Chart 61).

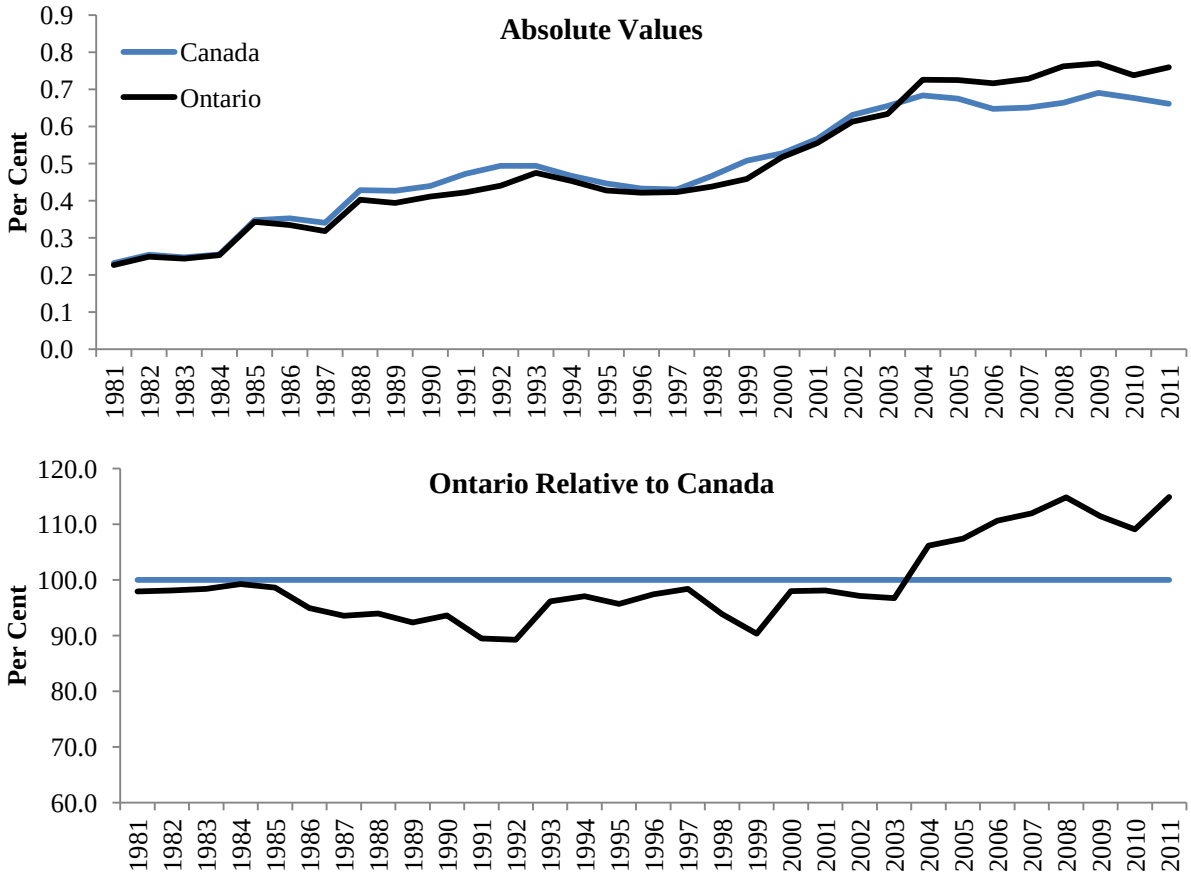
Among the provinces, Ontario had the third fastest growth in HERD in the 1981-2000 period and the fifth fastest in 2000-2011 (Chart 60). In 2011, Ontario had a high absolute HERD intensity, third among the provinces and behind only Quebec and Nova Scotia.

Chart 60: Annual HERD Growth for Canada and the Provinces, 1981-2000 and 2000-2011



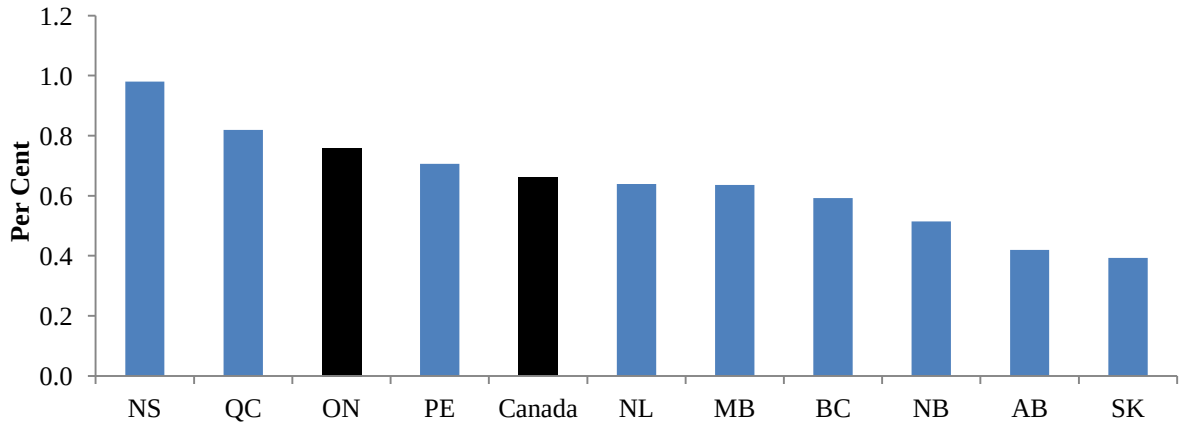
Source: CSLS calculations based on Statistics Canada data

Chart 61: HERD as Share of Nominal GDP, 1981-2011



Source: CSLS calculations based on Statistics Canada data

Chart 62: HERD Intensity for Canada and the Provinces, 2011

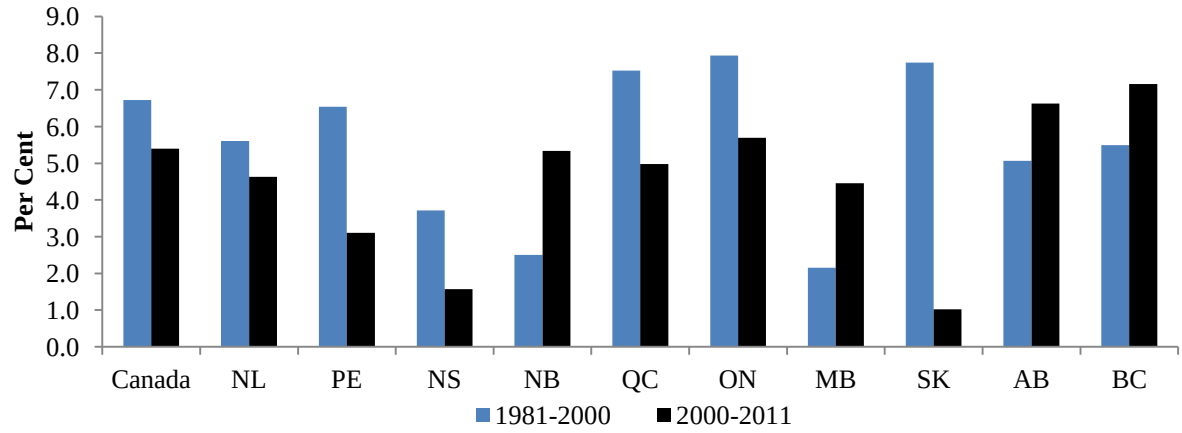


Source: CSLS calculations based on Statistics Canada data

6.2.1.3 Government Spending on Research and Development

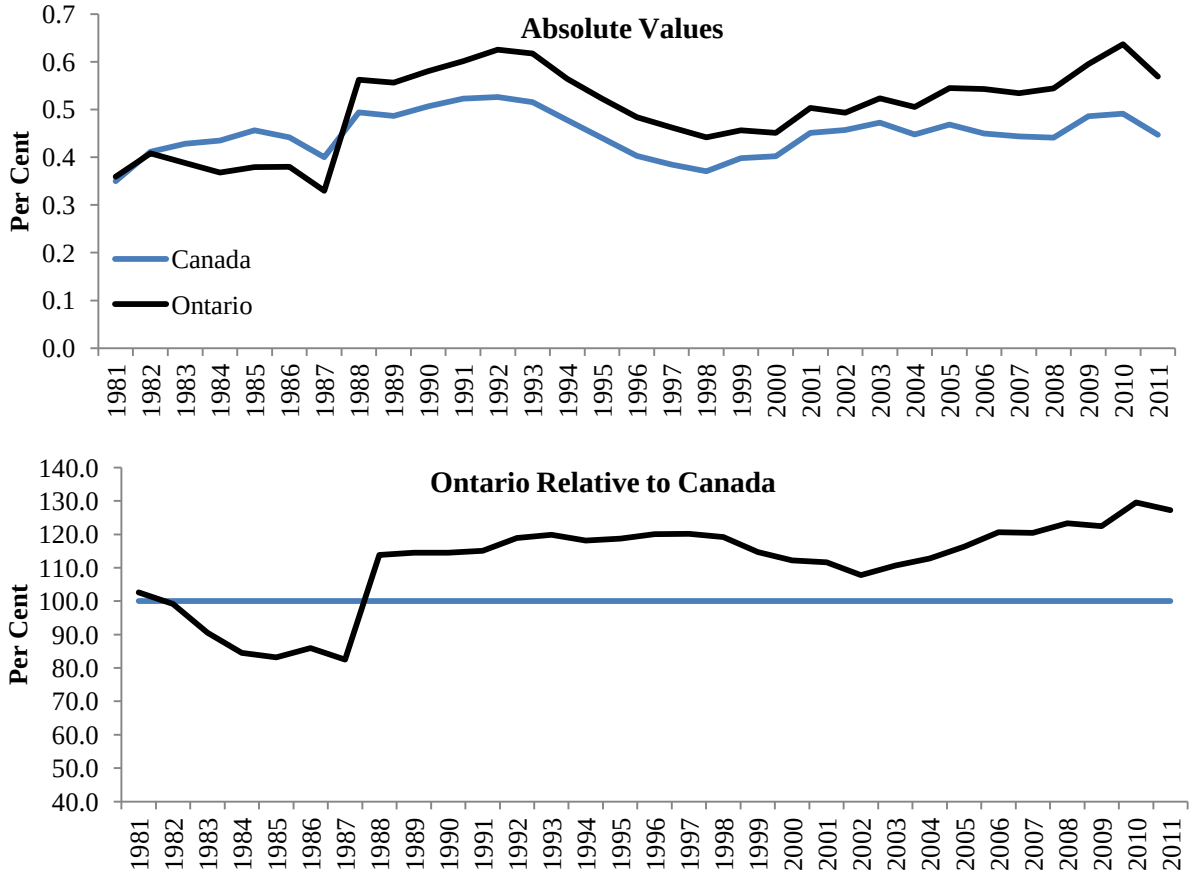
Trends in government expenditures on research and development (GOVERD) intensity in Ontario have been relatively stable, at least compared with the decline in BERD intensity and the increase in HERD intensity. In 2011, GOVERD intensity (GOVERD/total economy GDP) in Ontario was 0.57 per cent, up from 0.45 per cent in 2000 and 0.36 per cent in 1981 (Chart 64). Ontario's GOVERD intensity rose from 103 per cent of the national average in 1981 to 112 per cent in 2000 to 127 per cent in 2011 (Chart 64). Among the provinces, Ontario had the fastest growth in GOVERD in 1981-2000 and the third fastest growth in 2000-2011 (Chart 63). Ontario in 2011 had the highest GOVERD intensity among the provinces (Chart 65).

Chart 63: Government Expenditure for Research and Development Growth for Canada and the Provinces, 1981-2000 and 2000-2011



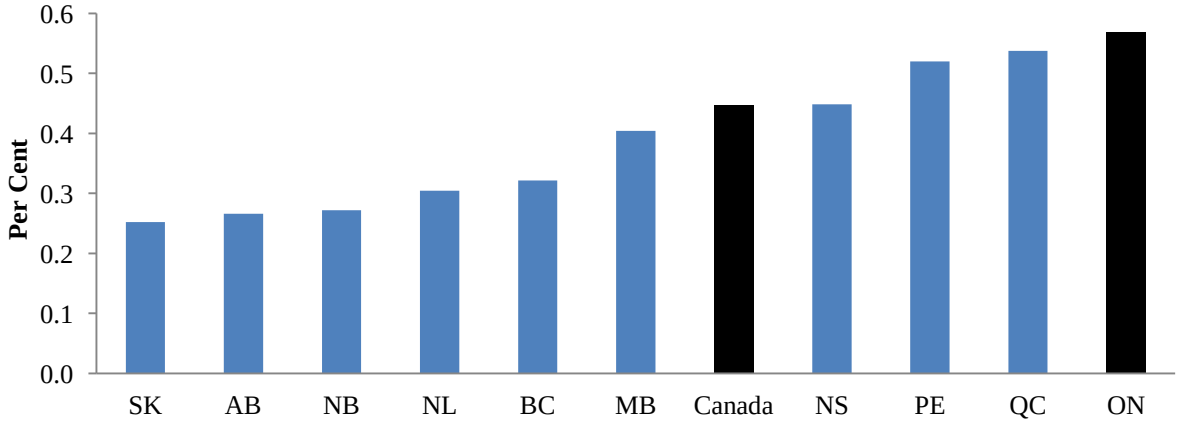
Source: CSLS calculations based on Statistics Canada data

Chart 64: Government Expenditure for Research and Development as Share of Nominal GDP, 1981-2011



Source: CSLS calculations based on Statistics Canada data

Chart 65: Government Expenditure for Research and Development Intensity for Canada and the Provinces, 2011



Source: CSLS calculations based on Statistics Canada data

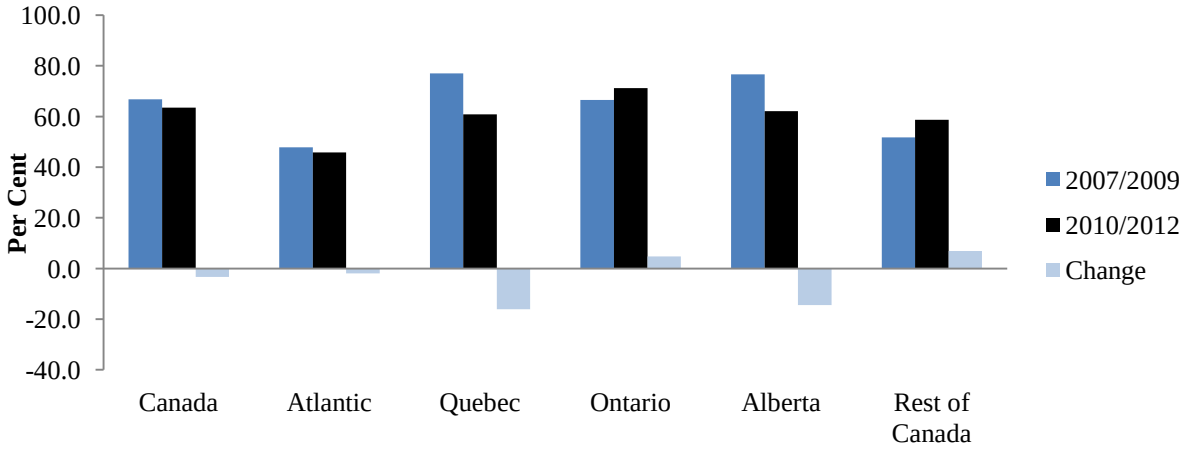
6.2.2 Survey of Innovation and Business Strategies (SIBS)

Innovation surveys ask firms about their implementation of new innovations and use of advanced technology. Statistics Canada's current innovation survey, the Survey of Innovation and Business Strategy (SIBS), provides information on the strategic decisions, innovation activities and operational tactics used by Canadian enterprises and the involvement of enterprises in global value chains. The last two waves of the SIBS (2007-2009 and 2010-2012) provide insight on Ontario's innovation performance, both over time and relative to other provinces.

6.2.2.1 Innovation rate

In 2010-2012, the percentage of enterprises which deployed new innovation across all surveyed industries (referred to as the innovation rate) was 71.2 per cent in Ontario (Chart 66), well above the rate for other regions (Atlantic: 45.8 per cent; Quebec: 60.9 per cent; Alberta: 62.1 per cent; and ROC: 58.7 per cent).[20] This suggests that firms of Ontario are more dynamic and forward-looking than elsewhere in the country.

Chart 66: Percentage of Firms that Deployed Innovation, Business Sector, Canada and the Regions, 2007-2009 and 2010-2012



Source: Statistics Canada, CANSIM Table 358-0221

Between the three year periods of 2007-2009 and 2010-2012, the percentage of enterprises in Ontario that deployed new innovation rose from 66.5 per cent to 71.2 per cent (Appendix Table 25). In contrast, the rate at the national level fell from 66.8 per cent to 63.5 per cent. This meant that Ontario went from being at the national average in terms of innovation to 12 per cent above that level.

Innovation rates vary greatly by sector. In 2010-2012 the rate in Ontario ranged from a high of 95.1 per cent in ASWRS and 90.7 per cent in professional, scientific and technical to a low of 3.4 per cent in agriculture, forestry, fishing and hunting (Appendix Table 25). This latter estimate is an outlier as the second least innovative industry was transportation and warehousing

[20] For the statistical definition of an enterprise, see http://www.ic.gc.ca/eic/site/cis-sic.nsf/eng/h_00005.html.

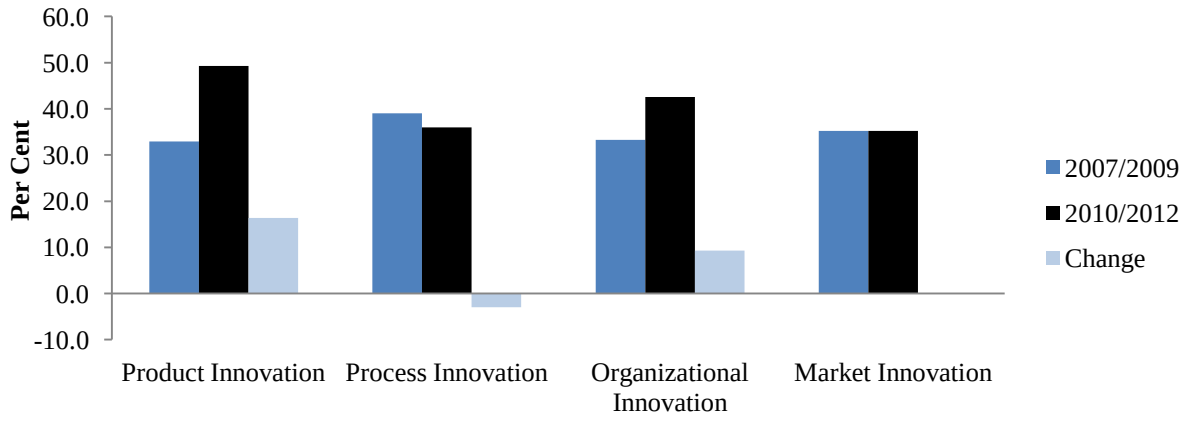
at 54.4 per cent. The rate of innovation in manufacturing was 74.2 per cent, slightly above the overall rate of 71.2 per cent.

Between 2007-2009 and 2010-2012, five of the eight industries for which estimates are available in both periods for Ontario experienced an increase in the innovation rate, while three experienced a decline. The largest decline was in manufacturing, which fell from 84.9 per cent, then by far the highest innovation rate of any sector, to 74.2 per cent. The largest increase was in finance and insurance, which rose from 62.1 per cent to 77.9 per cent. These trends capture well the dynamic of the Ontario economy in the late 2000s, including the decline of manufacturing and rise of the financial sector. Concentrated in Toronto, the financial sector has become a more important part of Ontario's economy. In fact, Toronto is the financial capital of Canada, containing the headquarters of Canada's largest banks, insurance companies, pension funds and other financial institutions.

6.2.2.2 Type of innovative activity

The SIBS captures four types of innovative activity: product innovation, process innovation, organizational innovation, and marketing innovation. In Ontario, product innovation in 2010-2012 was the most important type of innovative activity (49.3 per cent), followed by organizational innovation (42.6 per cent), process innovation (36.0 per cent) and marketing innovation (35.2 per cent) (Appendix Table 26 and Chart 67). The rate of innovation across all four types of innovative exceeds 100 per cent (163 per cent) because many firms engage in more than one type of innovative activity.

Chart 67: Types of Innovation Deployed by Firms, Business Sector, Ontario, 2007-2009 and 2010-2012



Source: Statistics Canada, CANSIM Table 358-0221

The rise in the overall innovation rate in Ontario from 66.5 per cent in 2007-2009 to 71.2 per cent in 2010-2012 is explained by increases in the rate for product innovation (32.9 per cent to 49.3 per cent) and organizational innovation (33.3 per cent to 42.6 per cent). The rates in the other two types of innovative activity were unchanged or fell slightly.

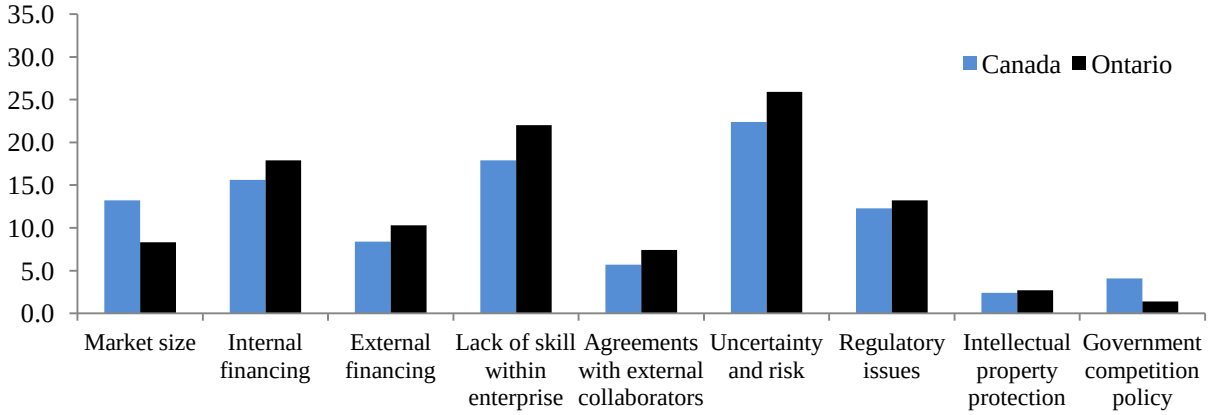
As noted above, the innovation rate in manufacturing in Ontario fell from 84.9 per cent to 74.2 per cent between 2007-2009 and 2010-2012. This development reflected falls in all four types of innovative activity. The innovative rate was down 11.4 percentage points in process innovation, 10.7 percentage points in organizational innovation, 9.3 percentage points in market innovation, and 5.3 percentage points in product innovation. In contrast, the rise in the innovation rate in finance and insurance from 62.1 per cent to 77.9 per reflected increases in three types of innovative activity: 14.9 percentage points in organizational innovation, 14.1 percentage points in process innovation, and 9.9 percentage points in product innovation. Marketing innovation dropped 10.5 percentage points.

6.2.2.3 Obstacles to innovation

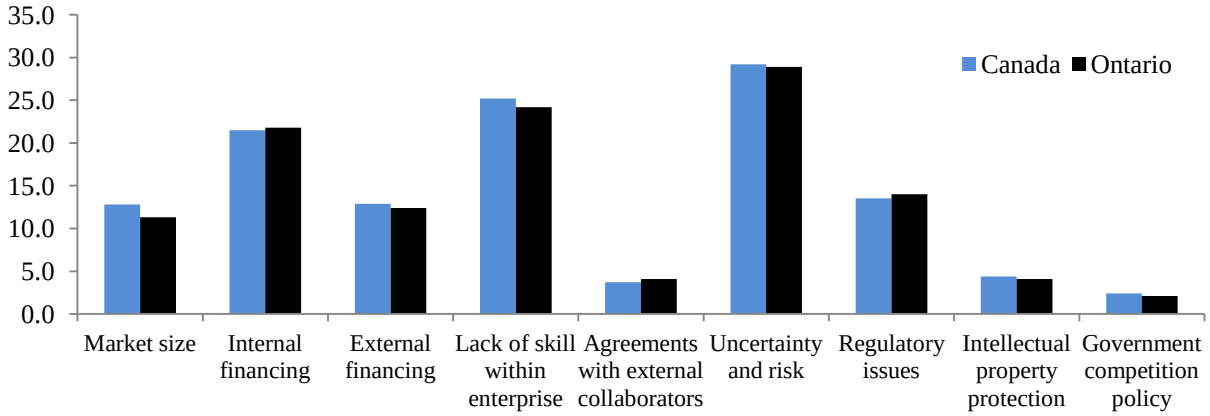
In 2012, Ontario fared worse than Canada as a whole in terms of the percentage of enterprises in all industries confronting obstacles to innovation. In fact, enterprises in Ontario were only less likely to report market size and government competition policy as barriers to innovation than the average Canadian enterprise (Chart 68, Panel A).

Chart 68: Obstacles to Innovation Confronted by Enterprises, Percentage of Enterprises, 2012

(A) *All Industries*



(B) *Manufacturing*



Source: Statistics Canada, CANSIM Table 358-0268 (SIBS)

Manufacturing, which accounted for a larger share of enterprises in Ontario than in Canada as a whole, consistently fared worse than the all-industry average in terms of the

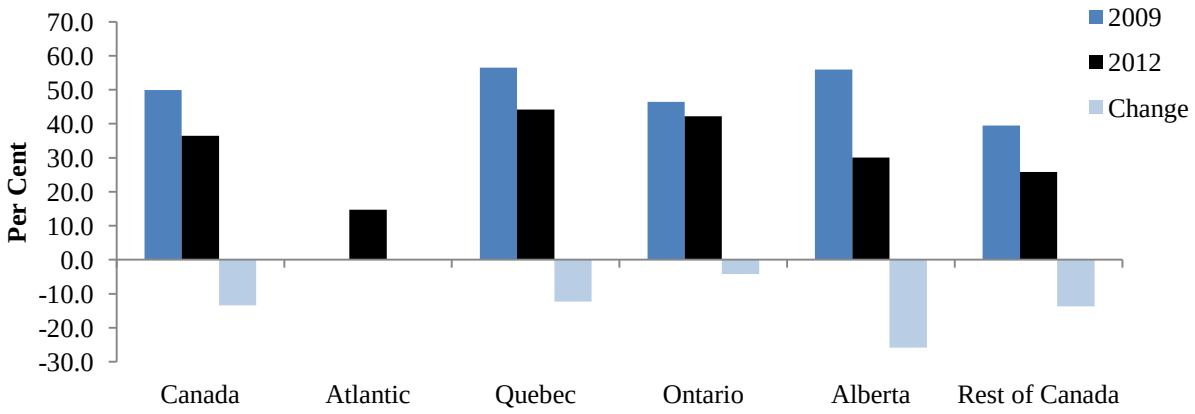
percentage of enterprises in all industries confronting obstacles to innovation. However, the performance of Ontario and Canada as a whole were similar in terms of the obstacles to innovation faced by manufacturing enterprises (Chart 68, Panel B). Thus, Ontario's greater obstacles at the aggregate level to innovation appear to have been due to its industrial composition (*i.e.* a greater share of Ontario's enterprises are located in the manufacturing sector).

In 2012, the most important obstacles to innovation were the same for Ontario and Canada as a whole, as well as for manufacturing and the all-industry average: uncertainty and risk, followed by lack of skill within enterprise, and internal financing.

6.2.2.4 Use of advanced technology

In 2012, the percentage of enterprises which reported use of advanced technology across all surveyed industries was 42.2 per cent in Ontario, well above the rate for the Atlantic (14.7 per cent), Alberta (30.1 per cent) and the ROC (25.8 per cent), but slightly below the rate for Quebec (44.2 per cent) (Appendix Table 27 and Chart 69). Between 2009 and 2012, the percentage of enterprises in Ontario that reported use of advanced technologies actually fell from 46.4 per cent to 42.2 per cent. The decline was even more dramatic at the national level, from 49.9 per cent in 2009 to 36.5 per cent in 2012.

Chart 69: Percentage of Enterprise that Reported the Use of Advanced Technology, Business Sector, Canada and the Regions, 2009 and 2012



Source: Statistics Canada, CANSIM Table 358-0223

These results are surprising given the increasing importance of advanced technology. They may reflect confusion on the part of survey respondents regarding the definition of what constitutes advanced technology. Technologies considered advanced in the earlier period may not be so considered in the second period. Consequently, these results should be interpreted with caution.

The industries that had the highest rate of advanced technology use in Ontario in 2012 were utilities (66.7 per cent), professional, scientific and technical services (61.4 per cent), and manufacturing (55.0 per cent).

Between 2009 and 2012, seven of the eight industries for which estimates are available in both periods for Ontario experienced falls in the use of advanced technologies (wholesale trade was the exception). By far the largest decline was in information and cultural industries (35.7 percentage points), followed by transportation and warehousing (15.4 percentage points), and manufacturing (12.1 percentage points).

6.2.2.5 Off-shoring

In recent decades the phenomenon of off-shoring, defined as the production of goods or the performance of technical and support activities outside of Canada, whether within the same enterprise or outsourced to another enterprise, has grown in importance. The motivation for such a strategy is generally to reduce costs and lead to a competitive advantage for a firm. A high degree of outsourcing may be considered a sign of dynamism for an economy.

In 2012, the extent of outsourcing by Ontario's business enterprises consistently exceeded the national average (Appendix Table 28). For the production of goods, 19.4 per cent of enterprises in Ontario outsourced, compared to 13.7 per cent for Canada, for technical activities, 13.9 per cent versus 10.1 per cent, and for support activities, 17.3 per cent versus 12.9 per cent. Of the five regions for which estimates are available, Ontario had the highest rate of outsourcing for the production of goods and support services and second highest (after Alberta) for technical services.

Appendix Table 29 provides estimates of the degree of outsourcing activities of Ontario's business enterprises by two-digit NAICS industries in 2012. The sector with the highest incidence of outsourcing for production activities was information and cultural activities (32.9 per cent), for technical activities it was mining and oil and gas extraction (30.7 per cent), and for support activities it was professional, scientific and technical services (34.2 per cent).

6.3 Investment

As noted several times in this report, long-run productivity growth is determined by the rate of technological progress in an economy; however, this progress is largely embodied in capital goods. Since it is through investment that these new capital goods come into place, the investment performance of an economy contributes to productivity growth. This section examines Ontario's investment performance for total non-residential business investment, which includes structures, machinery and equipment, and intellectual property products, and public investment. Investment trends in the manufacturing are also provided. Even though ICT investment is included as part of intellectual property products, a more detailed analysis will be provided because of the importance of ICT investment to productivity growth.

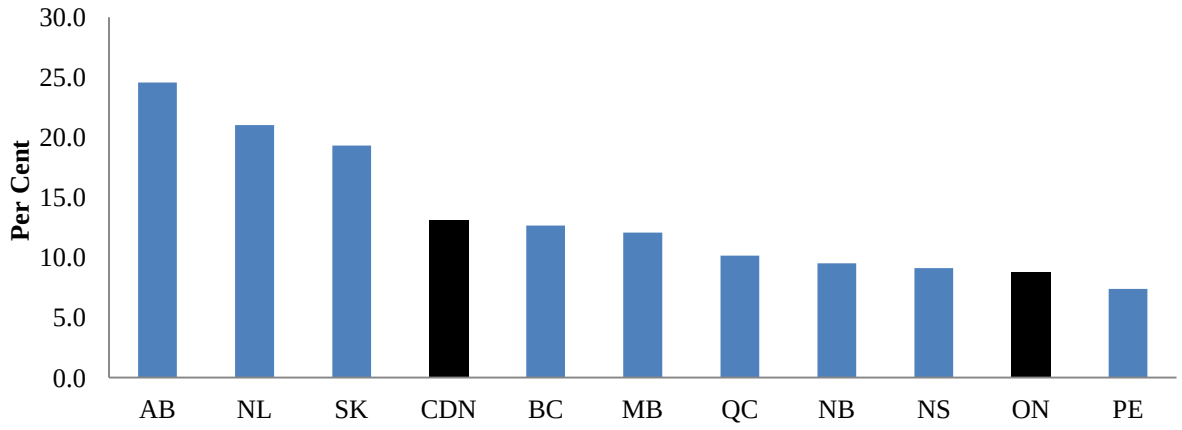
6.3.1 Business Sector

Chart 71 shows the trend in business sector non-residential investment, broken down into structures, machinery and equipment, and intellectual property products, as a share of nominal GDP for the 1981-2012 period in Ontario and the ROC. In 2012, there was a 6.8 percentage point difference in this ratio between Ontario and the ROC (15.6 per cent in the ROC versus 8.8

per cent in Ontario). Chart 70 shows that Ontario had the second lowest share of non-residential investment in GDP among the provinces in 2012 at 8.79 per cent. Only Prince Edward Island was lower.

This large gap is most attributed to structures, where the gap between Ontario and the ROC is a 5.9 percentage difference. As shown in Chart 70, this situation largely reflects the very large investment by the resource sector in the western provinces and Newfoundland and Labrador, and should not necessarily be seen as a weakness of the Ontario economy. Most investment in the resource sector is in structures (Chart 71), whereas machinery and equipment investment is a more relevant metric for Ontario. However, in 2012 the share of business sector machinery and equipment in GDP was also lower in Ontario than in the ROC (1.0 percentage point). Spending on intellectual property products (which includes R&D), software and mining and oil and gas exploration were about the same in Ontario as the ROC in 2012 and throughout the 1981-2012 period.

Chart 70: Business Sector Non-Residential Investment as a Share of Total Nominal GDP, Canada and the Provinces, 2012



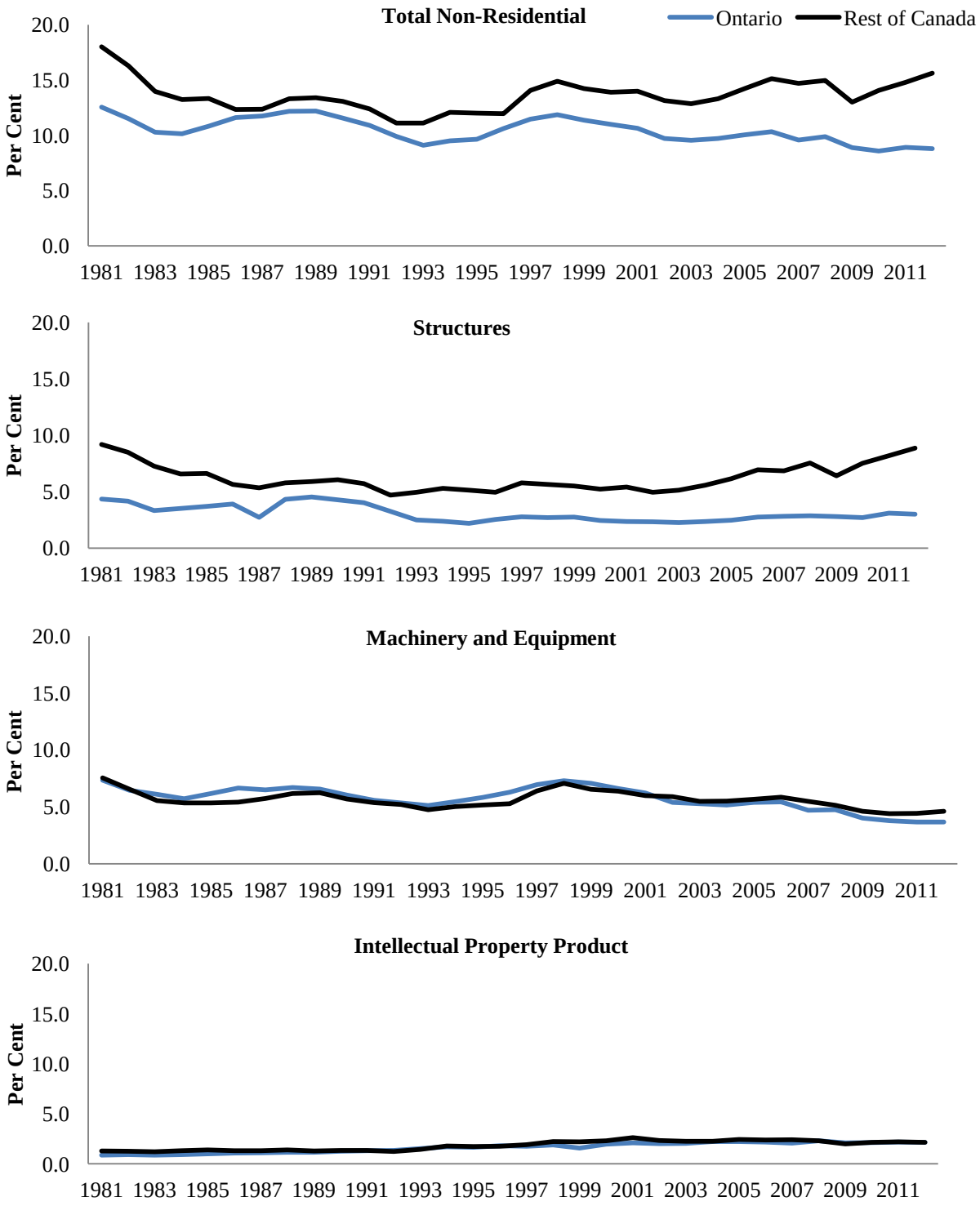
Source: CSLS Calculations based on Statistics Canada

6.3.2 Manufacturing Sector

Chart 72 shows the trend in manufacturing non-residential investment, broken down into structures, machinery and equipment, and intellectual property products, as a share of nominal GDP for the 1981-2012 period in Ontario and the ROC. In 2012, the share of manufacturing non-residential investment in nominal GDP in Ontario was identical to the share for the ROC, even though Ontario is the manufacturing heartland of Canada. Among the five provinces for which estimates of manufacturing investment are available, only Quebec had a higher investment share than Ontario in the same year (Chart 73).

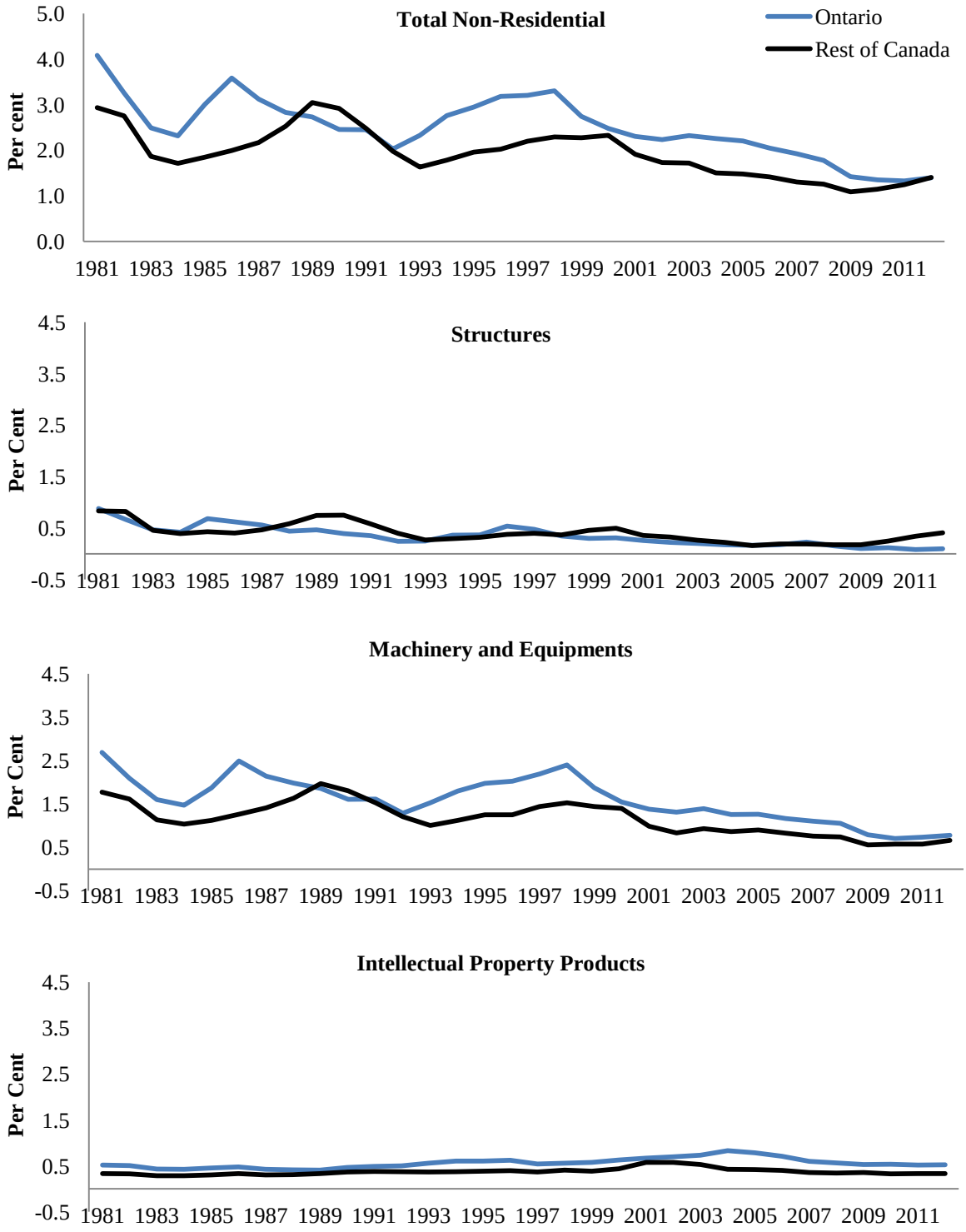
Manufacturing investment's share of nominal GDP has fallen significantly since 2000 in both Ontario and the ROC, with most of the fall attributable to machinery and equipment investment. This fall in manufacturing investment is another reflection of the declining importance of the sector in both Ontario and the ROC.

Chart 71: Non-Residential Investment as a Share of Total Nominal GDP, Business Sector, Ontario and the Rest of Canada, 1981-2012



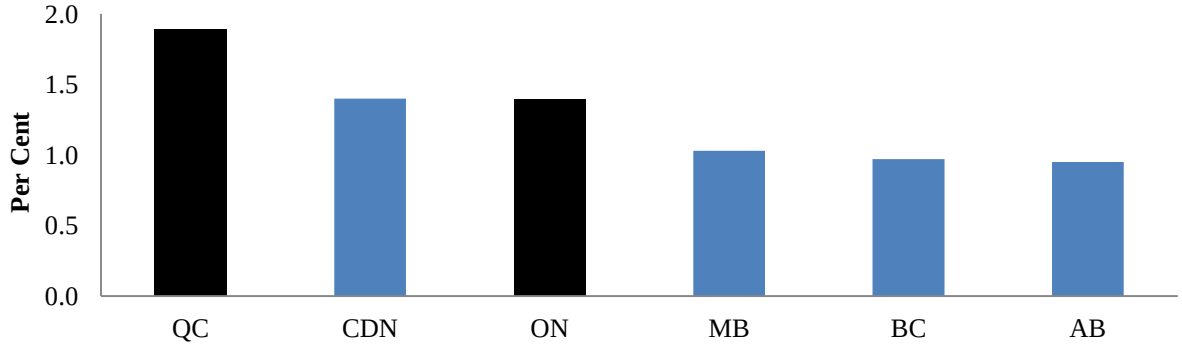
Source: CSLS Calculations based in Statistics Canada Data

Chart 72: Non-Residential Investment as Share of Total Nominal GDP, Manufacturing Sector, Ontario and the Rest of Canada, 1981-2012



Source: CSLS calculations based on Statistics Canada data

Chart 73: Manufacturing Sector Non Residential Investment as a Share of Nominal GDP, Canada and the Provinces, 2012



Source: CSLS calculations based on Statistics Canada data
Note: Data for Newfoundland and Labrador, Nova Scotia, New Brunswick, Prince Edward Island, and Saskatchewan were unavailable

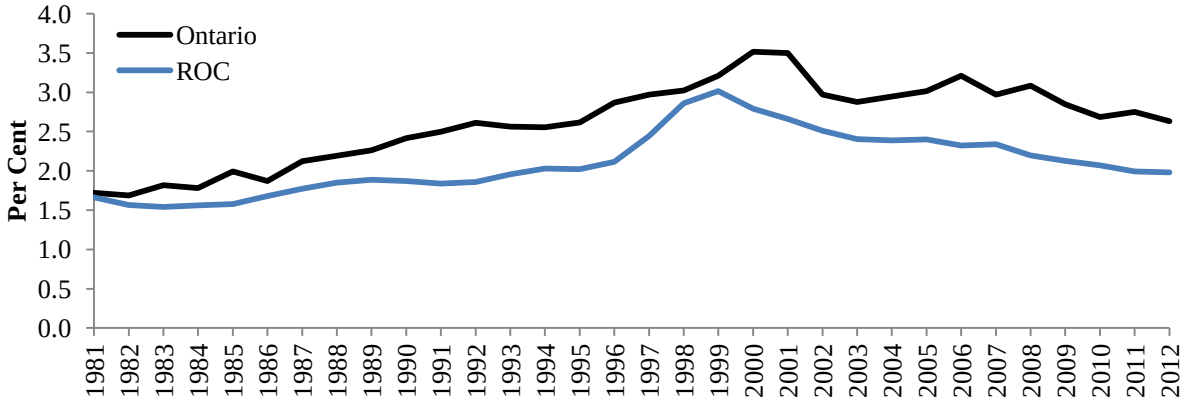
6.3.3 Information and Communications Technology Investments

Investment in information and communications technology (ICT) has been identified as an important source of productivity growth. The three components of ICT investment are: investment in computers, investment in telecommunications equipment, and investment in software.[21]

6.3.3.1 Total ICT investment

Chart 74 shows trends in total ICT investment as a share of nominal GDP for the 1981-2012 period for Ontario and the ROC. During this period, Ontario devoted a larger share of GDP to ICT investment than the ROC.

Chart 74: Total ICT Investment as Per Cent of Nominal GDP, Ontario and the Rest of Canada, 1981-2012

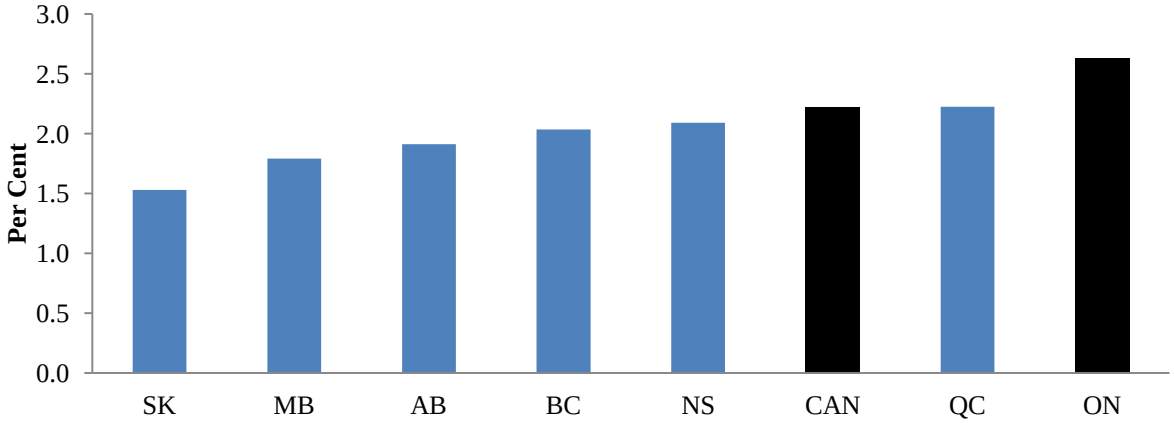


Source: CSLS calculations based on Statistics Canada data

[21] Detailed definitions of the three components of ICT investment can be found at http://www.csls.ca/reports/csls2013-03.pdf (Table 34).

Chart 75 compares Ontario to Canada and the rest of the provinces for 2012, showing that Ontario also dedicated a greater share of GDP to ICT investment than any other individual province.

Chart 75: Business Sector ICT Investment as Per Cent of Nominal GDP for Canada and the Provinces, 2012

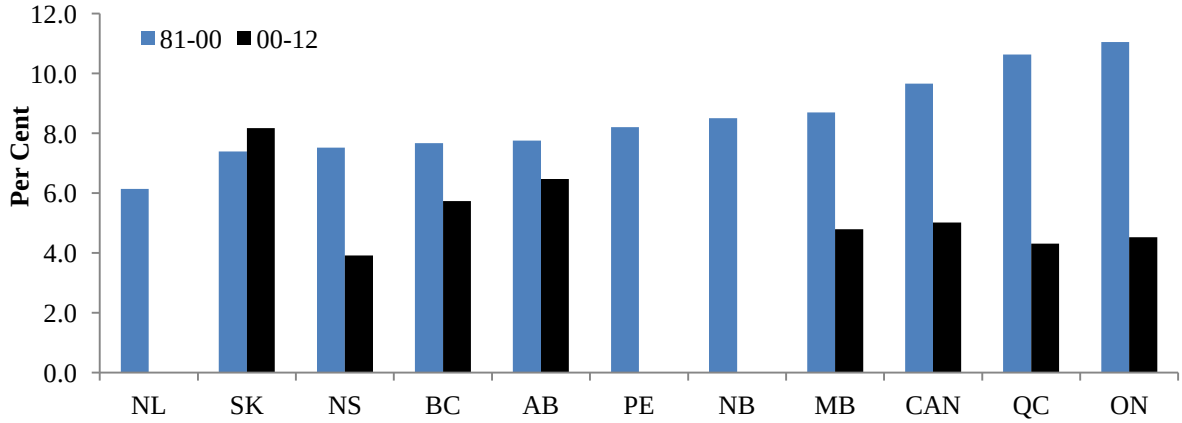


Source: CSLS calculations based on Statistics Canada data
Note: Data for Newfoundland and Labrador, New Brunswick, and Prince Edward Island are not available past 2008; for 2008, Ontario also had the highest share of ICT investment than any other province.

6.3.3.2 ICT investment per worker

Chart 76 provides growth rates for business sector ICT investment per worker for the 1981-2000 and 2000-2012 periods for Canada and the provinces. Ontario outperformed the national average before 2000, and underperformed after 2000. All provinces (excluding Saskatchewan) saw their investment growth rates decline between the two periods.

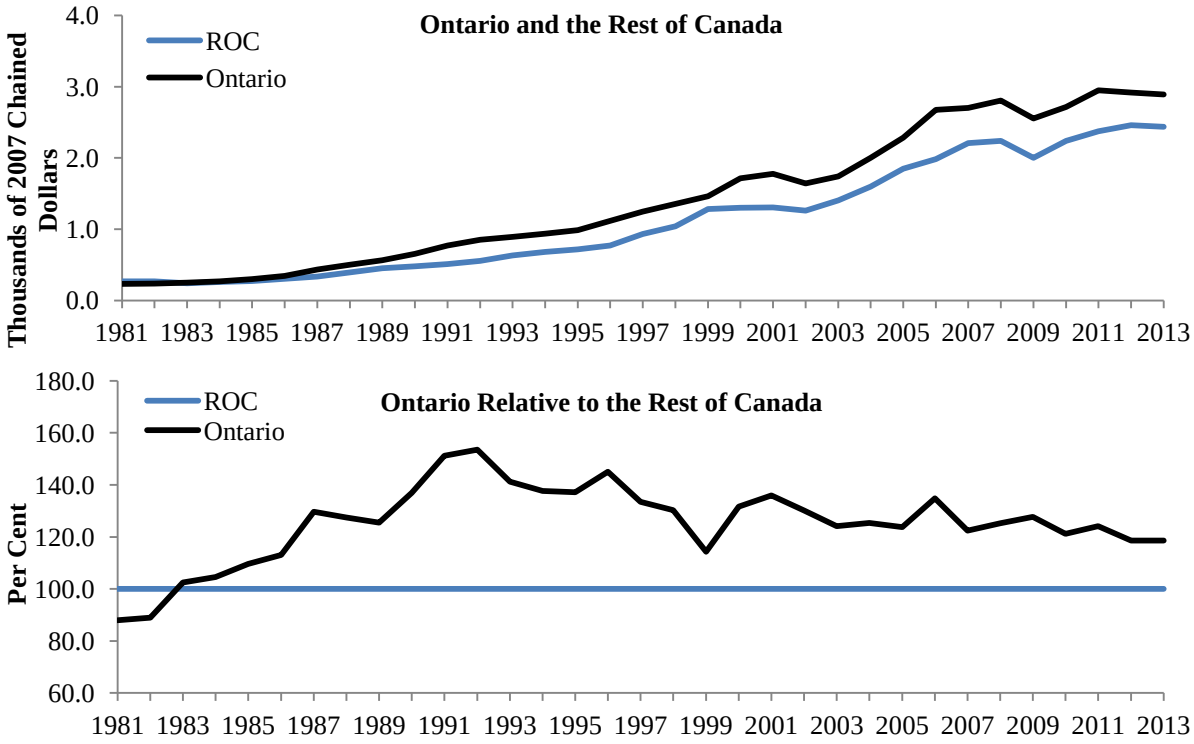
Chart 76: ICT Investment per Worker Growth Rates for Canada and the Provinces, 1981-2000 and 2000-2012, 2007 Chained Dollars



Source: CSLS calculations based on Statistics Canada data
Note: Data for Newfoundland and Labrador, New Brunswick, and Prince Edward Island are not available past 2008. In 2008, Ontario also had the highest share of ICT investment among all of the provinces.

Chart 77 shows ICT per worker for Ontario and the ROC between 1981 and 2012. It suggests that total ICT investment per worker has grown relatively steadily in Ontario, and at a faster rate than in the ROC. However, following the initial surge in investment that took Ontario from just 88.0 per cent of ICT investment per worker in the ROC in 1983 to 153.6 per cent in 1993, Ontario's lead over the ROC has steadily declined (second panel).

Chart 77: ICT Investment per Worker for Ontario and the Rest of Canada, 2007 Chained Dollars, 1981-2013



Source: CSLS calculations based on Statistics Canada data

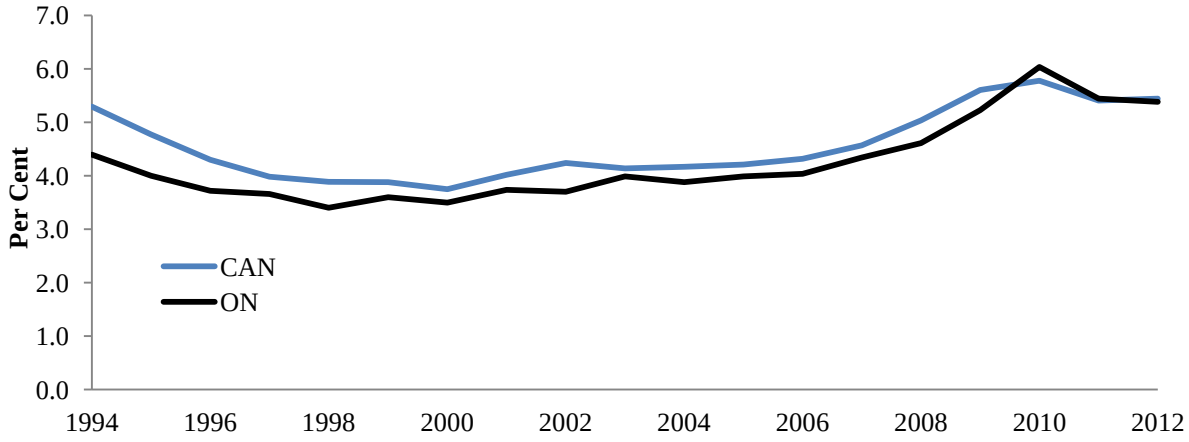
6.3.4 Public Investment

Economists have found a strong link between public infrastructure investment and business sector productivity growth (Aschauer, 1989; Gu and MacDonald, 2009). The efficient operation of businesses requires high quality roads to reduce congestion, effective public transit systems to reduce commuting time and expand the effective supply of workers, and water and sewer systems to foster production.

Data on public investment are available from Statistics Canada from 1994 to 2012. Chart 78 shows that public investment as a share of nominal GDP for Ontario and Canada. In recent years, Ontario's public investment share has risen, peaking at 6.0 per cent of GDP in 2010. While there may still be weaknesses in the province's infrastructure, the Ontario government has been increasingly devoting resources for infrastructure improvement in recent years.

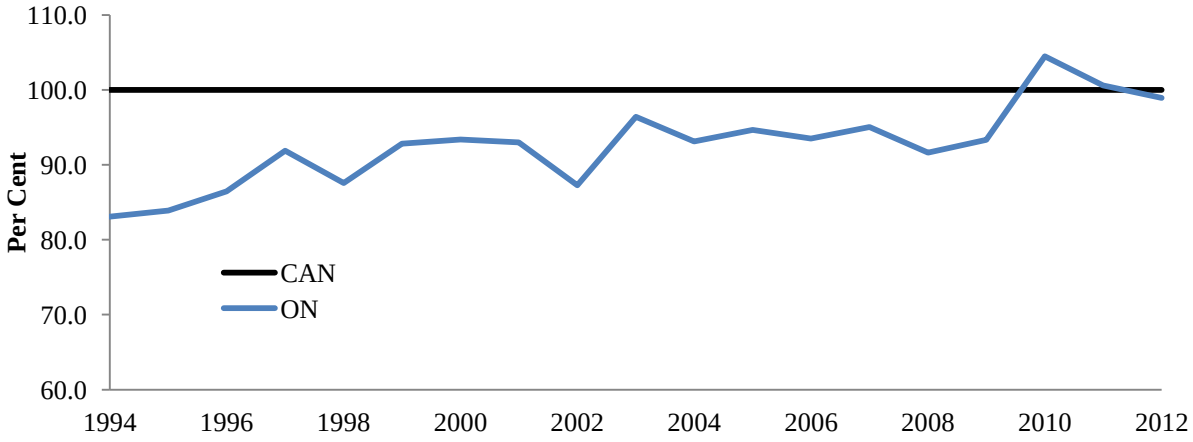
Ontario has also outperformed the national average on this indicator. The province's public investment as a share of GDP was 83 per cent of the Canadian average in 1994 (Chart 79). By 2010 it was 104 per cent, although it had dropped to 99 per cent in 2012.

Chart 78: Total Public Capital and Repair Investment Intensity for Canada and Ontario, Per Cent, 1994-2012



Source: Statistics Canada, CANSIM Table 032-0002

Chart 79: Total Public Capital and Repair Investment Intensity for Ontario Relative to Canada, Per Cent, 1994-2012



Source: Statistics Canada, CANSIM Table 032-0002

6.4 Assessment

After examining variables such as innovation, research and development expenditures, human capital and investment, it is fair to conclude Ontario has created an environment that is suitable for business sector productivity growth. Indeed, Ontario fared well relative to the ROC in terms of public investment, ICT investment, human capital, HERD growth, GOVERD growth, and non-residential investment in the manufacturing sector. However, Ontario was weak relative to the ROC with respect to BERD growth and non-residential investment in the business sector as a whole.

Government policies on education have transformed Ontario's workforce into the most educated in Canada, based on the metric of percentage of population aged 15+ with university degrees, high school non-completion rate, and average years of schooling. Even though business and enterprise research and development expenditure growth in Ontario is the lowest of all provinces, but its expenditure as share of nominal GDP is second highest in Canada which indicates Ontario's businesses are still investing heavily in research and development, while other provinces are trying to catch up.

While there is room for improvement in Ontario's supply-side performance, there does not appear to be a dramatic slowdown in supply-side variables after 2000 that can explain the slowdown in labour productivity growth in Ontario's business sector. In the next section, we will explore how the demand-side effects are putting drag on labour productivity growth.

7. An Analysis of Ontario's Productivity Drivers: A Demand-side Perspective

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 the demand conditions for Ontario because of its large manufacturing sector that relies heavily on exports. In this section, we will examine the historic changes of demand conditions for Ontario and provide an explanation of how these conditions have affected labour productivity in the province.

This section first looks at developments in the expenditure components of demand in Ontario and the ROC in the 2000s, identifying that exports accounted for the lion's share of the slowdown in output growth. Next, this section examines the reasons for the decline in exports. Finally, this section looks at the relationship between slower output growth and weaker productivity growth.

7.1 Breakdown of Real GDP by Expenditure in Ontario

Before analyzing demand conditions in Ontario in the 2000s, it is important to obtain a historical perspective to add a point of reference for Ontario's period of slower labour productivity growth since 2000.

Table 27 provide estimates, expressed in 2007 chained dollars, for demand categories in 1981, 2000 and 2012 in Ontario and the ROC, with the growth rates and contributions to output growth of the categories in the 1981-2000 and 2000-2012 periods.

As was emphasized in the third section of this report, the most important stylized fact in the past three decades affecting the Ontario economy has been the near halving of trend output growth (-1.48 percentage points) between the 1981-2000 and 2000-2012 periods, from 3.10 per cent per year to 1.63 per cent. In contrast, the ROC saw only a 0.29 percentage point fall in output growth from 2.47 per cent per year in 1981-2000 to 2.18 per cent per year in 2000-2012. As will be seen, it is this difference in output growth trends that explains productivity developments.

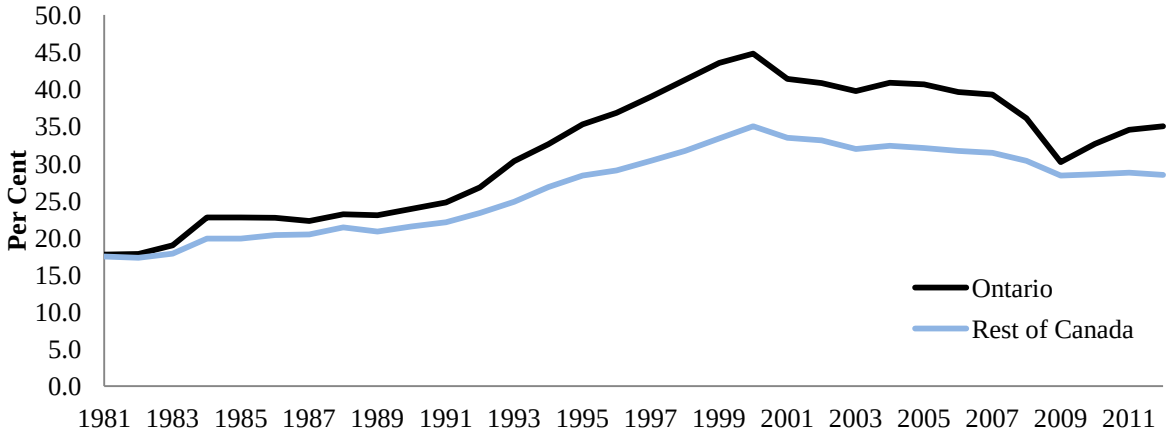
The strength of the Ontario economy in the 1980s and 1990s, as manifested by its superior growth rate compared to the ROC (3.10 per cent per year versus 2.47 per cent per year), was fuelled by exports. Indeed, international exports grew at an average annual rate of 8.25 per cent from 1981 to 2000, by far the fastest growth rate recorded by any expenditure category. Indeed, in the 1981-2000 period, the increase in exports was 79.3 per cent as large as the overall increase in Ontario's output. From 17.8 per cent of GDP in 1981, international exports rose to 44.9 per cent in 2000 (Chart 80). Even more impressive was the increased international orientation of trade. In 1981, for every dollar of exports to other provinces, Ontario exported $0.70 to other countries. By 2000, Ontario's international exports were more than double the size

of inter-provincial exports. Now for every dollar of exports to other provinces, $2.43 was exported to countries, a 3.5-fold rise.

Ontario's international exports were less in 2012 than in 2000, with average annual growth of -0.46 per cent between 2000 and 2012 in real terms. As a share of GDP, international exports fell from 44.9 per cent in 2000 to 35.0 per cent in 2012. After accounting for 79.3 per cent of output growth in 1981-2000, exports made a negative contribution of 11.3 per cent in 2000-2012.

A second factor explaining the weakness of Ontario's output growth after 2000, and the relative strength in the ROC, was investment. Business investment advanced at a strong 4.10 per cent per year in Ontario from 1981 to 2000 because strong demand for exports required large investments in productive capacity. After 2000, investment growth in Ontario fell to 2.60 per cent per year, in part because of a lower need for productive capacity for exports. In contrast, investment in the ROC, after growing at a tepid 1.82 per cent average annual rate in the 1981-2000 period, picked up to 4.50 per cent after 2000, due to significant investments in resource projects.

Chart 80: International Exports as a Share of Real GDP, Ontario and Rest of Canada, 1981-2012

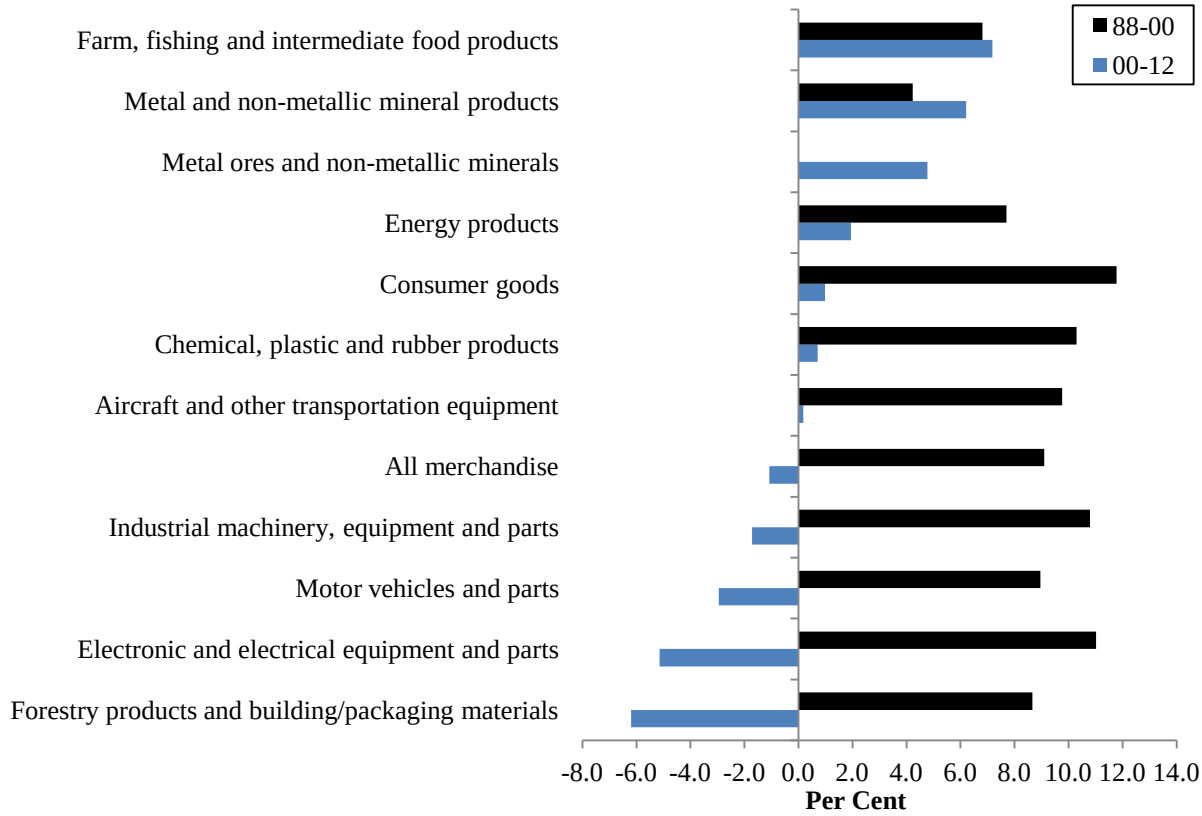


Source: CSLS calculations based on Statistics Canada data, CANSIM Table 384-0038

International export growth for Ontario was significantly lower for eight of the eleven merchandise exports categories in 2000-2012 relative to 1988-2000 (Chart 81).[22] Most significantly, exports of motor vehicles and parts decreased 2.95 per cent per year in 2000-2012, down from an annual increase of 8.96 per cent in 1988-2000. While growth in merchandise exports related to manufacturing unambiguously fell in 2000-2012 relative to 1988-2000, merchandise exports related to natural resources experienced an increase in their compound annual growth rates. More specifically, farm, fishing and intermediate food products, metal and non-metallic mineral products, and metal ores and non-metallic minerals saw their compound annual growth rates increase in 2000-2012 relative to 1988-2000.

[22] Data are not available by merchandise exports category for 1981-1987.

Chart 81: Compound Annual Growth in International Merchandise Exports by NAPCS, Current Dollars, Ontario, 1988-2000 and 2000-2012



Source: Statistics Canada, CANSIM Table 228-0060

Table 27: Real GDP Expenditure Components Growth and Levels, Ontario and Rest of Canada, 1981-2012

	Levels (2007 Chained Dollars)			Shares of GDP (Per Cent)			Growth Rate (Per Cent)			Contributions to Change (Per Cent)		
	1981	2000	2012	1981	2000	2012	1981-2000	2000-2012	Change in Growth Rate	1981-2000	2000-2012	Changes in Contribution
Ontario	A	B	C				E	F	F - E			
GDP	279,212	498,920	605,461	100.00	100.00	100.00	3.10	1.63	-1.48	100.00	100.00	
Household Consumption	148,946	260,550	355,409	53.35	52.22	58.70	2.99	2.62	-0.37	50.80	89.04	38.24
Government Expenditure	65,936	92,042	130,385	23.62	18.45	21.53	1.77	2.94	1.17	11.88	35.99	24.11
Investment	42,813	91,934	125,143	15.33	18.43	20.67	4.10	2.60	-1.50	22.36	31.17	8.81
Total Exports	120,723	315,739	322,145	43.24	63.28	53.21	5.19	0.17	-5.02	88.76	6.01	-82.75
Exports to Countries	49,594	223,754	211,725	17.76	44.85	34.97	8.25	-0.46	-8.71	79.27	-11.29	-90.56
Exports to Provinces	71,129	91,985	110,420	25.47	18.44	18.24	1.36	1.53	0.17	9.49	17.30	7.81
Total Imports	99,206	261,345	327,621	35.53	52.38	54.11	5.23	1.90	-3.33	73.80	62.21	-11.59
Imports from Countries	50,404	189,298	234,855	18.05	37.94	38.79	7.21	1.81	-5.40	63.22	42.76	-20.46
Imports from Provinces	48,802	72,047	92,766	17.48	14.44	15.32	2.07	2.13	0.06	10.58	19.45	8.87
Net Exports	21,517	54,394	-5,476	7.71	10.90	-0.90	..	..	..	14.96	-56.19	-71.16
Rest of Canada												
GDP	495,091	786,637	1,018,916	100.00	100.00	100.00	2.47	2.18	-0.29	100.00	100.00	
Household Consumption	250,997	393,673	568,778	50.70	50.05	55.82	2.40	3.11	0.72	48.94	75.39	26.45
Government Expenditure	130,941	164,972	215,926	26.45	20.97	21.19	1.22	2.27	1.04	11.67	21.94	10.26
Investment	114,648	161,497	273,798	23.16	20.53	26.87	1.82	4.50	2.68	16.07	48.35	32.28
Total Exports	139,176	354,522	387,543	28.11	45.07	38.03	5.04	0.74	-4.30	73.86	14.22	-59.65
Exports to Countries	90,374	282,475	294,777	18.25	35.91	28.93	6.18	0.36	-5.83	65.89	5.30	-60.59
Exports to Ontario	48,802	72,047	92,766	9.86	9.16	9.10	2.07	2.13	0.06	7.97	8.92	0.95
Total Imports	140,671	288,027	427,129	28.41	36.61	41.92	3.84	3.34	-0.51	50.54	59.89	9.34
Imports from Countries	69,542	196,042	316,709	14.05	24.92	31.08	5.61	4.08	-1.53	43.39	51.95	8.56
Imports from Ontario	71,129	91,985	110,420	14.37	11.69	10.84	1.36	1.53	0.17	7.15	7.94	0.78
Net Exports	-1,495	66,495	-39,586	-0.30	8.45	-3.89	..	..	..	23.32	-45.67	-68.99

Source: CSLS calculations based on Statistics Canada data, CANSIM Table 384-0038

7.2 Analysis of the Decline in International Exports

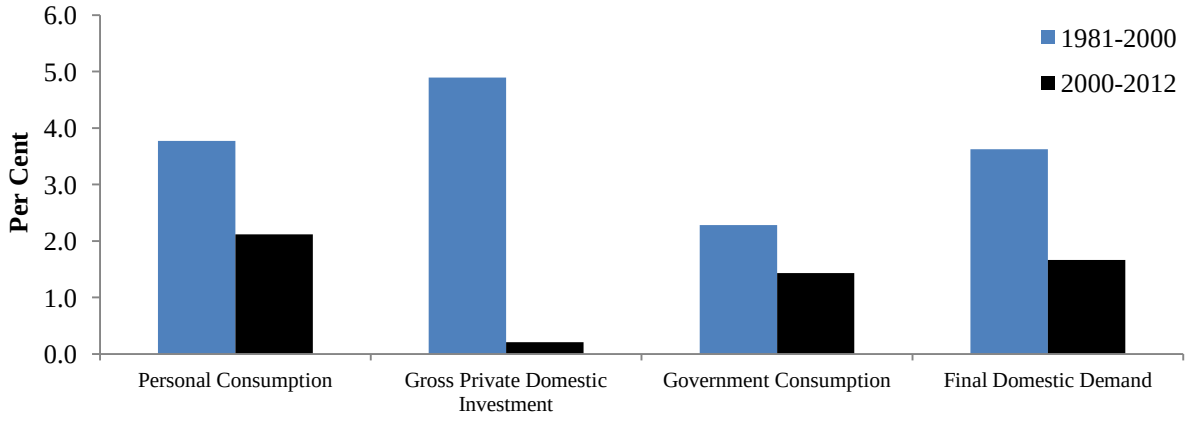
As shown in the preceding section, the slowdown in output growth in the Ontario economy after 2000 was largely due to the decline in international export growth. This section now attempts to explain this decline, looking at: 1) the weak demand growth of the U.S. economy, both before and especially following the 2008 global financial crisis; 2) increasing competition from international players such as China, South Korea and Mexico in the U.S. market; and 3) the loss of cost competitiveness of Ontario's exporters.

The loss of cost competitiveness in Ontario's export sector is a result of higher domestic currency unit labour cost and the appreciation of the Canadian dollar. It is worth noting that, as revealed in the recent Survey of Innovation and Business Strategy (SIBS), Ontario is the province most heavily oriented toward exports, with 25.4 per cent of enterprises exporting or seeking to export between 2010 and 2012, compared with a national average of 20.8 per cent. Even though we are discussing these three factors individually, they are related at the macroeconomic level.

7.2.1 Weakness of the U.S. Economy

Between 1981 and 2000, final domestic demand in the United States grew at a compound annual rate of 3.62 per cent, but fell to 1.66 per cent between 2000 to 2012 (Chart 82). Personal consumption also fell between those two periods, from 3.77 per cent per year to 2.11 per cent per year. Gross private domestic investment fell even more significantly from 4.89 per cent per year between 1981 and 2000 to 0.21 per cent per year between 2000 and 2012. Since Ontario's most important international export destination is the United States, accounting for 79.2 per cent of Ontario's international exports in 2012 (Gauthier, 2013), the weakness of the U.S. economy is one of the main contributors to the decline in Ontario's international exports.

Chart 82: Final Domestic Demand Components Growth, U.S., 2000-2012



Source: U.S. Bureau of Economic Analysis

7.2.2 International Competition from Emerging Markets

In addition to the weak U.S. economy, growing competitiveness from China, Mexico and other emerging markets also contributed to the decline of Ontario's export market in the United States. U.S. imports from Canada grew at a compound annual rate of 2.9 per cent from $229 billion (current U.S. dollars) in 2000 to $324 billion in 2012 (Table 28). This slow growth rate resulted in Canada's share of U.S. imports falling from 19.0 per cent in 2000 to 14.4 per cent in 2012. Ontario accounts for most of Canada's exports to the United States.

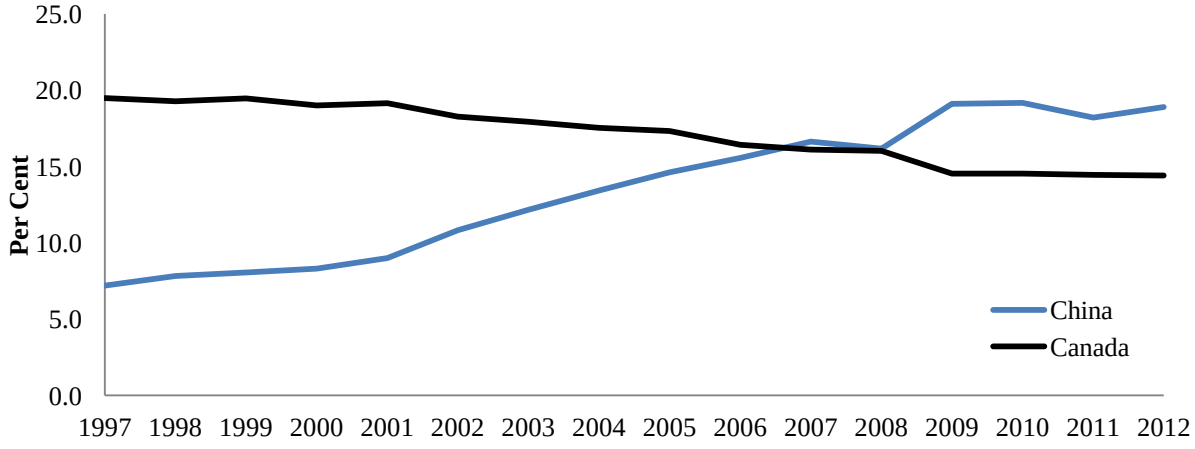
Canada's loss of share in the U.S. import market stems from the rising competition from emerging markets, most notably China. U.S. imports from China grew at a compound annual rate of 12.8 per cent, from $100 billion (current U.S. dollars) in 2000 to $425 billion in 2012. China eclipsed Canada in terms of the value of its exports to the United States in 2007 when China's share of the U.S. import market reached 16.6 per cent, while Canada was only 16.1 per cent (Chart 83). The shift in the import shares is in part explained by the reallocation of manufacturing plants from western countries to China, where labour costs are much lower.

Table 28: U.S. Imports for Consumption Levels and Growth, China and Canada, 2000-2012

	2000		2012		2000-2012	
	Levels (Billions)	Share	Levels (Billions)	Share	Compounded Annual Growth Rate	Change in Shares
Canada	229	19.00	324	14.40	2.93	-4.60
China	100	8.30	425	18.89	12.81	10.59

Source: CSLS Calculations based on U.S. Department of Commerce and the U.S. International Trade Commission

Chart 83: U.S. Imports for Consumption Market Share, China and Canada, 1997-2012



Source: CSLS Calculations based on U.S. Department of Commerce and the U.S. International Trade Commission

7.2.3 Loss of Cost Competitiveness

A third factor that contributed to the decline in Ontario's international exports is the loss of cost competitiveness. This factor is interrelated to the second factor as part of explanation of the gains by China in the U.S. import share at the expense of Canada may be linked to the lack of cost competitiveness of Canadian exports.

Unit labour cost in a common currency, defined as the average cost of labour per unit of output, is a key metric in measuring the cost competitiveness of an economy. Changes in the cost competitiveness can be broken down into two effects: 1) an exchange rate effect; and 2) a unit labour cost in domestic currency effect. This latter effect can be further broken down into two effects: 1) changes in hourly labour compensation; and 2) labour productivity. In this section, we will explore how each of these effects contributes to the loss of cost competitiveness in Ontario's manufacturing export sector.

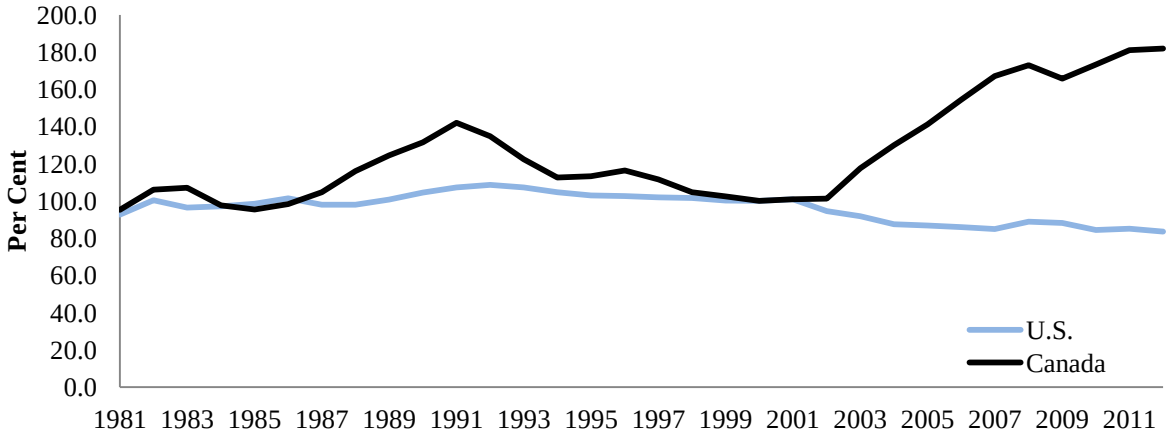
7.2.3.1 Trends in Unit Labour Costs in Canada and Ontario

Chart 84 shows trends in indices of unit labour costs for the manufacturing sector in U.S. dollars for Canada and the United States from 1981 to 2012. The indices are expressed in relative terms, and they equal 100 in both countries for 2000. Chart 85 gives the index for the manufacturing sector for Ontario, Canada and the United States from 2000 to 2012.

Trends in Canada's cost competitiveness were not greatly out of line with those in the United States from 1981 to 2000, except for some deterioration in the second half of the 1980s. The situation has changed dramatically since then. Between 2000 and 2012, Ontario and Canada's manufacturing unit labour costs have risen 88.0 and 81.8 per cent respectively, which is in stark contrast to the United States where unit labour cost have fallen 16.4 per cent. This represents a significant decline in Ontario and Canada's cost competitiveness.

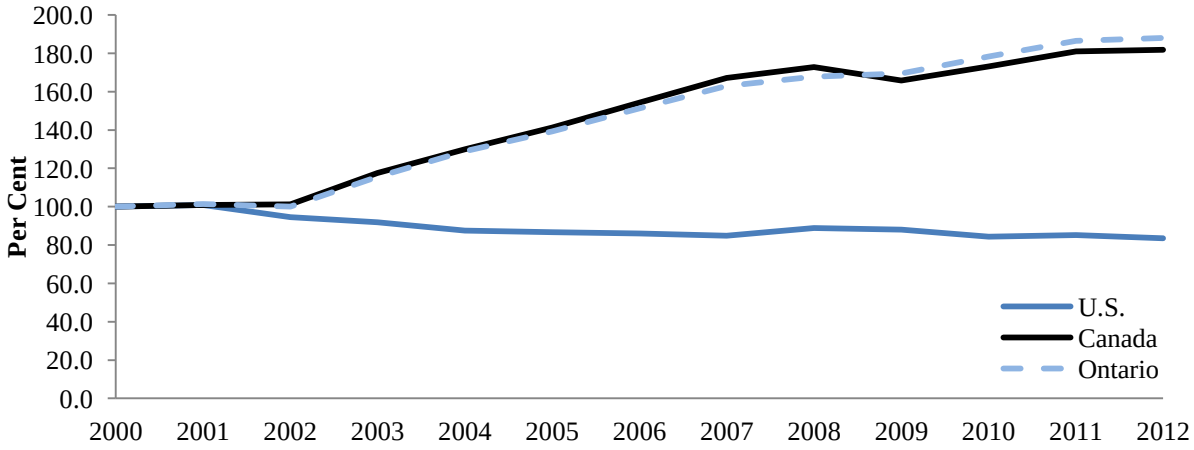
Trends in unit labour costs in U.S. dollars can be decomposed into trends in nominal labour costs, labour productivity, and the exchange rate. Chart 86 shows the growth rate in each of these variables for manufacturing in Ontario, Canada and the United States for 2000- 2012. Unit labour costs in Ontario grew at a compound annual rate of 5.40 per cent, while unit labour costs in the United States fell by 1.48 per cent per year. Almost half of this decline can be explained by the 3.36 per cent average annual appreciation of the Canadian dollar. Ontario's relative deterioration in labour productivity growth compared to the United States accounted for a further 56 per cent of the loss in Ontario's cost competitiveness. The slower rate of hourly compensation growth in Ontario offsets the trends in the exchange rate and relative deterioration of labour productivity growth, and accounted for -4 per cent of the fall in relative competitiveness.

Chart 84: Unit Labour Cost (U.S. Dollars), Manufacturing Sector, Canada and the U.S., 1981-2012 (Index, 2000 = 100)



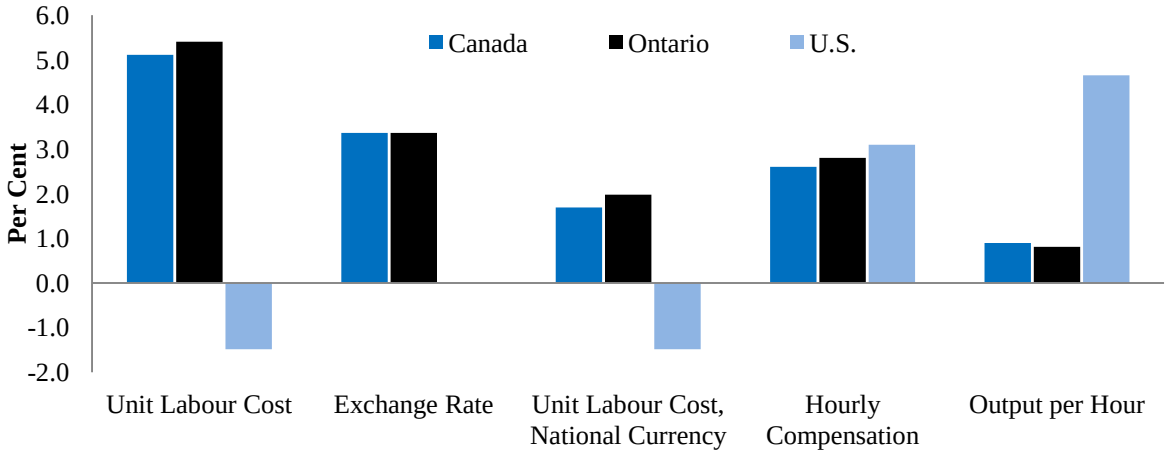
Source: The Conference Board
Note: Data for Ontario are only available for the 2000-2012 period.
Note: Data for Canada were calculated based on data from the Conference Board, and differ from calculations based on data from Statistics Canada

Chart 85: Unit Labour Cost (U.S. Dollars), Manufacturing Sector, Canada, Ontario and United States, 2000-2012 (Index, 2000=100)



Source: CSLS calculations based on data from Statistics Canada and The Conference Board
Note: Data for Canada were calculated based on data from the Conference Board, and differ from calculations based on data from Statistics Canada

Chart 86: Unit Labour Cost Growth (U.S. Dollars), Manufacturing Sector, Canada, Ontario, and the U.S., 2000-2012



Source: CSLS calculations based on data from Statistics Canada and The Conference Board
Note: Data for Canada were calculated based on data from the Conference Board, and differ from calculations based on data from Statistics Canada

7.2.3.2 Explanation of the Appreciation of the Canadian Dollar

About one-half of the loss in cost competitiveness of Ontario's manufacturing sector relative to the U.S. manufacturing sector was due to the appreciation of the value of the Canadian dollar from $0.69 U.S. in 2000 to about parity in 2012. Explanations for this development vary and a full discussion of the issue is beyond the scope of this report.

Mark Carney (2012), the former governor at the Bank of Canada, estimated that half of the appreciation of the Canada-U.S. exchange was due to the rise of global commodity prices, and about 40 per cent to the depreciation of the U.S. dollar against other major currencies. Similarly, Beine et al. (2012) argued that about half of the appreciation of the Canadian dollar between 2002 and 2008 was due to the weakness of the U.S. dollar and about 42 per cent of the appreciation was due to the strength of the Canadian component.

The rise of the value of the Canadian dollar due to the boom in natural resource exports, especially oil, and the negative consequences for manufacturing exports has been called the "Dutch disease".[23] Dutch disease is the relationship between the increase in extraction of natural resources and the decline of the exporting sector of a specific country. The increase of foreign demand for natural resources leads to upward pressure on the country's currency. This appreciation of the country's currency in turn makes exports (manufacturing or agriculture) more expensive; thus, causing a contraction in the exporting sector, which many regard as important to the long-term health of an economy.

There is support in the economics literature for the existence of Dutch disease in Canada. Van Wijnbergen (1984) constructed a model characterized by an economy with traded and non-traded goods where an increase in income due to the export of natural resources raises the

[23] The term was coined by the *The Economist* in 1977 to describe the decline of the Netherland's manufacturing sector after the discovery of a large natural gas field in the 1960s.

demand for non-traded goods, which increases the price of non-traded good relative to the price of traded goods; thus, drawing resources away from the traded-goods sector and hampering long-term economic growth if the traded goods sector is the main driver of growth. Sachs and Warner (1995) empirically showed that countries with high exports of natural resources in the early 1970s experienced slower GDP growth in the late 1970s and 1980s.

Canada has a number of symptoms of Dutch disease, such as the recent natural resource boom in Alberta, Saskatchewan, and Newfoundland and Labrador, the appreciation of the Canadian dollar, and the decline of the manufacturing sector in Ontario. While the Canadian dollar appreciated significantly during the 2000 decade, the proportion of this rise that stemmed from the increased extraction of natural resources in other parts of Canada is still an open question. Shakeri, Gray and Leonard (2012) showed that approximately one-quarter of industries in the manufacturing sector experienced a negative relationship between output and the U.S.-Canada exchange rate, and the effects are only significant in small labour-intensive industries.

Chart 87 and Chart 88 provide further evidence for the existence of Dutch disease in Canada. One would expect that the U.S. and Canadian manufacturing sectors experienced the same structural phenomena in recent years. In principle, these structural phenomena – most importantly, the shift of low-skill manufacturing activities to emerging markets – should have affected the U.S. and Canadian manufacturing sectors roughly equally, *ceteris paribus*. However, manufacturing's share of total economy real GDP declined much more dramatically in Canada than in the United States from 2000 to 2009 (Chart 87). Admittedly, the U.S. manufacturing sector experienced a significant decline in its share of total economy real GDP earlier than Canada, as Canada's manufacturing sector was supported by a low dollar in the 1990s and early 2000s.

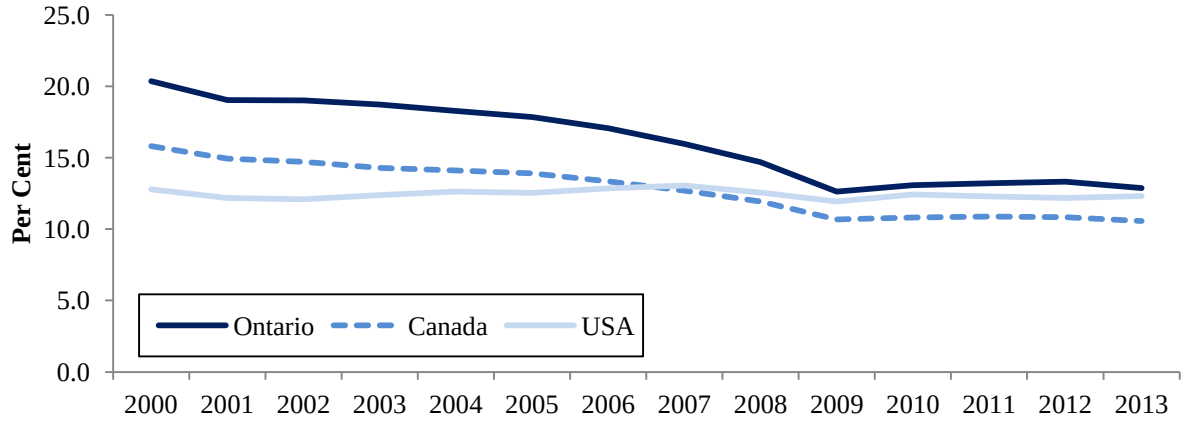
In Canada, manufacturing's share of total economy real GDP fell from 15.8 per cent in 2000 to 10.7 per cent in 2009, while the manufacturing sector's share of total economy real GDP was quite stable in the United States. It is important to note that declines in the Canadian average were largely driven by declines in Ontario, which accounts for the lion's share of Canada's manufacturing sector. In Ontario, manufacturing's share of total economy real GDP fell from 20.3 per cent in 2000 to 12.6 per cent in 2009, a decline of 7.7 percentage points (versus a decline of 5.1 percentage points for Canada as a whole).[24]

Chart 88 also evidences the divergence between the United States and Ontario in terms of value added in the manufacturing sector. In particular, real GDP in the U.S. manufacturing sector was 20.7 per cent above its 2000 level in 2013, while real GDP in Ontario's manufacturing sector was 23.3 per cent below its 2000 level in 2013. Coinciding with Canada's oil boom, much of the divergence between Ontario and the United States occurred in 2002-2007, with real GDP in the U.S. manufacturing rising dramatically and falling in Ontario. In 2008-2009, real GDP in manufacturing fell dramatically in both the United States and Canada due to the Great Recession. However, manufacturing experienced a more rapid recovery in the United States, with real GDP

[24] The story is the same in terms of nominal GDP. While the U.S. manufacturing sector's share of total economy nominal GDP fell 2.9 percentage points from 15.1 per cent in 2000 to 12.2 per cent in 2010, the Canadian manufacturing sector's share of total economy nominal GDP fell 10.5 percentage points from 23.3 per cent in 2000 to 12.8 per cent in 2010.

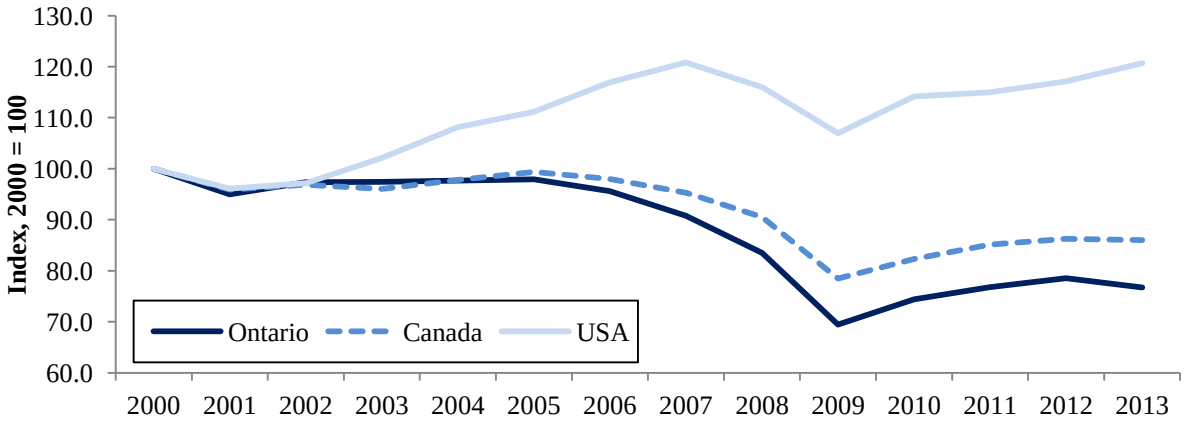
rising 12.9 per cent from 2009 to 2013. While real GDP in Ontario's manufacturing sector rose 13.1 per cent from 2009 to 2012, it continued to decline in 2013.

Chart 87: Manufacturing as a Share of All Industries, Real GDP, Canada, Ontario and the United States 2000-2013



Source: Statistics Canada, CANSIM Tables 379-0030 and 379-0031. BEA, GDP by Industry.
Note: Real GDP for the US are in 2009 Chained Dollars. Real GDP for Canada and Ontario are in 2007 Chained Dollars.

Chart 88: Index of Real GDP in Manufacturing, Canada, Ontario and the United States, 2000-2013



Source: Statistics Canada, CANSIM Tables 379-0030 and 379-0031. BEA, GDP by Industry.
Note: Real GDP for the US are in 2009 Chained Dollars. Real GDP for Canada and Ontario are in 2007 Chained Dollars.

7.2.4 Caveats on the Contribution of Productivity to the Loss of Cost Competitiveness

Chart 86 shows that 56 per cent of the decline in the cost competitiveness of Ontario's manufacturing sector relative to the U.S. manufacturing sector between 2000 and 2012 was due to the much weaker manufacturing labour productivity growth in Ontario than in the United States: 0.81 per cent per year versus 4.65 per cent per year. However, the 56 per cent figure should be treated with caution for, as will be shown in the next section, productivity can be an endogenous variable.

Productivity growth is a function of output growth, which in turn is affected by both demand conditions in foreign markets and the exchange rate. A slump in the United States and an appreciation of the Canadian dollar can therefore reduce productivity growth through the output growth channel. Consequently, it seems likely that the total effect of an exchange rate appreciation on cost competitiveness is underestimated in a simple decomposition of changes in unit labour costs, while the effect of productivity growth is overestimated.

7.3 Relationship between Output Growth and Productivity Growth

This report has documented that weaker demand conditions in the 2000-2012 led to slower output growth in Ontario, and that this development was associated with slower productivity growth. This section argues that this is not a correlation, but a causal relationship, with slower output growth leading to slower productivity growth. This section first examines the concept of productivity elasticity and then discusses the Verdoorn Law literature.

7.3.1 Productivity Elasticity

Output growth is the sum of the rate of growth of labour input and labour productivity. The elasticity of labour productivity with respect to output ("productivity elasticity") is defined as the labour productivity growth rate as a proportion of the output growth rate. It measures the effect of a 1 percentage point increase in output growth on labour productivity growth. In other words, productivity elasticity measures the sensitivity of productivity growth to a change in output growth. A key characteristic of the productivity elasticity at the aggregate level is its stability over time at around 0.5; this implies that a 1.0 percentage point increase in output growth is associated with a 0.5 percentage point increase in labour productivity growth.

Table 29 shows output growth, labour productivity growth and the productivity elasticity for the business sector and two-digit NAICS industries for Ontario and the ROC for 1987-2000 and 2000-2012. For Ontario, the business sector productivity elasticity in 1987-2000 was 0.61 based on labour productivity growth of 1.89 per cent per year and output growth of 3.12 per cent per year. The elasticity was similar in 2000-2012 at 0.44 based on output growth of 1.17 per cent per year and labour productivity growth of 0.51 per cent per year. The similarity of the productivity elasticity reflects the proportionality of the declines in output growth and labour productivity growth between periods (70 per cent for output and 73 per cent for labour productivity).

In the ROC, the stability of the productivity elasticity between periods was even greater. The elasticity was 0.47 in 1987-2000 and 0.48 per cent in 2000-2012 based on a 35 per cent fall in output growth and a 34 per cent fall in labour productivity growth between these periods.

One possible implication of these findings is that if there had been no slowdown in output growth after 2000, there would have been no slowdown in labour productivity growth. The reasons for this are explored in the next section.

Table 29: Labour Productivity Elasticity, Business Sector Industries, Ontario and the Rest of Canada, 1987-2000 and 2000-2012

	1987-2000			2000-2012		
	Output Growth	**Labour Productivity Growth**	**Elasticity**	**Output Growth**	**Labour Productivity Growth**	**Elasticity**
	A	**B**	**C = B / A**	**D**	**E**	**F = E / D**
	Ontario					
Business Sector Industries	3.12	1.89	0.61	1.17	0.51	0.44
Agriculture, forestry, fishing and hunting	1.68	3.92	2.33	0.77	1.71	2.23
Mining and oil and gas extraction	-1.01	2.58	-2.56	-1.80	-4.34	2.41
Utilities	0.18	0.75	4.16	1.67	0.23	0.14
Construction	0.00	0.16	n.a.	2.83	-0.45	-0.16
Manufacturing	3.50	3.58	1.02	-2.00	0.81	-0.40
Wholesale Trade	6.03	4.46	0.74	2.67	2.97	1.11
Retail Trade	2.32	1.44	0.62	2.72	2.66	0.98
Transportation and warehousing	2.48	0.86	0.35	1.62	-0.04	-0.03
Information and cultural industries	4.38	1.03	0.24	2.93	1.45	0.50
FIRE	4.06	2.39	0.59	2.28	-0.35	-0.15
Professional, scientific and technical services	6.56	0.41	0.06	1.65	0.51	0.31
ASWMRS	2.80	-2.92	-1.04	2.50	-0.61	-0.24
Arts, entertainment and recreation	0.90	-1.54	-1.71	0.79	-0.02	-0.02
Accommodation and food services	2.12	-0.11	-0.05	0.35	0.10	0.29
Other private services	2.37	1.57	0.66	1.87	-0.21	-0.11
	Rest of Canada					
Business Sector Industries	3.13	1.48	0.47	2.03	0.98	0.48
Agriculture, forestry, fishing and hunting	1.59	2.60	1.63	0.95	3.22	3.40
Mining and oil and gas extraction	2.86	2.81	0.98	1.24	-3.91	-3.16
Utilities	1.47	0.56	0.38	1.09	2.04	1.88
Construction	1.26	-0.58	-0.46	4.94	0.12	0.02
Manufacturing	3.62	1.19	0.33	-0.42	1.44	-3.41
Wholesale Trade	4.17	1.29	0.31	3.29	2.18	0.66
Retail Trade	1.10	0.23	0.21	3.61	2.30	0.64
Transportation and warehousing	3.36	1.47	0.44	1.48	1.75	1.18
Information and cultural industries	7.31	7.35	1.00	2.90	2.39	0.83
FIRE	3.22	2.90	0.90	2.90	0.23	0.08
Professional, scientific and technical services	6.55	2.13	0.32	3.45	1.24	0.36
ASWMRS	3.49	-1.45	-0.41	3.16	1.38	0.44
Arts, entertainment and recreation	3.84	-0.08	-0.02	1.06	-0.29	-0.27
Accommodation and food services	1.39	-0.03	-0.02	1.55	0.45	0.29
Other private services	4.01	3.23	0.80	1.99	1.86	0.93

Source: CSLS calculations based on Statistics Canada data

7.3.2 Verdoorn Law

As was noted earlier, the contributions of labour productivity to the loss of competitiveness in Ontario economy based on actual data might overestimate the true contributions if labour productivity growth is endogenous to demand conditions. The proposition that labour productivity growth is a function of output growth is known as "Verdoorn 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. It is interesting to note that the Kaldor coefficient is identical to the productivity elasticity for both Ontario and the ROC for the 1987-2000 and 2000-2012 periods shown in Table 29.[25]

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. 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.

As 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 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, business 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 physical and human capital accumulation; thus, creating a

[25] Many studies have verified the relationship between output growth and labour productivity growth, such as Castiglion (2011), Libanio and Moro (2009), and Harris and Liu (1999).

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 the fall in internal and external demand impacts key labour productivity growth drivers such as R&D spending and M&E investments. As this report has documented, Ontario was the major contributor to the slowdown in labour productivity growth in Canada between 1987-2000 and 2000-2012. This indicates the conclusion reached by Rao and Li regarding the relationship between slow labour productivity growth and a slowdown in demand in Canada applies to Ontario.

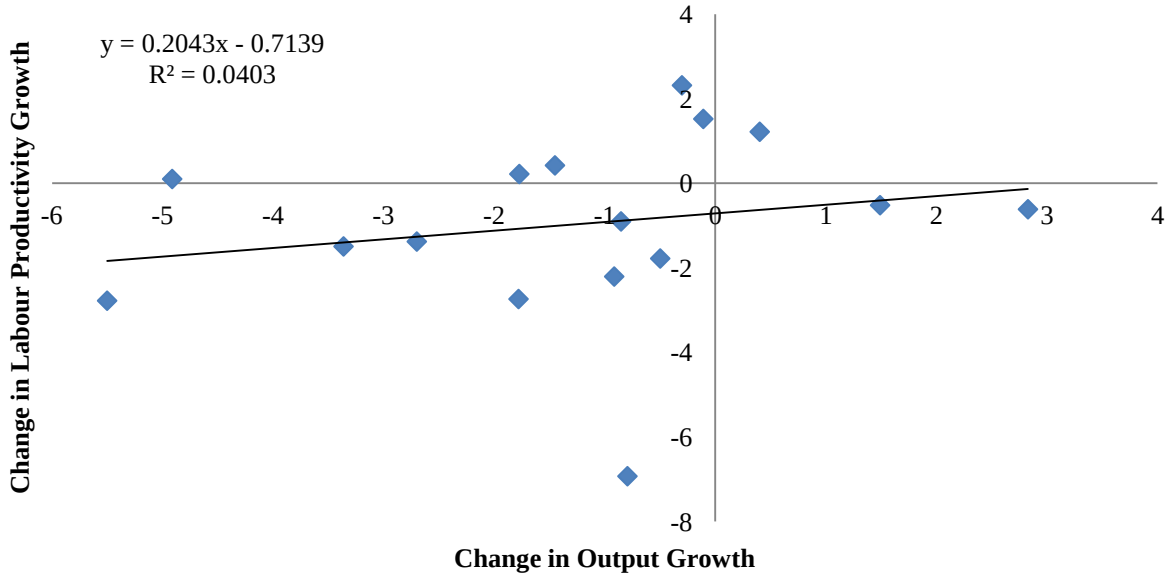
7.3.2.1 Estimates of the Verdoorn Law Relationship for Ontario

We will now conduct an exercise to verify whether Ontario's productivity performance follows Verdoorn law. We use the percentage point change in output growth and labour productivity growth for business sector industries at the two-digit NAICS level and at the three-digit NAICS level for manufacturing industries between the 1987-2000 and 2000-2012 periods. We also estimated the relationship for two-digit NAICS industries for Canada excluding Ontario.

For the two-digit NAICS industries in Ontario, the coefficient on the change in output variable as a determinant of the change in labour productivity growth between the two periods is 0.2043 (Chart 89). The coefficient is even larger in the equation for two-digit NAICS industries for the ROC at 0.5264 (Chart 90).

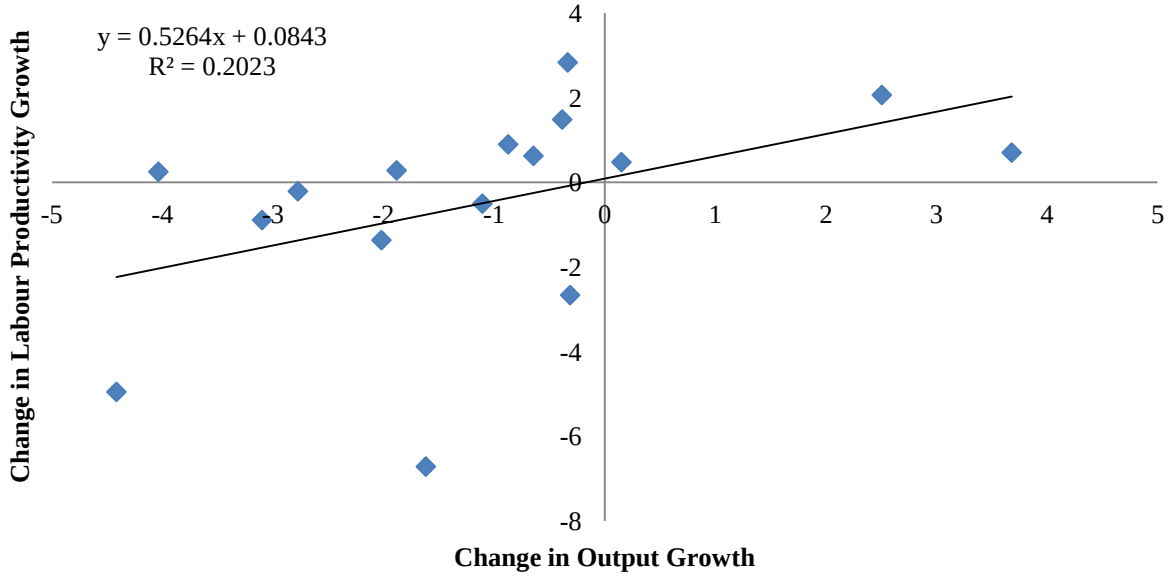
For the manufacturing industries in Ontario, the coefficient (0.3062) is larger than for two-digit industries, which is to be expected as the Verdoorn relationship has been found to be stronger for manufacturing industries than for non-manufacturing industries (Chart 91). These simple statistical relationships show that the industries that experienced a larger fall in output from between the 1987-2000 and 2000-2012 periods also experienced a larger fall in productivity growth. Since Ontario experienced a negative demand-side shock after 2000 (and no obvious negative supply-side shock), this implies that the causation flows from the fall in output growth to the fall in labour productivity growth.

Chart 89: Verdoorn Law for Ontario, two-digit NAICS Business Sector Industries, 1987-2000 and 2000-2012



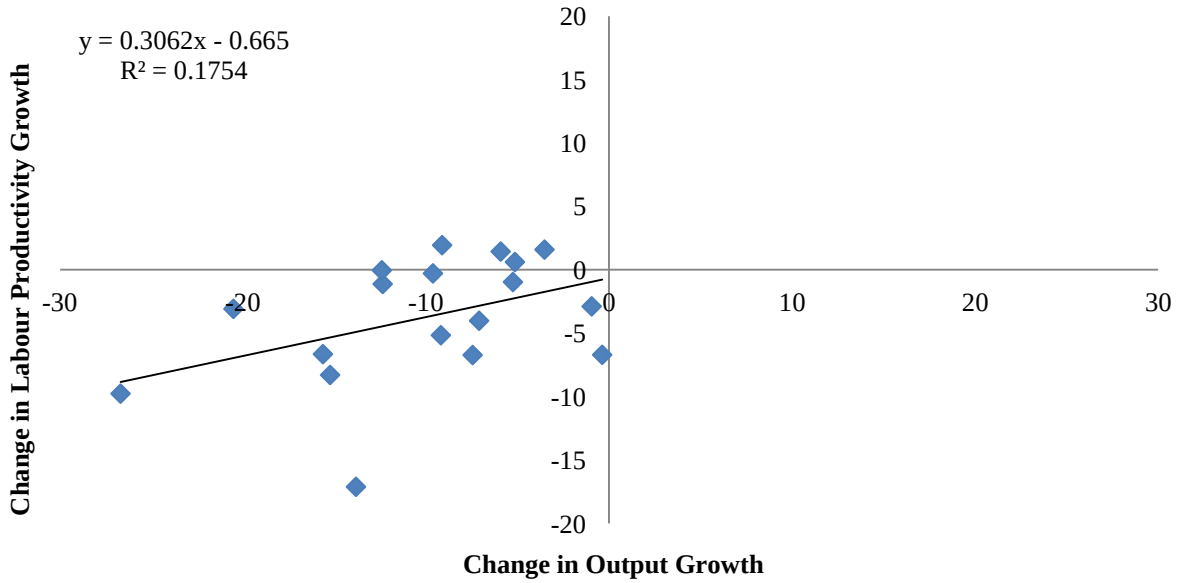
Source: CSLS calculations based on Statistics Canada data

Chart 90: Verdoorn Law for Rest of Canada, two-digit NAICS Business Sector Industries, 1987-2000 and 2000-2012



Source: CSLS calculations based on Statistics Canada data

Chart 91: Verdoorn Law for Ontario, three-digit NAICS Manufacturing Industries, 1997-2000 and 2000-2012



Source: CSLS calculations based on Statistics Canada data

7.3.2.2 Firm-level Evidence of the Verdoorn Law for Canadian Manufacturing

In recent years, productivity analysis has been greatly enriched by the increased availability of firm-level data. This new data source has generated numerous insights into productivity growth, especially the observed heterogeneity in productivity levels among firms within an industry (Syverson, 2011).[26]

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.

[26] For a discussion of the potential contribution of firm-level research to understanding and improving productivity, see Drummond, Ryan and Veall (2013), Bartelsmann and Doms (2000), and Petrin and Levinsohn (2012).

8. Implications of the Findings for Public Policy

8.1 Ontario's Recent Public Policy Environment

In the past decade, the Ontario government has made significant efforts to boost productivity within the province, notably by investing in infrastructure, education and training, and encouraging a business-friendly climate conducive to private sector investment and R&D. This section will briefly highlight efforts in the investment, human capital and innovation areas.

8.1.1 Investment

A key productivity-enhancing policy initiative taken by the Ontario government has been the replacement of the Retail Sales Tax with the Harmonized Sales Tax (HST) in 2010. This measure had been advocated by many economists (*e.g.*, Sharpe, 2007) as the most important policy that the Ontario government could take to boost productivity. It reduced the marginal effective tax rate, which in principle should foster investment. Unfortunately, this measure coincided with the Great Recession when investment declined and productivity fell, making it difficult to assess the impact of the HST.

Additional tax measures have been taken to improve Ontario's business climate. The capital tax has been eliminated since 2007 for resource and manufacturing industries, and for all corporations since July 1, 2010. Corporate Income Tax rates were cut beginning on July 1, 2010,[27] at the same time the HST was introduced; the result of this package of tax reforms, in combination with federal CIT rate cuts, was to halve the marginal effective tax rate and to reduce the cost of investment. Since 2007, high Business Education Property Tax rates have been cut significantly resulting in annual savings of over $200 million for Ontario businesses. The 2013 Federal Budget extended the 50 per cent Capital Cost Allowance for manufacturing and processing machinery and equipment to 2015. Ontario paralleled this Federal measure for machinery or equipment acquired in 2014 or 2015. Lastly, a rebate program extended for three additional years in 2013 can reduce industrial electricity prices by up to 25 per cent in northern Ontario.

In terms of public investment, in 2005 the Ontario government introduced its five-year, $30 billion ReNew Ontario investment plan. In 2008-09, the ReNew Ontario investment plan was completed a full year ahead of schedule, and has helped to address the significant infrastructure deficit that built up over the three decades prior to 2003. Planned spending in 2014-15 is expected to be almost twice its 2005-06 levels.

8.1.2 Human capital

The Ontario government has provided financial support for the expansion of the post-secondary education system. In 2012, 41.2 per cent of persons aged 18 to 25 in the province were enrolled in post-secondary education, above the national average of 39.1 per cent, and up from

[27] The 2012 Ontario Budget froze the general Corporate Income Tax rate at 11.5 per cent until the budget is balanced in 2017-18.

28.8 per cent in 2000. Capital investments have supported the construction of the Kawartha Trades and Technology Centre at Fleming College in Peterborough, which opened in 2014, and ongoing construction of the Global Innovation Exchange at Wilfred Laurier University in Waterloo. In addition, the 30% Off Ontario Tuition grant introduced in 2012 is making post-secondary education more accessible to eligible students.

In addition to funding programs that increase the skills and training of Ontario's population, there have been efforts to better match people to jobs. The 2013 Budget announced that nearly $300 million will be earmarked over two years towards the Youth Jobs Strategy to support employment, entrepreneurship, innovation, business-labour connectivity, and training among Ontario youth. In 2013-14, over $95 million was also spent to help new immigrants to Ontario settle, improve language skills and find jobs.

8.1.3 Innovation

The government has taken several measures to stimulate R&D. Since 2004, the Ontario government has committed or announced $740 million in research infrastructure investments through the Ontario Research Fund – Research Infrastructure Program. Income tax exemptions were granted in 2008 for new corporations that commercialize intellectual property developed by qualifying Canadian universities or research institutes; the Jobs and Prosperity Council cited poor commercialization of R&D as a weakness of the Ontario economy.

The government has taken steps to improve its overall strategic capacity, establishing a Jobs and Prosperity Council to advise the government on a plan to boost Ontario's productivity and host an Ontario Productivity Workshop. In addition to announcing the Jobs and Prosperity Council, the 2012 Budget announced the creation of a Jobs and Prosperity Fund, which directs $2.5 billion toward business investment, jobs and economic growth. Other important government measures in innovation include various tax credits and initiatives, such as the Northleaf Venture Catalyst Fund (NVCF).

The bottom line is that the Ontario government – in a time when the fiscal situation needed to be addressed through cuts in certain program areas – has been aware of the importance of fostering productivity growth and has taken action in this direction.

8.2 Implications of the Findings for Public Policy

This report has shown that the main cause of Ontario's lackluster productivity growth was the deterioration in external demand conditions. Since 2000, the decline in international exports, due to weak demand growth in the United States, loss of cost competitiveness linked to the appreciation of the Canadian dollar, and increasing international competition, played a direct role in the slowdown in Ontario's productivity growth. Ontario's poor productivity performance cannot be blamed on public policy. Indeed, without the measures put in place by the Ontario government, it is likely that Ontario's productivity performance could have been even worse.

The revival of productivity growth in Ontario requires the resurgence of the Ontario economy. This depends on both external and internal factors largely beyond the government's

control. International demand for Ontario's exports depends on exchange rates and domestic demand conditions in importing countries. Exports are also determined by the ability of the Ontario private sector to produce and market high quality goods and services for which there is international demand. Responsibility for business sector productivity performance ultimately lies with businesses.

But public policy does have an important role to play in contributing to and facilitating business sector productivity growth through the provision of public infrastructure, education, and incentives to invest and innovate through taxation and the regulatory environment. Indeed, public policy actions in many areas have implications for productivity growth. Appropriate public policy is a necessary but not a sufficient condition for productivity growth.

The Ontario government has done much policy development in the past to foster productivity growth and the resulting policy framework is in general very good. There is no silver bullet that the Ontario government could take to supercharge productivity growth. However, better, more effective, policies are always possible and should be strived for. Incremental (and possibly non-incremental) change in improving the suite of productivity-related policies run by the Ontario government is needed. Current policies and programs should always be monitored for opportunities for positive change.

8.3 Potential Insights from Firm-Level Research to an Understanding of Productivity Growth and the Development of Productivity-enhancing Policies[28]

Further productivity research in Canada should be to produce detailed studies of the productivity performance in all provinces and in all major sectors. These studies can identify the drivers of productivity growth in the different industries in each provincial economy, enabling policy makers to better craft policies that are suitable for productivity improvements.

As Drummond (2011) has noted, governments in Canada have implemented many of the market-oriented policies that in principle are conducive to labour productivity growth, but the results have been disappointing. The poor macroeconomic environment may account for much of this poor productivity record. It is unlikely that the policies themselves have been detrimental to productivity growth.

Boothe and Roy (2008) argue that role of the potential influential factors at the firm level, such as firm size and scale, and managerial skills and experience, requires further research to determine their impact on productivity growth. Drummond, Ryan and Veall (2013) make the case that a better understanding of firm-level behaviour could help resolve this productivity puzzle. The availability of firm-level micro-data from Statistics Canada now makes such research possible to a wider range of researchers. For example, firm-level data can document the actual distribution of firms by productivity levels and potentially shed light on why such wide variation in firm productivity performance can take place.

[28] John Lester contributed to part of this section.

Syverson (2011) has identified a number of questions that he believes firm-level data can shed light and should be the topic of future research. These questions are highlighted below.

What is the importance of demand?

- Many economists and policy makers have focused on the supply-side effects such as human capital, research and development, and innovation, but research indicates that demand factors are also important.

What is the role of government policies that encourage productivity growth?

- How external conditions influence the decision-making process of the government and how policies such as trade policy and market regulation design enhance productivity.

- Research should focus not just on policy versus no policy, but rather two or more competing policies that influence productivity.

What is the importance of higher variance in productivity outcomes?

- How diffusion of new technologies influences the variance of productivity across firms.

Can we predict innovation based on market conditions?

- Is it possible to predict how great a product or process innovation will be and whether it will dominate based on market or technological factors?

The nature of intangible capital.

- Understanding how intangible capital stocks are built and sustained would illuminate many productivity-related issues.

Management versus managers.

- Do managerial practices increase productivity, or is it the person that is implementing the practices providing the productivity gains? How do management practices and the skills of a manager influence productivity of a firm?

- If managers do not seem to matter, then broader managerial practices likely have a strong causal impact on productivity.

Research at the Bank of Canada and Statistics Canada indicates that a larger share of small firms in Canada makes a substantial contribution to the Canada-U.S. productivity differential. Lower productivity of small firms relative to large firms in Canada than in the United States also contributes to the productivity gap. Removing both of these differences would

have raised productivity in Canada by 17 per cent in 2008. This is a substantial increase that would have reduced the Canada-U.S. labour productivity gap by about 45 per cent.[29]

These findings raise a number of interesting policy-related issues, including:

- Why is the employment share of small firms larger in Canada than in the United States?
- Why is the productivity gap between large and small firms greater in Canada than in the United States?

A more pronounced policy tilt in favour of small business in Canada could be contributing to both the larger share and the lower relative productivity of smaller firms. Such policies could encourage additional entry by small firms and create disincentives to grow. Institutional arrangements, such as government-paid medical insurance, could facilitate entry into small business in Canada and allow less productive firms to survive because of lower employment costs. Differences in market size could also be playing a role. The spatial distribution of activity in Canada could result in relatively more small centres that cannot support larger firms and for which agglomeration economies are limited. Similarly, large centres in Canada may not be of sufficient size, or located close enough to other large centres, to reap the maximum benefit from agglomeration economies.

All three of the above "explanations" of the poor relative performance of small firms in Canada deserve to be investigated in an Ontario context. The role of policy in the decision to enter and on survival rates could be explored by exploiting interprovincial differences in the tax treatment of small firms in an econometric analysis. For example, the small firm income tax rate advantage in Québec has varied relative to the small firm advantage in Ontario, and it may be possible to use this interprovincial variation to quantify the impact of the small business advantage on entry and survival through econometric analysis using firm-level data maintained by Statistics Canada. While it is possible to provide a useful perspective on the contribution of policy to firm entry and survival using Canadian data only, examining the role of institutional factors would require estimating entry and survival equations for Canada and the United States, making it a much larger undertaking.

The contribution of market size and the spatial distribution of economic activity to the Canada-U.S. productivity gap could be assessed by comparing the productivity of firms in markets in Canada and the United States matched for size, proximity to other markets and other relevant characteristics. For example, the productivity of firms in Toronto would be compared to a similar urban agglomeration in the United States. If the share and productivity of small firms relative to large firms turns out to be the same in the matched urban agglomerations, it would be reasonable to conclude that agglomeration economies are playing an important role in the Canada-U.S. productivity gap.

One possibility would be to examine firm size distributions in Canada and use aggregate data on the spatial distribution of activity in both countries to draw inferences about the impact

[29] The observed gap has been adjusted to account for industry composition and methodological differences in this calculation. See the "Background" section for an explanation.

on the relative productivity of small firms of having the same spatial distribution of activity in Canada as in the United States. More specifically, one could relate the small firm productivity disadvantage in Canada to relevant firm[30] and place characteristics as in Brown and Rigby (2013), taking care to include explanatory variables, such as population in the urban agglomeration and proximity to other markets, that could be set at U.S. levels to calculate an alternative value of the dependent variable.

8.4 Support for STEM Workers

The focus of this report has been to provide a detailed analysis of Ontario's productivity performance and to identify the elements of a policy strategy to improve that performance. The report has not discussed in any detail specific productivity-enhancement polices. One particular policy to improve productivity growth that may merit attention, and in which the Centre for the Study of Living Standards is conducting research, is support for science, technology, engineering and math (STEM) workers. The Council of Canadian Academies has appointed a panel, chaired by David Dodge, to investigate this issue and report its findings in early 2015.

The interest in the productivity-enhancing effect of STEM workers has been stimulated by the findings of significant productivity gains from an increase in the relative supply of such workers, both in Canada and the United States. Peri, Shih and Sparber (2013) have shown that foreign-born STEM workers were responsible for 40 per cent of the MFP gains in the United States during the 1990s. Peri and Shih (2013) estimate for Canada that the 1.7 percentage point increase in foreign STEM workers as a share of employment in 1991-2006 raised the college-educated real wage growth by 11 percentage points, half of the total increase.

STEM workers can create new knowledge (*e.g.,* patents) through R&D, and such knowledge can lead to new products, production processes and models of organizational change that boost productivity. Such workers have the ability to scan and monitor current technologies used throughout the world and identify best practices that could be used in Canada. They also have the technical skills needed to adopt and implement new technologies and also to adapt technologies to local conditions and needs. Finally, entrepreneurially-oriented STEM workers can use their technical skills and knowledge to identify economic opportunities and start new businesses. So, the more STEM workers, the greater the pool of individuals from which new high-tech businesses, a key driver of economic growth, can emerge.

These findings and the obvious channels by which STEM workers can boost innovation and productivity suggest that policies to educate and attract STEM workers have high returns. An examination of current policies and programs to support STEM education may be warranted. However, based on the empirical evidence presented in this report, Ontario is producing a healthy amount of STEM graduates, which suggests that STEM education may be one of Ontario's strengths. Nevertheless, the potential for additional STEM workers to spur productivity advance merits exploration.

[30] Note that the analysis is likely to be undertaken using data for individual business units (e.g., manufacturing plants) rather than firm-level data.

9. Conclusion

This report has shown that the main cause of Ontario's lackluster productivity growth was the deterioration of external demand conditions. Since 2000, the decline in international exports, due to weak demand growth in the United States, loss of cost competitiveness linked to the appreciation of Canadian dollar, and increasing international competition, played a direct role in the slowdown in Ontario's productivity growth. Ontario's poor productivity performance cannot be blamed on public policy. Indeed, without the measures put in place by the Ontario government, it is likely that Ontario's productivity performance would have been even worse.

The revival of productivity growth in Ontario requires the resurgence of the Ontario economy. This depends on both external and internal factors largely beyond the government's control. International demand for Ontario's exports depends on exchange rates and domestic demand conditions in importing countries. Exports are also determined by the ability of the Ontario private sector to produce and market high quality goods and services for which there is international demand. Responsibility for business sector productivity performance ultimately lies with businesses.

But public policy does have an important role to play in contributing to and facilitating business sector productivity growth through the provision of public infrastructure, education, and incentives to invest and innovate through taxation and the regulatory environment. Indeed, public policy actions in many areas have implications for productivity growth. Appropriate public policy is a necessary but not a sufficient condition for productivity growth.

The Ontario government has done much policy development in the past to foster productivity growth and the resulting policy framework is in general very good. There is no silver bullet that the Ontario government could take to supercharge productivity growth. However, better, more effective policies are always possible and should be strived for. Incremental (and possibly non-incremental) change in improving the suite of productivity-related policies run by the Ontario government is needed. Current policies and programs should always be monitored for opportunities for positive change.

Going Forward with the Productivity Agenda

The short-term priority for the Government of Ontario is to meet the fiscal target laid out in the 2014 Budget of balancing the budget by 2017-2018. Along with this focus, the government should continue to pursue policies aimed at strengthening productivity growth. Productivity growth drives real wage growth and hence the future living standards of Ontarians.

The 2012 report of the Commission on the Reform of Ontario's Public Services, known as the Drummond report, provided the government with myriad recommendations to achieve a balanced fiscal position over the long-term and to improve the efficiency of government operations. The commissioning of a report similar in comprehensiveness to examine both public sector policies and private sector actions to boost business sector productivity would be a cost effective way to obtain cogent analysis and solid recommendations in the productivity area and to raise the public profile of the productivity issue.

Of course, the Government of Ontario has shown considerable interest in the productivity/prosperity issue for many years. In 2000, the Government established the Task Force on Competitiveness, Prosperity and Economic Progress. Chaired by Roger Martin, the Task Force through the Institute of Competitiveness and Prosperity has issued annual reports highlighting the importance of productivity (*e.g.,* Task Force, 2012 and 2013), identifying the productivity gap as the main cause of the province's prosperity gap with the United States.

In 2011, the government created the Jobs & Prosperity Council to provide advice on what actions were needed to create a more competitive and productive Ontario. The Council's 2012 report entitled "Advantage Ontario" identified a number of policies to boost productivity growth (Jobs and Prosperity Council, 2012).

The Ontario government itself through the Ministry of Finance's long-term outlook report has examined in depth the productivity question and policy options. For example, the third report released in April 2014 entitled "Ontario's Long-Term Report on the Economy" put forward an agenda to improve the province's productivity performance based on the general principles of investing in people, investing in modern infrastructure, and creating a dynamic and innovative business climate.

Given this background of extensive work already done on productivity policy for Ontario, and the focus of this report being more on the analysis of Ontario's productivity performance than on policy development, this section on policy recommendations is relatively short and exploratory in nature.

There are six elements of our strategy or agenda to boost productivity growth in Ontario:

- Recognition of the importance of robust demand to stimulate productivity advance;

- Facilitation of the reallocation of resources from low-productivity activities to high-productivity activities (*e.g.*, through the removal of barriers to mobility, whether inter-regional, inter-industry or inter-occupational);

- Encouragement of the substitution of capital for labour in the production process by incenting firms to invest in capital through a reduction in the cost of capital relative to labour (*e.g.*, through lower taxes and subsidies for capital investment);

- Fostering technological diffusion and the adoption of best-practices techniques, especially by medium and small enterprises;

- Investment in public infrastructure, both as a means to increase the supply-side capacity of the economy and to boost demand when an output gap exists; and

- Continued emphasis on human capital development at all levels to make the workforce more productive.

The Demand Dimension of Productivity Growth

The main finding of this report is that the slowdown in productivity growth in Ontario after 2000 has been largely a demand-side, not a supply-side, phenomenon. When demand conditions are weak, productivity growth flags, as has been documented in this report. Historically, productivity growth accounted for roughly one-half of output growth at the aggregate level. As output growth increased (or decreased), productivity growth has increased (or decreased) in proportion to the change in output growth, and its contribution to output growth has remained roughly one-half. Thus, the decline in Ontario's business sector output growth from 3.1 per cent per year in 1987-2000 to 1.2 per cent in 2000-2012 led to a decline in labour productivity growth from 1.9 per cent to 0.5 per cent.

The Government of Ontario has limited control over demand conditions, which are largely determined in export markets outside the province and by fiscal and monetary policy at the federal level. However, the government does set fiscal policy for the province and indeed fiscal consolidation is currently its top priority. To be sure, fiscal sustainability, best defined as a stable or declining debt burden expressed as the debt-to-GDP ratio (and not by the absolute size of the fiscal balance), is an important long-term objective. But its attainment must be balanced with other equally important goals, including ensuring that aggregate demand is adequate to support acceptable levels of employment. Large cuts in government spending in a short-time frame are problematic, especially in a period of sluggish demand. They reduce output and employment, with negative implications for productivity growth.

Reallocation From Low- to High-productivity Activities

The essence of productivity growth is the transfer of labour and other factors of production from low- to high-productivity activities. The classic example of this phenomenon was the movement of workers from low-productivity farm jobs to high-productivity manufacturing positions. This was an important source of labour productivity growth in the first three-quarters of the 20th century. This reallocation effect not only takes place at the industry level, but also across regions, occupations, and firms within an industry.

The role of government is to facilitate this transfer and this can best be accomplished by minimizing barriers to mobility, whether inter-regional, inter-industry or inter-occupational. Given its market-oriented policies, Ontario fares well in allowing market forces to redirect resources to their most productivity use, for example from low-productivity manufacturing industries such as clothing and textiles to high-productivity services industries. The importance of open markets and competitive policies has been crucial for this resource reallocation process and policies in this area could potentially be strengthened. This means that the identification of barriers to this reallocation and their removal should be a component of any productivity strategy. One potential area for examination may be internal or interprovincial barriers on the movement of products, services and people and the development of new arrangements to address these barriers.

Substitution of Capital for Labour

The rising capital intensity of production, or capital-labour ratio, has been and will continue to be a very important source of labour productivity growth. Technological developments are embodied in new investment goods. This means that the pace of capital intensity growth is a good proxy for the rate of introduction of productivity-enhancing new technologies into the production process.

The relative price of factors of production, namely labour and capital, is a key variable affecting the decisions of firms related to the capital intensity of production. If labour is cheap and/or capital is expensive, there is little incentive to substitute capital for labour. If labour is expensive and/or capital is cheap, there is considerable incentive to use more capital-intensive production processes, with positive implications for productivity growth.

Government policies can affect both the price of labour and the price of capital. Policies that reduce the cost of capital (such as lower taxes and subsidies to capital investment) encourage firms to adopt more capital-intensive methods of production.

Fostering Technological Diffusion and the Adoption of Best-practice Techniques

The fundamental factor underlying an economy's labour productivity is the level of the technological development of the country. The rate of labour productivity growth reflects the pace at which new technologies are diffused and best-practice techniques are adopted. Indeed, it can be argued that for a small territorial unit such as Ontario, which produces only a very small proportion of the world's new innovations, it is the adoption of the latest technologies by the greatest number of firms that has more impact on productivity growth than the creation of new processes and products, given the small number of firms in the province who actually engage in knowledge creation through R&D.

Due to competitive pressures, firms already have a keen incentive to introduce new technologies. But because of a number of factors, including incomplete or imperfect information, inadequate financial and human resources, and lack of appreciation and recognition of the importance of best practices, many firms, especially small- and medium-sized enterprises, may not adopt new technologies as quickly as they could. A more rapid diffusion of new technologies would consequently boost productivity growth.

Governments thus can play a role in fostering the diffusion of best-practice technologies by the private sector. Indeed, this was recognized in the 19th century when governments established agricultural extension programs to assist farmers adopt the best-practice techniques. The federal government's Industrial Research Assistance Program (IRAP) plays a similar role in providing support to small- and medium-sized enterprises for the adoption of information and communications technologies. Both these programs have been shown to have contributed to private sector productivity growth.

The Government of Ontario does currently have programs that support private sector adoption of best-practice techniques. However, this component of the government's overall productivity strategy could be strengthened. Measures to accomplish this may include the evaluation of current programs to improve their effectiveness, the identification of best-practice technological diffusion programs in other jurisdiction and their introduction to Ontario, and more generally greater financial resources for such programs.

Investment in Public Infrastructure

It has been well demonstrated that public infrastructure contributes importantly to private sector productivity growth and that in recent decades the stock of public infrastructure in Ontario was falling behind what was needed to achieve potential private sector productivity growth. It is encouraging that the Government of Ontario has recognized the shortfall in public infrastructure and has taken significant steps to rectify this situation through large infrastructure investments.

Public infrastructure investment is thus recognized by the Government of Ontario as a key component to any productivity strategy. Rigorous benefit-cost analysis should be undertaken on potential public infrastructure projects to ascertain if these investment opportunities could boost future productivity growth.

More importantly, public investment in infrastructure should be thought of as part of an overall macroeconomic strategy rather than an isolated productivity-enhancing initiative. Investment in public infrastructure can act as both as a means to increase the supply-side capacity of the economy and to boost demand when an output gap exists. The positive effect of public infrastructure investment on aggregate demand is important given that productivity gains from increased supply-side capacity may not occur if macroeconomic conditions do not improve.

Continued Emphasis on Human Capital Development

In terms of years of formal schooling, Ontario has one of the most educated workforces in the world. This propitious situation results from the province's large investments in post-secondary education, especially at the community college level. This emphasis on human capital development has been a positive force for productivity growth and should be continued. In particular, weaknesses in the educational and training system should be identified and addressed.

Areas of concern include the low level of educational attainment by Aboriginal Ontarians, especially those living on reserves, the under-utilization of the skills of many highly-educated recent immigrants, and actual or potential skill shortages in some highly specialized occupations and fields. A productivity agenda should address these issues through greater and more effective Aboriginal education, better programs to integrate recent immigrants into the workforce, and closer ties or partnerships between post-secondary educational institutions and industry to ensure that the future human resource needs of industry are recognized and an adequate supply of suitably trained and educated graduates are produced.

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Appendices

Appendix I: Labour Productivity Decomposition using the GEAD formula

The Generalized Exactly Addictive Decomposition (GEAD) formula requires nominal output and relative prices; hence the decomposition can only be calculated up to 2010 because of the unavailability of nominal output data from Statistics Canada after that year. The inclusion of nominal output and relative prices in the decompositions provides another perspective of each sector's contribution to aggregate labour productivity growth.

Appendix Table 17 provides estimates of contributions to labour productivity growth at the two-digit NAICS level for the 2000-2010 period in Ontario based on the GEAD methodology, The GEAD formula reveals only two sectors, agriculture, forestry and fishing and hunting and manufacturing, contributed negatively to business sector labour productivity growth in Ontario. The manufacturing sector contributed -1.20 percentage points to business sector labour productivity growth, which is a stark contrast when compared to the CSLS formula where manufacturing had a small positive effect. In both CSLS and GEAD formula, manufacturing had a similar magnitude of within-sector effect (0.21 percentage point in CSLS vs. 0.17 percentage point in GEAD), but the differences lies with the reallocation level effect. Even though the reallocation level effect is negative according to both the CSLS and GEAD formula, the magnitude of the effect differs significantly (-0.10 percentage point in CSLS vs. -1.30 percentage points in GEAD). The large reallocation level effect can be accounted for by the declines in hours worked and in relative prices for the manufacturing sector. The decline in hours worked is amplified by the decline in the relative prices. The decline of relative prices in the manufacturing sector can be attributed to competition from the manufacturing sector in emerging markets (*e.g.*, China, South Korea, Mexico) and the appreciation of the Canadian dollar. The appreciation of the Canadian dollar caused foreign manufactured goods to become cheaper relative to their Canadian counterparts. The influx of inexpensive manufactured goods from emerging markets depressed the prices of local manufactured goods, causing their prices to decline relative to other goods and services. It is interesting to note that the large negative reallocation level effects in wholesale trade and retail trade, which do not exist in the CSLS formula. This reflects the decrease in relative prices from the lower margins of wholesale and retail firms.

The top two sectors that contributed positively to Ontario's business sector labour productivity growth are construction and the finance sector (FIRE), each contributing 0.44 and 0.37 percentage point, respectively. Both sectors have significant reallocation level effects (0.46 percentage point in construction and 0.43 percentage point in FIRE). The large reallocation level effect in the construction sector may be due to the rise of housing prices between 2000 and 2010, especially in the Greater Toronto Area, which boosted the prices of the output of the construction industry. The significant reallocation level effect in FIRE can be accounted for by the expansion of jobs in this well-paying sector as well as by the increased prices of the products produced by the sector.

The GEAD formula reveals that in Canada sectoral contributions to business sector labour productivity growth were similar to those observed in Ontario. The main drag on business sector labour productivity growth was the manufacturing sector, which contributed -1.13

percentage points. The top two contributors of business sector labour productivity growth are mining and oil and gas extraction and construction. The mining and oil and gas extraction contributed 0.72 percentage point. Of the 0.72 percentage point, within-sector effect accounts for -0.28 percentage point, reallocation level effect accounts for 1.39 percentage points, and reallocation growth effect accounts for -0.39 percentage point. The strong positive reallocation level effect is due to the increase in prices of natural resources and the large influx of workers to the natural resource extraction sectors in Alberta and Saskatchewan. In the construction sector, almost all the contributions to labour productivity growth are derived from reallocation level effect. This is explained through the rise of housing prices in major urban cities.

Appendix II: Appendix Tables

Appendix Table 1: Real GDP, Two-digit NAICS, Business Sector Industries, Canada, 2000-2012

	Canada		
	2000	2012	Compounded Annual Growth Rate
	(Millions, 2007 Dollars)		(Per Cent)
Business Sector Industries	943,106	1,154,414	1.70
Agriculture, forestry, fishing and hunting	21,609	24,091	0.91
Mining and oil and gas extraction	109,755	123,906	1.02
Utilities	30,420	35,321	1.25
Construction	68,334	112,537	4.24
Manufacturing	194,442	168,585	-1.18
Wholesale Trade	59,638	85,141	3.01
Retail Trade	57,005	83,815	3.26
Transportation and warehousing	52,882	63,430	1.53
Information and cultural industries	35,289	49,788	2.91
FIRE	134,881	183,595	2.60
Professional, scientific and financial services	60,066	81,658	2.59
ASWMRS	28,348	39,719	2.85
Arts, entertainment and recreation	8,578	9,611	0.95
Accommodation and food services	27,524	31,471	1.12
Other private services	49,149	61,934	1.95
	(Share of Business Sector)		(Change)
Business Sector Industries	100.00	100.00	..
Agriculture, forestry, fishing and hunting	2.29	2.09	-0.20
Mining and oil and gas extraction	11.64	10.73	-0.90
Utilities	3.23	3.06	-0.17
Construction	7.25	9.75	2.50
Manufacturing	20.62	14.60	-6.01
Wholesale Trade	6.32	7.38	1.05
Retail Trade	6.04	7.26	1.22
Transportation and warehousing	5.61	5.49	-0.11
Information and cultural industries	3.74	4.31	0.57
FIRE	14.30	15.90	1.60
Professional, scientific and financial services	6.37	7.07	0.70
ASWMRS	3.01	3.44	0.43
Arts, entertainment and recreation	0.91	0.83	-0.08
Accommodation and food services	2.92	2.73	-0.19
Other private services	5.21	5.36	0.15

Source: CSLS calculations based on Statistics Canada data

Appendix Table 2: Employment, Two-digit NAICS Business Sector Industries, Canada, 2000-2012

	Canada		
	2000	**2012**	**Compounded Annual Growth Rate**
	(Thousands)		**(Per Cent)**
Business Sector Industries	10,968	12,446	1.06
Agriculture, forestry, fishing and hunting	485	379	-2.03
Mining and oil and gas extraction	159	299	5.38
Utilities	116	141	1.64
Construction	807	1,268	3.84
Manufacturing	2,242	1,786	-1.88
Wholesale Trade	546	612	0.96
Retail Trade	1,754	2,032	1.23
Transportation and warehousing	773	849	0.79
Information and cultural industries	668	790	1.42
FIRE	858	1,093	2.04
Professional, scientific and financial services	936	1,299	2.77
Accommodation and food services	941	1,102	1.33
Other private services	683	795	1.28
	(Share of Business Sector)		**(Change)**
Business Sector Industries	100.00	100.00	
Agriculture, forestry, fishing and hunting	4.42	3.05	-1.38
Mining and oil and gas extraction	1.45	2.40	0.95
Utilities	1.06	1.13	0.07
Construction	7.36	10.18	2.83
Manufacturing	20.44	14.35	-6.10
Wholesale Trade	4.98	4.92	-0.06
Retail Trade	15.99	16.33	0.33
Transportation and warehousing	7.05	6.82	-0.22
Information and cultural industries	6.09	6.35	0.26
FIRE	7.82	8.78	0.96
Professional, scientific and financial services	8.53	10.44	1.91
Accommodation and food services	8.58	8.86	0.28
Other private services	6.22	6.39	0.17

Source: CSLS calculations based on Statistics Canada data

Appendix Table 3: Capital Stock, Two-Digit NAICS Business Sector Industries, Canada, 2000-2012

	Canada		
	2000	**2012**	**Compounded Annual Growth Rate**
	(Millions, 2007 dollars)		**(Per Cent)**
Business Sector Industries	1,019,732	1,325,291	2.21
Agriculture, forestry, fishing and hunting	48,617	46,777	-0.32
Mining and oil and gas extraction	166,457	337,408	6.06
Utilities	173,261	220,091	2.01
Construction	15,026	24,830	4.27
Manufacturing	164,307	142,681	-1.17
Wholesale Trade	22,372	34,883	3.77
Retail Trade	40,093	63,632	3.92
Transportation and warehousing	104,861	128,852	1.73
Information and cultural industries	53,020	59,405	0.95
FIRE	184,348	186,697	0.11
Professional, scientific and financial services	12,508	25,785	6.21
ASWMRS	3,067	9,148	9.53
Arts, entertainment and recreation	10,425	16,038	3.65
Accommodation and food services	21,371	29,063	2.60
	(Share of Business Sector)		**(Change)**
Business Sector Industries	100.00	100.00	
Agriculture, forestry, fishing and hunting	4.77	3.53	-1.24
Mining and oil and gas extraction	16.32	25.46	9.14
Utilities	16.99	16.61	-0.38
Construction	1.47	1.87	0.40
Manufacturing	16.11	10.77	-5.35
Wholesale Trade	2.19	2.63	0.44
Retail Trade	3.93	4.80	0.87
Transportation and warehousing	10.28	9.72	-0.56
Information and cultural industries	5.20	4.48	-0.72
FIRE	18.08	14.09	-3.99
Professional, scientific and financial services	1.23	1.95	0.72
ASWMRS	0.30	0.69	0.39
Arts, entertainment and recreation	1.02	1.21	0.19
Accommodation and food services	2.10	2.19	0.10

Source: CSLS calculations based on Statistics Canada data

Appendix Table 4: Employment by Business Sector Industry (two-digit NAICS), Ontario, 1987, 2000 and 2012

	Levels (Thousands)			Shares of Business Sector (Per Cent)			Growth (Per Cent)			Contributions to Change (Per Cent)		
	1987	2000	2012	1987	2000	2012	1987-2000	2000-2012	Change in Growth Rate	1987-2000	2000-2012	Changes in Contribution
Business Sector Industries	4,200	4,851	5,491	100.00	100.00	100.00	1.11	1.04	-0.08	100.00	100.00	
Agriculture, forestry, fishing and hunting	165	126	95	3.92	2.61	1.73	-2.01	-2.34	-0.33	-6.59	-4.39	2.20
Mining and oil and gas extraction	28	17	21	0.66	0.35	0.39	-3.69	1.87	5.57	-1.86	0.60	2.46
Utilities	34	33	44	0.80	0.69	0.80	-0.08	2.31	2.38	-0.06	1.48	1.53
Construction	317	307	514	7.55	6.33	9.36	-0.26	4.40	4.65	-1.79	29.15	30.94
Manufacturing	1,005	989	739	23.94	20.38	13.46	-0.13	-2.39	-2.26	-2.91	-35.08	-32.17
Wholesale Trade	294	349	350	7.01	7.19	6.37	1.32	0.02	-1.30	9.43	0.12	-9.31
Retail Trade	589	654	740	14.02	13.47	13.48	0.81	1.04	0.23	11.18	12.15	0.97
Transportation and warehousing	204	244	299	4.85	5.04	5.44	1.41	1.69	0.28	7.02	7.64	0.62
Information and cultural industries	88	130	159	2.09	2.68	2.89	3.05	1.68	-1.37	7.25	4.05	-3.21
FIRE	354	426	587	8.42	8.79	10.69	1.45	2.70	1.25	12.58	22.59	10.01
Professional, scientific and technical services	190	384	475	4.52	7.91	8.66	5.55	1.80	-3.75	33.41	12.89	-20.53
ASWMRS	..	307	450	..	6.32	8.20	..	3.25	..	..	20.19	..
Arts, entertainment and recreation	..	89	116	..	1.84	2.11	..	2.18	..	..	3.72	..
Accommodation and food services	265	339	387	6.31	6.99	7.06	1.92	1.12	-0.81	12.83	6.79	-6.04
Other private services	369	412	514	8.80	8.49	9.36	0.84	1.86	1.03	7.30	14.36	7.07

Source: CSLS calculations based on Statistics Canada data

Appendix Table 5: Employment by Business Sector Industry (two-digit NAICS), Rest of Canada, 1987, 2000 and 2012

	Levels (Thousands)			Shares of Business Sector (Per Cent)			Growth (Per Cent)			Contributions to Change (Per Cent)		
	1987	2000	2012	1987	2000	2012	1987-2000	2000-2012	Change in Growth Rate	1987-2000	2000-2012	Changes in Contribution
Business Sector Industries	5,860	7,106	8,330	100.00	100.00	100.00	1.49	1.33	-0.16	100.00	100.00	
Agriculture, forestry, fishing and hunting	407	338	257	6.94	4.76	3.08	-1.41	-2.26	-0.85	1.69	1.32	-0.37
Mining and oil and gas extraction	117	120	212	2.00	1.69	2.55	0.18	4.88	4.70	16.27	10.26	-6.02
Utilities	64	63	66	1.09	0.88	0.80	-0.18	0.51	0.69	2.02	1.97	-0.06
Construction	533	564	955	9.10	7.94	11.46	0.44	4.48	4.04	3.50	22.17	18.67
Manufacturing	1,002	1,158	934	17.10	16.29	11.21	1.12	-1.77	-2.89	18.83	-3.06	-21.89
Wholesale Trade	381	441	471	6.51	6.21	5.65	1.13	0.54	-0.58	7.03	9.85	2.82
Retail Trade	912	1,047	1,268	15.56	14.73	15.22	1.07	1.61	0.54	2.40	11.61	9.21
Transportation and warehousing	382	453	503	6.51	6.37	6.04	1.32	0.89	-0.44	6.49	4.34	-2.15
Information and cultural industries	107	167	185	1.83	2.35	2.22	3.45	0.85	-2.61	6.44	5.31	-1.12
FIRE	422	534	710	7.21	7.52	8.52	1.82	2.40	0.58	12.31	18.14	5.83
Professional, scientific and technical services	247	482	624	4.21	6.79	7.50	5.29	2.17	-3.11	8.91	9.68	0.77
ASWMRS	..	344	502	..	4.84	6.02	..	3.20	..	2.83	4.31	1.48
Arts, entertainment and recreation	..	142	179	..	2.00	2.15	..	1.96	..	1.03	0.44	-0.60
Accommodation and food services	442	606	715	7.54	8.53	8.59	2.45	1.39	-1.06	1.51	2.25	0.74
Other private services	550	637	749	9.39	8.96	8.99	1.13	1.36	0.23	6.21	5.03	-1.18

Source: CSLS calculations based on Statistics Canada data

Appendix Table 6: Total Hours Worked by Business Sector Industry (two-digit NAICS), Ontario, 1987, 2000 and 2012

	Levels (Millions)			Shares of Business Sector (Per Cent)			Growth Rate (Per Cent)			Contributions to Change (Per Cent)		
	1987	2000	2012	1987	2000	2012	1987-2000	2000-2012	Change in Growth Rate	1987-2000	2000-2012	Changes in Contribution
Business Sector Industries	7,517	8,814	9,530	100.00	100.00	100.00	1.23	0.65	-0.58	0.05	-0.08	
Agriculture, forestry, fishing and hunting	298	225	201	3.96	2.55	2.11	-2.15	-0.93	1.22	-0.07	0.17	0.24
Mining and oil and gas extraction	57	36	49	0.76	0.41	0.51	-3.50	2.66	6.16	0.20	0.86	0.65
Utilities	73	67	80	0.97	0.76	0.84	-0.57	1.44	2.00	0.11	0.28	0.17
Construction	696	682	1,006	9.26	7.73	10.56	-0.16	3.30	3.46	0.25	0.48	0.23
Manufacturing	2,036	2,016	1,437	27.09	22.87	15.08	-0.08	-2.78	-2.70	-0.21	-0.38	-0.16
Wholesale Trade	573	696	671	7.63	7.89	7.04	1.50	-0.30	-1.79	-0.02	-0.25	-0.23
Retail Trade	969	1,085	1,093	12.89	12.31	11.47	0.87	0.06	-0.80	0.00	-0.11	-0.12
Transportation and warehousing	377	464	566	5.02	5.26	5.94	1.60	1.67	0.07	0.13	0.01	-0.12
Information and cultural industries	149	227	270	1.98	2.58	2.83	3.32	1.46	-1.86	0.11	-0.26	-0.37
FIRE	619	764	1,044	8.23	8.67	10.95	1.63	2.64	1.01	0.20	0.14	-0.06
Professional, scientific and technical services	339	734	840	4.51	8.33	8.81	6.12	1.13	-4.99	0.09	-0.70	-0.78
ASWMRS	242	509	736	3.22	5.78	7.73	5.89	3.12	-2.77	0.24	-0.39	-0.63
Arts, entertainment and recreation	107	147	162	1.42	1.67	1.70	2.48	0.81	-1.67	0.06	-0.23	-0.30
Accommodation and food services	408	544	561	5.43	6.17	5.88	2.24	0.25	-1.99	0.02	-0.28	-0.30
Other private services	574	636	814	7.64	7.21	8.54	0.79	2.08	1.30	0.16	0.18	0.02

Source: CSLS calculations based on Statistics Canada data

Appendix Table 7: Total Hours Worked by Business Sector Industry (two-digit NAICS), Rest of Canada, 1987, 2000 and 2012

	Levels (Millions)			Shares of Business Sector (Per Cent)			Growth Rate (Per Cent)			Contributions to Change (Per Cent)		
	1987	2000	2012	1987	2000	2012	1987-2000	2000-2012	Change in Growth Rate	1987-2000	2000-2012	Changes in Contribution
Business Sector Industries	10,466	12,804	14,613	100.00	100.00	100.00	1.56	1.11	-0.46	100.00	100.00	
Agriculture, forestry, fishing and hunting	806	754	543	7.70	5.89	3.71	-0.51	-2.70	-2.19	-2.23	-11.68	-9.45
Mining and oil and gas extraction	256	271	482	2.45	2.12	3.30	0.43	4.92	4.49	0.63	11.69	11.05
Utilities	121	115	121	1.15	0.90	0.83	-0.38	0.46	0.84	-0.25	0.36	0.61
Construction	866	1,114	1,934	8.28	8.70	13.23	1.96	4.70	2.74	10.61	45.31	34.70
Manufacturing	1,634	2,225	1,782	15.61	17.38	12.19	2.40	-1.83	-4.24	25.27	-24.49	-49.76
Wholesale Trade	550	846	901	5.25	6.61	6.17	3.37	0.53	-2.85	12.68	3.05	-9.63
Retail Trade	1,473	1,653	1,922	14.08	12.91	13.15	0.89	1.26	0.37	7.71	14.85	7.14
Transportation and warehousing	790	914	973	7.55	7.14	6.66	1.13	0.52	-0.60	5.31	3.27	-2.03
Information and cultural industries	298	300	315	2.85	2.34	2.16	0.04	0.41	0.38	0.06	0.84	0.78
FIRE	843	932	1,203	8.05	7.28	8.24	0.77	2.16	1.38	3.80	15.03	11.23
Professional, scientific and technical services	486	854	1,095	4.65	6.67	7.49	4.43	2.09	-2.34	15.73	13.30	-2.43
ASWMRS	344	575	800	3.29	4.49	5.47	4.04	2.79	-1.25	9.89	12.43	2.54
Arts, entertainment and recreation	127	204	247	1.22	1.60	1.69	3.70	1.58	-2.12	3.29	2.34	-0.95
Accommodation and food services	789	955	1,081	7.54	7.45	7.40	1.47	1.04	-0.43	7.07	7.01	-0.06
Other private services	1,082	1,090	1,214	10.34	8.51	8.30	0.06	0.90	0.84	0.35	6.82	6.48

Source: CSLS calculations based on Statistics Canada data

Appendix Table 8: Average Annual Hours Worked per Worker by Business Sector Industry (two-digit NAICS), Ontario, 1987, 2000 and 2012

	Levels (Hours per Person)			Ratio to Business Sector (Per Cent)			Growth Rate (Per Cent)		
	1987	2000	2012	1987	2000	2012	1987-2000	2000-2012	Change in Growth Rate
Business Sector Industries	1,790	1,817	1,736	100.00	100.00	100.00	0.12	-0.38	-0.50
Agriculture, forestry, fishing and hunting	1,811	1,973	2,109	101.17	108.60	121.49	0.66	0.55	-0.11
Mining and oil and gas extraction	2,036	2,041	2,290	113.79	112.35	131.94	0.02	0.96	0.94
Utilities	2,159	1,879	1,827	120.62	103.44	105.23	-1.06	-0.24	0.82
Construction	2,194	2,074	1,958	122.60	114.15	112.78	-0.43	-0.48	-0.05
Manufacturing	2,025	1,988	1,944	113.15	109.40	112.01	-0.14	-0.18	-0.04
Wholesale Trade	1,948	1,999	1,919	108.88	110.02	110.57	0.20	-0.34	-0.54
Retail Trade	1,646	1,588	1,477	91.99	87.37	85.10	-0.28	-0.60	-0.32
Transportation and warehousing	1,853	1,971	1,894	103.52	108.45	109.12	0.48	-0.33	-0.81
Information and cultural industries	1,690	1,825	1,702	94.45	100.45	98.05	0.59	-0.58	-1.17
FIRE	1,750	1,769	1,778	97.81	97.38	102.45	0.08	0.04	-0.04
Professional, scientific and technical services	1,783	1,855	1,768	99.65	102.09	101.83	0.30	-0.40	-0.71
ASWMRS	..	1,679	1,635	..	92.38	94.21	..	-0.22	..
Arts, entertainment and recreation	..	1,558	1,398	..	85.72	80.54	..	-0.90	..
Accommodation and food services	1,540	1,575	1,447	86.08	86.70	83.35	0.17	-0.71	-0.88
Other private services	1,554	1,617	1,584	86.83	89.01	91.28	0.31	-0.17	-0.48

Source: CSLS calculations based on Statistics Canada data

Appendix Table 9: Average Annual Hours Worked per Worker by Business Sector Industry (two-digit NAICS), Rest of Canada, 1987, 2000 and 2012

	Levels (Hours per Person)			Ratio to Business Sector (Per Cent)			Growth Rate (Per Cent)		
	1987	2000	2012	1987	2000	2012	1987-2000	2000-2012	Change in Growth Rate
Business Sector Industries	1,786	1,817	1,760	100.00	100.00	100.00	0.13	-0.26	-0.40
Agriculture, forestry, fishing and hunting	1,982	2,149	2,110	110.95	118.28	119.85	0.63	-0.15	-0.78
Mining and oil and gas extraction	2,188	2,271	2,281	122.51	124.96	129.60	0.29	0.04	-0.25
Utilities	1,885	1,913	1,792	105.53	105.30	101.80	0.12	-0.54	-0.66
Construction	1,625	2,059	2,036	90.98	113.34	115.67	1.84	-0.09	-1.93
Manufacturing	1,631	1,959	1,939	91.30	107.83	110.16	1.42	-0.09	-1.51
Wholesale Trade	1,442	1,918	1,915	80.72	105.58	108.77	2.22	-0.02	-2.24
Retail Trade	1,615	1,624	1,514	90.44	89.38	86.03	0.04	-0.58	-0.62
Transportation and warehousing	2,071	1,987	1,952	115.95	109.37	110.88	-0.32	-0.15	0.17
Information and cultural industries	2,782	1,755	1,691	155.75	96.61	96.08	-3.48	-0.31	3.17
FIRE	1,995	1,729	1,708	111.71	95.16	97.02	-1.09	-0.10	0.99
Professional, scientific and technical services	1,970	1,835	1,738	110.30	101.01	98.75	-0.54	-0.45	0.09
ASWMRS	..	1,647	1,600	..	90.62	90.90	..	-0.24	..
Arts, entertainment and recreation	..	1,490	1,377	..	81.99	78.21	..	-0.66	..
Accommodation and food services	1,785	1,600	1,505	99.95	88.08	85.52	-0.84	-0.51	0.33
Other private services	1,967	1,673	1,628	110.11	92.06	92.46	-1.24	-0.23	1.01

Source: CSLS calculations based on Statistics Canada data

Appendix Table 10: CSLS Labour Productivity Decomposition, Business Sector, Ontario, 1987-2000

	Within-Sector Effect	Reallocation Level Effect	Reallocation Growth Effect	Total
	Percentage Point Contribution			
Business sector industries	2.09	0.06	-0.27	1.89
Agriculture, forestry, fishing and hunting	0.06	0.06	0.00	0.13
Mining and oil and gas extraction	0.12	-0.11	-0.05	-0.04
Utilities	0.02	-0.03	0.00	-0.01
Construction	0.01	-0.01	0.03	0.04
Manufacturing	1.02	0.02	-0.08	0.96
Wholesale trade	0.27	-0.01	0.00	0.27
Retail trade	0.10	0.02	0.01	0.12
Transportation and warehousing	0.04	0.00	0.00	0.04
Information and cultural industries	0.03	0.03	0.00	0.06
FIRE	0.40	0.03	0.01	0.44
Professional, scientific and technical services	0.02	0.05	-0.06	0.01
ASWMRS	-0.08	0.03	-0.12	-0.17
Arts, entertainment and recreation	-0.02	0.00	-0.01	-0.03
Accommodation and food services	0.00	-0.02	-0.01	-0.04
Other private services	0.09	0.01	0.00	0.10
	Per Cent Contribution			
Business sector industries	110.76	3.39	-14.15	100.00
Agriculture, forestry, fishing and hunting	3.37	3.35	0.23	6.96
Mining and oil and gas extraction	6.24	-6.06	-2.54	-2.36
Utilities	1.24	-1.77	-0.05	-0.59
Construction	0.76	-0.32	1.42	1.87
Manufacturing	54.05	1.02	-4.14	50.94
Wholesale trade	14.50	-0.31	0.23	14.42
Retail trade	5.15	1.02	0.36	6.53
Transportation and warehousing	2.26	0.03	-0.14	2.15
Information and cultural industries	1.82	1.66	-0.06	3.43
FIRE	20.92	1.47	0.66	23.05
Professional, scientific and technical services	1.07	2.50	-2.97	0.60
ASWMRS	-4.47	1.71	-6.15	-8.92
Arts, entertainment and recreation	-0.85	-0.10	-0.40	-1.35
Accommodation and food services	-0.17	-1.17	-0.78	-2.12
Other private services	4.88	0.36	0.16	5.40

Source: CSLS Calculation based on Statistics Canada Data

Appendix Table 11: CSLS Labour Productivity Decomposition, Business Sector, the Rest of Canada, 1987-2000

	Within-Sector Effect	Reallocation Level Effect	Reallocation Growth Effect	Total
	Percentage Point Contribution			
Business sector industries	1.87	-0.17	-0.22	1.48
Agriculture, forestry, fishing and hunting	0.11	0.08	0.00	0.19
Mining and oil and gas extraction	0.58	-0.21	-0.10	0.27
Utilities	0.03	-0.02	0.00	0.00
Construction	-0.05	0.00	-0.01	-0.05
Manufacturing	0.19	0.00	-0.01	0.19
Wholesale trade	0.07	0.00	0.00	0.06
Retail trade	0.02	0.04	0.02	0.08
Transportation and warehousing	0.09	0.00	0.00	0.09
Information and cultural industries	0.23	0.01	-0.04	0.21
FIRE	0.39	-0.04	-0.04	0.31
Professional, scientific and technical services	0.08	-0.04	0.00	0.05
ASWMRS	-0.03	-0.03	-0.04	-0.11
Arts, entertainment and recreation	0.00	-0.01	-0.01	-0.02
Accommodation and food services	0.00	0.01	0.00	0.01
Other private services	0.17	0.04	0.00	0.21
	Per Cent Contribution			
Business sector industries	125.98	-11.46	-14.53	100.00
Agriculture, forestry, fishing and hunting	7.17	5.72	0.25	13.14
Mining and oil and gas extraction	38.86	-14.29	-6.68	17.89
Utilities	1.77	-1.57	-0.05	0.15
Construction	-3.54	0.22	-0.36	-3.68
Manufacturing	12.97	0.12	-0.34	12.75
Wholesale trade	4.43	-0.25	-0.18	4.01
Retail trade	1.17	2.91	1.25	5.33
Transportation and warehousing	6.15	-0.24	-0.05	5.85
Information and cultural industries	15.81	0.70	-2.47	14.04
FIRE	26.50	-2.99	-2.82	20.69
Professional, scientific and technical services	5.34	-2.45	0.20	3.09
ASWMRS	-2.12	-2.11	-2.95	-7.18
Arts, entertainment and recreation	-0.04	-0.68	-0.44	-1.16
Accommodation and food services	-0.08	0.47	0.20	0.60
Other private services	11.59	2.98	-0.09	14.48

Source CSLS calculations based on Statistics Canada data

Appendix Table 12: CSLS Labour Productivity Decomposition, Business Sector, Ontario 2000-2012

	Within-Sector Effect	Reallocation Level Effect	Reallocation Growth Effect	Total
	Percentage Point Contribution			
Business sector industries	0.57	0.10	-0.16	0.51
Agriculture, forestry, fishing and hunting	0.02	0.02	0.00	0.04
Mining and oil and gas extraction	-0.08	0.04	-0.02	-0.06
Utilities	0.01	0.01	0.00	0.02
Construction	-0.03	-0.03	-0.02	-0.09
Manufacturing	0.21	-0.10	-0.03	0.08
Wholesale trade	0.25	0.00	-0.02	0.23
Retail trade	0.18	0.03	-0.01	0.21
Transportation and warehousing	0.00	0.00	0.00	-0.01
Information and cultural industries	0.06	0.01	0.00	0.08
FIRE	-0.06	0.19	-0.03	0.11
Professional, scientific and technical services	0.04	0.00	0.00	0.04
ASWMRS	-0.02	-0.06	-0.02	-0.09
Arts, entertainment and recreation	0.00	0.00	0.00	0.00
Accommodation and food services	0.00	0.01	0.00	0.02
Other private services	-0.01	-0.03	-0.01	-0.05
	Per cent Contribution			
Business sector industries	111.23	20.44	-31.66	100.00
Agriculture, forestry, fishing and hunting	4.12	3.69	-0.28	7.53
Mining and oil and gas extraction	-16.21	8.78	-4.43	-11.85
Utilities	0.99	2.24	0.02	3.25
Construction	-5.41	-6.78	-4.74	-16.93
Manufacturing	41.58	-19.06	-6.53	15.99
Wholesale trade	48.23	0.86	-4.35	44.74
Retail trade	35.47	6.48	-1.59	40.36
Transportation and warehousing	-0.38	-0.96	-0.71	-2.05
Information and cultural industries	11.88	2.29	0.94	15.10
FIRE	-11.43	37.33	-5.26	20.64
Professional, scientific and technical services	7.93	-0.20	-0.01	7.72
ASWMRS	-3.98	-11.22	-3.26	-18.46
Arts, entertainment and recreation	-0.03	-0.21	-0.03	-0.27
Accommodation and food services	0.53	2.53	0.26	3.32
Other private services	-2.05	-5.35	-1.68	-9.08

Source: CSLS calculations based on Statistics Canada data

Appendix Table 13: CSLS Labour Productivity Decomposition, Business Sector, the Rest of Canada, 2000-2012

	Within-Sector Effect	Reallocation Level Effect	Reallocation Growth Effect	Total
	Percentage Point Contribution			
Business sector industries	0.61	0.82	-0.44	0.98
Agriculture, forestry, fishing and hunting	0.10	0.06	-0.02	0.15
Mining and oil and gas extraction	-0.49	0.75	-0.33	-0.08
Utilities	0.08	-0.04	-0.01	0.02
Construction	0.01	-0.03	-0.04	-0.06
Manufacturing	0.23	0.01	-0.02	0.22
Wholesale trade	0.12	0.00	0.00	0.12
Retail trade	0.14	-0.02	0.00	0.12
Transportation and warehousing	0.11	0.02	0.00	0.12
Information and cultural industries	0.09	-0.01	0.00	0.08
FIRE	0.03	0.08	-0.01	0.10
Professional, scientific and technical services	0.06	-0.01	0.00	0.05
ASWMRS	0.03	-0.02	0.00	0.02
Arts, entertainment and recreation	0.00	0.00	0.00	0.00
Accommodation and food services	0.01	0.00	0.00	0.01
Other private services	0.09	0.03	0.00	0.12
	Per Cent Contribution			
Business sector industries	61.94	83.49	-45.43	100.00
Agriculture, forestry, fishing and hunting	10.55	6.07	-1.75	14.87
Mining and oil and gas extraction	-50.41	76.66	-34.13	-7.88
Utilities	8.01	-4.47	-1.48	2.06
Construction	0.84	-3.41	-3.96	-6.53
Manufacturing	23.73	0.89	-2.22	22.40
Wholesale trade	12.62	-0.02	0.04	12.63
Retail trade	14.10	-1.54	0.06	12.62
Transportation and warehousing	10.73	1.79	-0.49	12.02
Information and cultural industries	8.79	-0.59	-0.42	7.78
FIRE	2.56	8.40	-0.81	10.16
Professional, scientific and technical services	6.29	-1.43	0.02	4.89
ASWMRS	3.52	-1.62	-0.11	1.80
Arts, entertainment and recreation	-0.23	-0.22	-0.07	-0.51
Accommodation and food services	1.26	-0.22	-0.04	0.99
Other private services	9.58	3.20	-0.09	12.69

Source: CSLS calculations based on Statistics Canada data

Appendix Table 14: CSLS Labour Productivity Decomposition Summary, Business Sector, Ontario and the Rest of Canada, 1987-2000 and 2000-2012

	1987-2000	2000-2012	Change	Contributions to Change
	Ontario			
Business sector industries	1.89	0.51	-1.38	100.00
Agriculture, forestry, fishing and hunting	0.13	0.04	-0.09	6.74
Mining and oil and gas extraction	-0.04	-0.06	-0.02	1.16
Utilities	-0.01	0.02	0.03	-2.01
Construction	0.04	-0.09	-0.12	8.83
Manufacturing	0.96	0.08	-0.88	63.88
Wholesale trade	0.27	0.23	-0.04	3.19
Retail trade	0.12	0.21	0.08	-6.00
Transportation and warehousing	0.04	-0.01	-0.05	3.71
Information and cultural industries	0.06	0.08	0.01	-0.90
FIRE	0.44	0.11	-0.33	23.95
Professional, scientific and technical services	0.01	0.04	0.03	-2.04
ASWMRS	-0.17	-0.09	0.07	-5.38
Arts, entertainment and recreation	-0.03	0.00	0.02	-1.74
Accommodation and food services	-0.04	0.02	0.06	-4.14
Other private services	0.10	-0.05	-0.15	10.76
	Rest of Canada			
Business sector industries	1.48	0.98	-0.50	100.00
Agriculture, forestry, fishing and hunting	0.19	0.15	-0.05	9.76
Mining and oil and gas extraction	0.27	-0.08	-0.34	67.97
Utilities	0.00	0.02	0.02	-3.56
Construction	-0.05	-0.06	-0.01	1.88
Manufacturing	0.19	0.22	0.03	-6.02
Wholesale trade	0.06	0.12	0.06	-12.76
Retail trade	0.08	0.12	0.04	-8.85
Transportation and warehousing	0.09	0.12	0.03	-6.14
Information and cultural industries	0.21	0.08	-0.13	26.22
FIRE	0.31	0.10	-0.21	41.17
Professional, scientific and technical services	0.05	0.05	0.00	-0.42
ASWMRS	-0.11	0.02	0.12	-24.62
Arts, entertainment and recreation	-0.02	0.00	0.01	-2.43
Accommodation and food services	0.01	0.01	0.00	-0.17
Other private services	0.21	0.12	-0.09	17.98

Source: CSLS calculations based on Statistics Canada data

Appendix Table 15: CSLS Labour Productivity Decomposition, Manufacturing Sector Three-digit NAICS, Canada, 2000-2012

	Within-Sector Effect	Reallocation Level Effect	Reallocation Growth Effect	Total
	Percentage Point Contribution			
Manufacturing	1.04	0.02	0.05	1.11
Food manufacturing	0.01	-0.04	-0.05	-0.07
Beverage and tobacco product manufacturing	-0.05	0.05	-0.01	-0.02
Textile and textile product mills	0.00	0.02	0.01	0.03
Clothing and leather and allied product manufacturing*	-0.43	-0.08	0.28	-0.22
Wood product manufacturing	0.19	0.02	-0.01	0.20
Paper manufacturing	0.20	0.01	-0.04	0.17
Printing and related support activities	0.02	0.01	0.00	0.03
Petroleum and coal product manufacturing	-0.02	0.13	-0.01	0.09
Chemical manufacturing	-0.09	0.08	-0.04	-0.06
Plastics and rubber products manufacturing	0.11	0.00	0.00	0.11
Non-metallic mineral product manufacturing	0.04	-0.01	0.00	0.03
Primary metal manufacturing	0.54	-0.03	-0.10	0.40
Fabricated metal product manufacturing	0.05	-0.04	-0.01	0.00
Machinery manufacturing	0.22	-0.01	0.01	0.21
Computer and electronic product manufacturing	-0.14	-0.04	0.05	-0.12
Electrical equipment, appliance and component manufacturing	0.02	0.00	0.00	0.02
Transportation equipment manufacturing	0.47	-0.01	-0.03	0.43
Furniture and related product manufacturing	-0.08	0.01	0.01	-0.06
Miscellaneous manufacturing	-0.01	-0.04	-0.01	-0.06
	Per cent Contribution			
Manufacturing	93.00	2.15	4.85	100.00
Food manufacturing	1.34	-3.17	-4.85	-6.68
Beverage and tobacco product manufacturing	-4.76	4.33	-1.09	-1.52
Textile and textile product mills	-0.35	2.14	1.12	2.91
Clothing and leather and allied product manufacturing*	-38.43	-6.99	25.51	-19.91
Wood product manufacturing	16.98	1.95	-0.90	18.03
Paper manufacturing	17.70	1.01	-3.36	15.36
Printing and related support activities	2.15	0.65	0.12	2.92
Petroleum and coal product manufacturing	-1.84	11.25	-1.16	8.24
Chemical manufacturing	-8.35	6.78	-3.42	-4.99
Plastics and rubber products manufacturing	9.61	-0.19	0.03	9.45
Non-metallic mineral product manufacturing	3.21	-0.93	0.00	2.28
Primary metal manufacturing	48.27	-3.13	-9.11	36.04
Fabricated metal product manufacturing	4.29	-3.38	-0.82	0.09
Machinery manufacturing	19.34	-1.04	0.69	18.99
Computer and electronic product manufacturing	-12.45	-3.37	4.90	-10.93
Electrical equipment, appliance and component manufacturing	1.49	-0.03	0.11	1.57
Transportation equipment manufacturing	42.16	-1.32	-2.40	38.45
Furniture and related product manufacturing	-6.88	1.02	0.66	-5.20
Miscellaneous manufacturing	-0.48	-3.42	-1.19	-5.09

Source: CSLS calculations based on Statistics Canada data

Appendix Table 16: GEAD Labour Productivity Decomposition, Two-digit NAICS Business Sector Industries, Canada, 2000-2010

	Within-Sector Effect	Reallocation Level Effect	Reallocation Growth Effect	Total
	Percentage Point Contribution			
Business sector industries	1.07	0.42	-0.69	0.79
Agriculture, forestry, fishing and hunting	0.14	-0.18	-0.08	-0.12
Mining and oil and gas extraction	-0.28	1.39	-0.39	0.72
Utilities	0.00	-0.02	0.00	-0.02
Construction	0.01	0.52	0.00	0.53
Manufacturing	0.30	-1.31	-0.13	-1.13
Wholesale trade	0.30	-0.19	-0.07	0.04
Retail trade	0.22	-0.08	-0.02	0.12
Transportation and warehousing	0.04	-0.05	0.00	-0.02
Information and cultural industries	0.13	-0.12	-0.03	-0.02
FIRE	0.06	0.11	0.00	0.17
Professional, scientific and technical services	0.08	0.11	0.01	0.20
ASWMRS	0.01	0.13	0.00	0.14
Arts, entertainment and recreation	0.00	0.02	0.00	0.02
Accommodation and food services	0.02	0.00	0.00	0.02
Other private services	0.05	0.09	0.01	0.15
	Per Cent Contribution			
Business sector industries	135.01	52.74	-87.75	100.00
Agriculture, forestry, fishing and hunting	17.74	-23.27	-9.56	-15.08
Mining and oil and gas extraction	-35.16	175.98	-49.73	91.09
Utilities	0.28	-2.68	-0.01	-2.42
Construction	0.84	65.24	0.56	66.64
Manufacturing	38.29	-165.11	-16.46	-143.29
Wholesale trade	37.48	-24.20	-8.62	4.66
Retail trade	27.64	-9.56	-2.64	15.44
Transportation and warehousing	4.57	-6.64	-0.34	-2.41
Information and cultural industries	16.95	-15.08	-4.00	-2.13
FIRE	7.33	13.66	0.42	21.41
Professional, scientific and technical services	9.99	14.44	1.46	25.89
ASWMRS	0.96	16.07	0.34	17.37
Arts, entertainment and recreation	-0.10	2.49	-0.02	2.38
Accommodation and food services	2.46	-0.43	-0.02	2.01
Other private services	5.74	11.83	0.86	18.43

Source: CSLS calculations based on Statistics Canada data

Appendix Table 17: GEAD Labour Productivity Decomposition, Two-digit NAICS Business Sector, Ontario, 2000-2010

	Within-Sector Effect	Reallocation Level Effect	Reallocation Growth Effect	Total
	Percentage Point Contribution			
Business sector industries	0.73	0.14	-0.31	0.55
Agriculture, forestry, fishing and hunting	0.03	-0.04	-0.01	-0.02
Mining and oil and gas extraction	-0.06	0.23	-0.12	0.04
Utilities	0.01	-0.02	0.00	-0.01
Construction	-0.01	0.46	-0.01	0.44
Manufacturing	0.17	-1.30	-0.07	-1.20
Wholesale trade	0.33	-0.15	-0.06	0.11
Retail trade	0.21	-0.10	-0.03	0.08
Transportation and warehousing	-0.02	0.07	0.00	0.05
Information and cultural industries	0.09	0.00	0.00	0.09
FIRE	-0.05	0.43	-0.01	0.37
Professional, scientific and technical services	0.04	0.17	0.01	0.21
ASWMRS	-0.01	0.20	0.00	0.19
Arts, entertainment and recreation	0.00	0.02	0.00	0.02
Accommodation and food services	0.01	0.02	0.00	0.03
Other private services	-0.01	0.16	0.00	0.15
	Per cent Contribution			
Business sector industries	131.39	25.05	-56.44	100.00
Agriculture, forestry, fishing and hunting	4.68	-7.33	-1.32	-3.96
Mining and oil and gas extraction	-11.02	40.61	-22.11	7.48
Utilities	1.84	-3.96	-0.14	-2.26
Construction	-1.87	82.10	-1.46	78.78
Manufacturing	29.88	-234.23	-12.05	-216.41
Wholesale trade	58.91	-27.69	-11.51	19.72
Retail trade	38.10	-17.89	-5.74	14.46
Transportation and warehousing	-3.03	13.06	-0.45	9.58
Information and cultural industries	16.88	-0.61	-0.13	16.14
FIRE	-9.80	77.94	-2.24	65.90
Professional, scientific and technical services	6.56	30.16	1.34	38.07
ASWMRS	-0.97	36.48	-0.55	34.96
Arts, entertainment and recreation	0.50	3.55	0.10	4.16
Accommodation and food services	1.91	4.09	0.16	6.16
Other private services	-1.18	28.77	-0.35	27.23

Source: CSLS calculation based on Statistics Canada Data

Appendix Table 18: CSLS Labour Productivity Decomposition, Two-Digit NAICS Business Sector, Ontario, 2000 – 2010

	Within-Sector Effect	Reallocation Level Effect	Reallocation Growth Effect	Total
	Percentage Point Contribution			
Business sector industries	0.55	0.15	-0.15	0.55
Agriculture, forestry, fishing and hunting	0.02	0.02	0.00	0.59
Mining and oil and gas extraction	-0.13	0.09	-0.06	-0.06
Utilities	0.01	0.02	0.00	-0.07
Construction	-0.01	-0.04	-0.02	-0.04
Manufacturing	0.13	-0.11	0.00	-0.05
Wholesale trade	0.29	0.01	-0.03	0.29
Retail trade	0.19	0.02	0.00	0.48
Transportation and warehousing	-0.02	-0.01	-0.01	0.18
Information and cultural industries	0.08	0.01	0.01	0.07
FIRE	-0.05	0.21	-0.02	0.24
Professional, scientific and technical services	0.03	0.00	0.00	0.17
ASWMRS	-0.01	-0.06	-0.01	-0.04
Arts, entertainment and recreation	0.00	0.00	0.00	-0.07
Accommodation and food services	0.01	0.03	0.00	0.04
Other private services	-0.01	-0.03	-0.01	-0.01
	Per Cent Contribution			
Business sector industries	111.23	20.44	-31.66	100.00
Agriculture, forestry, fishing and hunting	4.12	3.69	-0.28	7.53
Mining and oil and gas extraction	-16.21	8.78	-4.43	-11.85
Utilities	0.99	2.24	0.02	3.25
Construction	-5.41	-6.78	-4.74	-16.93
Manufacturing	41.58	-19.06	-6.53	15.99
Wholesale trade	48.23	0.86	-4.35	44.74
Retail trade	35.47	6.48	-1.59	40.36
Transportation and warehousing	-0.38	-0.96	-0.71	-2.05
Information and cultural industries	11.88	2.29	0.94	15.10
FIRE	-11.43	37.33	-5.26	20.64
Professional, scientific and technical services	7.93	-0.20	-0.01	7.72
ASWMRS	-3.98	-11.22	-3.26	-18.46
Arts, entertainment and recreation	-0.03	-0.21	-0.03	-0.27
Accommodation and food services	0.53	2.53	0.26	3.32
Other private services	-2.05	-5.35	-1.68	-9.08

Source: CSLS calculations based on Statistics Canada data

Appendix Table 19: CSLS Labour Productivity Decomposition, Two-Digit NAICS Business Sector, Canada, 2000 – 2010

	Within-Sector Effect	Reallocation Level Effect	Reallocation Growth Effect	Total
	Percentage Point Contribution			
Business sector industries	0.60	0.38	-0.19	0.79
Agriculture, forestry, fishing and hunting	0.08	0.06	-0.02	0.13
Mining and oil and gas extraction	-0.29	0.35	-0.12	-0.06
Utilities	0.00	0.01	0.00	0.01
Construction	0.01	-0.04	-0.02	-0.05
Manufacturing	0.18	-0.03	-0.01	0.14
Wholesale trade	0.20	0.01	-0.01	0.19
Retail trade	0.15	-0.02	0.00	0.13
Transportation and warehousing	0.03	0.00	0.00	0.03
Information and cultural industries	0.09	0.00	0.00	0.09
FIRE	0.04	0.10	0.00	0.14
Professional, scientific and technical services	0.06	-0.01	0.00	0.05
ASWMRS	0.01	-0.04	-0.01	-0.04
Arts, entertainment and recreation	0.00	-0.01	0.00	-0.01
Accommodation and food services	0.01	0.01	0.00	0.03
Other private services	0.03	-0.01	0.00	0.02
	Per cent Contribution			
Business sector industries	75.52	48.37	-23.89	100.00
Agriculture, forestry, fishing and hunting	10.65	7.51	-1.92	16.25
Mining and oil and gas extraction	-37.24	44.28	-14.75	-7.71
Utilities	0.19	1.11	-0.02	1.28
Construction	0.71	-4.76	-2.77	-6.82
Manufacturing	23.27	-3.43	-1.53	18.31
Wholesale trade	25.48	0.80	-1.66	24.63
Retail trade	18.90	-2.34	0.22	16.78
Transportation and warehousing	3.27	-0.08	-0.02	3.17
Information and cultural industries	11.24	-0.01	-0.01	11.22
FIRE	5.01	12.49	-0.39	17.11
Professional, scientific and technical services	7.28	-0.98	0.04	6.34
ASWMRS	0.72	-5.44	-0.94	-5.67
Arts, entertainment and recreation	-0.07	-0.66	-0.13	-0.86
Accommodation and food services	1.80	1.53	0.16	3.49
Other private services	4.31	-1.67	-0.16	2.48

Source: CSLS calculations based on Statistics Canada data

Appendix Table 20: CSLS Labour Productivity Decomposition, Two-digit NAICS Business Sector, Ontario, 1997-2000

	Within-Sector Effect	Reallocation Level Effect	Reallocation Growth Effect	Total
	Percentage Point Contribution			
Business sector industries	4.00	-0.02	-0.12	3.85
Agriculture, forestry, fishing and hunting	0.13	0.13	0.00	0.25
Mining and oil and gas extraction	0.17	-0.14	-0.03	0.01
Utilities	0.09	-0.12	-0.01	-0.04
Construction	0.27	0.02	0.00	0.29
Manufacturing	1.62	-0.04	-0.04	1.55
Wholesale trade	0.43	0.00	0.00	0.43
Retail trade	0.25	0.06	0.01	0.32
Transportation and warehousing	0.05	0.00	0.00	0.04
Information and cultural industries	0.00	0.13	-0.02	0.12
FIRE	0.46	0.04	0.00	0.51
Professional, scientific and technical services	0.24	-0.01	0.00	0.23
ASWMRS	0.03	-0.05	-0.02	-0.04
Arts, entertainment and recreation	0.00	-0.01	0.00	-0.01
Accommodation and food services	0.04	-0.07	-0.01	-0.05
Other private services	0.21	0.03	0.00	0.24
	Per cent Contribution			
Business sector industries	103.88	-0.65	-3.23	100.00
Agriculture, forestry, fishing and hunting	3.35	3.31	-0.04	6.61
Mining and oil and gas extraction	4.49	-3.55	-0.72	0.22
Utilities	2.29	-3.10	-0.27	-1.08
Construction	7.01	0.47	0.04	7.52
Manufacturing	42.18	-0.92	-1.04	40.22
Wholesale trade	11.08	0.06	-0.02	11.11
Retail trade	6.62	1.58	0.18	8.37
Transportation and warehousing	1.18	-0.01	-0.05	1.12
Information and cultural industries	0.13	3.37	-0.50	3.00
FIRE	12.06	1.09	0.05	13.20
Professional, scientific and technical services	6.33	-0.28	-0.07	5.97
ASWMRS	0.73	-1.37	-0.45	-1.09
Arts, entertainment and recreation	0.02	-0.16	-0.05	-0.18
Accommodation and food services	0.96	-1.88	-0.36	-1.27
Other private services	5.45	0.74	0.09	6.28

Source: CSLS calculations based on Statistics Canada data

Appendix Table 21: CSLS Labour Productivity Decomposition, Three-digit NAICS Manufacturing Industries, Ontario, 1997-2000

	Within-Sector Effect	Reallocation Level Effect	Reallocation Growth Effect	Total
	Percentage Point Contribution			
Manufacturing	6.54	0.77	-1.12	6.19
Food manufacturing	0.49	-0.06	0.03	0.46
Beverage and tobacco product manufacturing	-0.43	0.40	-0.08	-0.11
Textile and textile product mills	0.16	0.00	0.00	0.16
Clothing and leather and allied product manufacturing*	1.45	0.43	-0.22	1.66
Wood product manufacturing	0.02	-0.07	-0.05	-0.10
Paper manufacturing	0.02	0.00	-0.01	0.02
Printing and related support activities	0.31	0.00	0.00	0.31
Petroleum and coal product manufacturing	0.50	-0.21	-0.09	0.20
Chemical manufacturing	-0.16	0.21	-0.07	-0.02
Plastics and rubber products manufacturing	0.15	-0.13	-0.14	-0.12
Non-metallic mineral product manufacturing	0.33	0.01	0.00	0.33
Primary metal manufacturing	0.37	-0.05	0.02	0.34
Fabricated metal product manufacturing	0.92	-0.18	-0.03	0.71
Machinery manufacturing	0.10	0.04	-0.12	0.02
Computer and electronic product manufacturing	0.94	-0.13	0.10	0.91
Electrical equipment, appliance and component manufacturing	0.37	0.01	0.00	0.38
Transportation equipment manufacturing	0.39	0.53	-0.29	0.63
Furniture and related product manufacturing	0.06	-0.10	-0.15	-0.19
Miscellaneous manufacturing	0.56	0.07	-0.03	0.61
	Per cent Contribution			
Manufacturing	105.76	12.38	-18.14	100.00
Food manufacturing	7.88	-0.97	0.47	7.38
Beverage and tobacco product manufacturing	-6.96	6.41	-1.23	-1.78
Textile and textile product mills	2.62	-0.04	0.00	2.58
Clothing and leather and allied product manufacturing*	23.43	7.03	-3.60	26.86
Wood product manufacturing	0.33	-1.08	-0.81	-1.56
Paper manufacturing	0.32	0.06	-0.08	0.29
Printing and related support activities	4.95	0.05	0.03	5.03
Petroleum and coal product manufacturing	8.03	-3.40	-1.47	3.16
Chemical manufacturing	-2.59	3.39	-1.12	-0.32
Plastics and rubber products manufacturing	2.46	-2.17	-2.27	-1.99
Non-metallic mineral product manufacturing	5.26	0.13	0.01	5.40
Primary metal manufacturing	5.95	-0.87	0.34	5.42
Fabricated metal product manufacturing	14.88	-2.97	-0.49	11.42
Machinery manufacturing	1.65	0.68	-1.99	0.33
Computer and electronic product manufacturing	15.19	-2.09	1.55	14.65
Electrical equipment, appliance and component manufacturing	6.00	0.08	0.06	6.14
Transportation equipment manufacturing	6.36	8.55	-4.73	10.18
Furniture and related product manufacturing	0.90	-1.58	-2.40	-3.08
Miscellaneous manufacturing	9.11	1.18	-0.41	9.88

Source: CSLS calculations based on Statistics Canada data

*Values are imputed by calculating the residual GDP from the manufacturing sector

Appendix Table 22: CSLS Labour Productivity Decomposition, Two-Digit NAICS Business Sector, Canada, 2000-2012

	Within-Sector Effect	Reallocation Level Effect	Reallocation Growth Effect	Total
	Percentage Point Contribution			
Business sector industries	0.58	0.46	-0.27	0.77
Agriculture, forestry, fishing and hunting	0.08	0.05	-0.02	0.12
Mining and oil and gas extraction	-0.30	0.42	-0.17	-0.05
Utilities	0.01	0.00	0.00	0.01
Construction	0.00	-0.04	-0.03	-0.06
Manufacturing	0.22	-0.02	-0.03	0.17
Wholesale trade	0.19	0.01	-0.01	0.18
Retail trade	0.15	0.01	0.00	0.16
Transportation and warehousing	0.03	0.00	0.00	0.03
Information and cultural industries	0.08	0.00	0.00	0.07
FIRE	0.03	0.09	-0.01	0.11
Professional, scientific and technical services	0.06	-0.01	0.00	0.05
ASWMRS	0.00	-0.04	-0.01	-0.05
Arts, entertainment and recreation	0.00	0.00	0.00	-0.01
Accommodation and food services	0.01	0.01	0.00	0.02
Other private services	0.03	-0.01	0.00	0.02
	Per cent Contribution			
Business sector industries	75.18	59.96	-35.14	100.00
Agriculture, forestry, fishing and hunting	10.46	6.98	-1.99	15.45
Mining and oil and gas extraction	-39.58	54.99	-22.54	-7.13
Utilities	1.62	-0.26	-0.01	1.35
Construction	0.42	-4.83	-3.43	-7.85
Manufacturing	28.63	-3.13	-3.28	22.21
Wholesale trade	24.68	0.68	-1.56	23.80
Retail trade	19.79	0.90	-0.11	20.58
Transportation and warehousing	4.05	0.00	0.00	4.05
Information and cultural industries	9.88	-0.07	-0.04	9.77
FIRE	3.75	11.79	-0.67	14.87
Professional, scientific and technical services	7.21	-0.87	0.03	6.37
ASWMRS	-0.33	-5.27	-1.35	-6.96
Arts, entertainment and recreation	-0.33	-0.29	-0.08	-0.69
Accommodation and food services	1.25	0.75	0.10	2.10
Other private services	3.69	-1.41	-0.20	2.08

Source: CSLS Calculation based on Statistics Canada Data

Appendix Table 23: Labour Productivity Adjusted for Purchasing Power Parity (PPP)*, United States, the Great Lake States and Ontario, 2000-2012

	U.S.	Illinois	Indiana	Michigan	Minnesota	New York	Ohio	Pennsylvania	Wisconsin	Ontario
	(Chained 2009 U.S. dollars per person)									
	(Total Private Sector)									
2000	97,489	92,624	76,513	82,449	82,485	106,626	78,493	81,606	72,412	71790
2001	98,637	93,987	77,290	82,682	83,092	111,839	78,214	82,093	73,962	71161
2002	102,091	96,443	80,992	87,040	86,058	113,812	81,761	84,852	76,467	72128
2003	105,313	98,951	84,486	90,186	89,432	114,812	83,563	87,133	78,511	71196
2004	108,015	101,739	86,068	89,399	92,596	117,109	85,210	87,891	80,144	71973
2005	109,875	102,431	85,438	89,738	92,588	121,532	85,492	87,588	80,672	73663
2006	110,975	103,670	84,306	89,187	91,276	125,754	84,585	88,127	81,272	74188
2007	111,406	104,275	88,067	90,809	91,174	125,309	85,162	89,072	81,740	74684
2008	111,303	103,311	86,789	87,077	93,020	121,484	84,052	89,208	80,021	73232
2009	113,670	105,220	86,699	85,151	93,638	123,871	83,875	89,403	81,569	71163
2010	117,390	107,908	92,523	90,109	97,482	128,781	86,369	91,633	84,881	73381
2011	117,497	108,833	92,789	91,150	97,149	128,091	87,724	92,124	84,933	74212
2012	118,351	109,408	93,850	91,341	99,247	127,544	88,169	92,734	85,517	74773
	(Manufacturing Sector)									
2000	93,070	81,505	88,339	78,261	69,941	75,553	82,458	85,063	71,210	77740
2001	93,913	83,347	87,377	77,022	67,120	75,958	79,817	86,444	72,014	74121
2002	102,360	88,321	101,349	93,239	73,539	87,782	90,188	96,872	76,744	73616
2003	113,139	96,850	109,432	100,507	84,049	90,903	94,014	101,290	81,543	73223
2004	121,378	106,728	116,467	98,027	95,340	99,095	102,849	100,339	85,866	72774
2005	125,526	107,667	112,562	101,362	96,888	104,825	104,980	98,616	87,786	75743
2006	132,712	108,133	111,495	102,830	97,550	113,321	105,884	100,270	91,903	78905
2007	139,865	112,523	131,878	116,672	95,932	117,371	109,349	102,869	92,983	80061
2008	139,035	106,247	125,815	102,186	98,893	111,037	101,388	98,757	85,302	77602
2009	145,073	114,458	123,726	85,808	101,112	120,828	94,070	101,684	86,178	73170
2010	159,170	123,968	147,535	112,139	112,546	126,195	104,008	103,382	95,034	79334
2011	157,591	131,018	147,104	116,100	117,762	120,377	111,257	102,090	95,893	80481
2012	157,895	137,127	151,519	118,694	122,800	123,768	114,209	107,024	99,473	81723

Source: CSLS Calculations based on Statistics Canada and OECD Data

* Adjusted using PPP data from OECD data, refer to appendix for data on PPP (Nominal GDP PPP 2009: 0.83 US/CAN)

Appendix Table 24: Labour Productivity Adjusted for Market Exchange Rate, United States, the Great Lake States and Ontario, 2000-2012

	U.S.	Illinois	Indiana	Michigan	Minnesota	New York	Ohio	Pennsylvania	Wisconsin	Ontario
	(Chained 2009 U.S. dollars per person)									
	(Total Private Sector)									
2000	97,489	92,624	76,513	82,449	82,485	106,626	78,493	81,606	72,412	58,126
2001	98,637	93,987	77,290	82,682	83,092	111,839	78,214	82,093	73,962	55,256
2002	102,091	96,443	80,992	87,040	86,058	113,812	81,761	84,852	76,467	55,241
2003	105,313	98,951	84,486	90,186	89,432	114,812	83,563	87,133	78,511	61,117
2004	108,015	101,739	86,068	89,399	92,596	117,109	85,210	87,891	80,144	66,519
2005	109,875	102,431	85,438	89,738	92,588	121,532	85,492	87,588	80,672	73,132
2006	110,975	103,670	84,306	89,187	91,276	125,754	84,585	88,127	81,272	78,657
2007	111,406	104,275	88,067	90,809	91,174	125,309	85,162	89,072	81,740	83,628
2008	111,303	103,311	86,789	87,077	93,020	121,484	84,052	89,208	80,021	82,537
2009	113,670	105,220	86,699	85,151	93,638	123,871	83,875	89,403	81,569	74,973
2010	117,390	107,908	92,523	90,109	97,482	128,781	86,369	91,633	84,881	85,673
2011	117,497	108,833	92,789	91,150	97,149	128,091	87,724	92,124	84,933	90,221
2012	118,351	109,408	93,850	91,341	99,247	127,544	88,169	92,734	85,517	89,984
	(Manufacturing Sector)									
2000	93,070	81,505	88,339	78,261	69,941	75,553	82,458	85,063	71,210	62,943
2001	93,913	83,347	87,377	77,022	67,120	75,958	79,817	86,444	72,014	57,555
2002	102,360	88,321	101,349	93,239	73,539	87,782	90,188	96,872	76,744	56,380
2003	113,139	96,850	109,432	100,507	84,049	90,903	94,014	101,290	81,543	62,856
2004	121,378	106,728	116,467	98,027	95,340	99,095	102,849	100,339	85,866	67,259
2005	125,526	107,667	112,562	101,362	96,888	104,825	104,980	98,616	87,786	75,196
2006	132,712	108,133	111,495	102,830	97,550	113,321	105,884	100,270	91,903	83,657
2007	139,865	112,523	131,878	116,672	95,932	117,371	109,349	102,869	92,983	89,649
2008	139,035	106,247	125,815	102,186	98,893	111,037	101,388	98,757	85,302	87,462
2009	145,073	114,458	123,726	85,808	101,112	120,828	94,070	101,684	86,178	77,088
2010	159,170	123,968	147,535	112,139	112,546	126,195	104,008	103,382	95,034	92,623
2011	157,591	131,018	147,104	116,100	117,762	120,377	111,257	102,090	95,893	97,843
2012	157,895	137,127	151,519	118,694	122,800	123,768	114,209	107,024	99,473	98,348

Source: CSLS Calculations based on Statistics Canada and UBC Sauder School of Business Data

Appendix Table 25: Percentage of Enterprises that Deployed Innovation, Canada and Regions, Per Cent, 2007-2009 and 2010-2012

	2007/2009					
	Canada	**Atlantic**	**Quebec**	**Ontario**	**Alberta**	**Rest of Canada**
All surveyed industries	66.8	47.8	77.0	66.5	76.6	51.8
Agriculture, forestry, fishing and hunting	..	..	..	..	..	..
Mining, quarrying, and oil and gas extraction	69.4	..	..	63.1	74.9	67.0
Utilities	66.3	85.8	..	66.6	42.9	69.0
Construction	63.4	..	..	..	..	..
Manufacturing	81.2	79.2	80.6	84.9	70.6	79.2
Wholesale trade	74.6	..	..	65.6	..	..
Retail trade	..	..	..	..	..	..
Transportation and warehousing	62.5	..	52.1	60.7	72.8	75.1
Information and cultural industries	73.2	85.4	75.2	68.1	96.6	78.1
Finance and insurance	68.0	..	72.2	62.1	..	76.7
Real estate and rental and leasing	31.8	..	..	..	..	..
Professional, scientific and technical services	78.5	99.0	96.1	75.0	65.0	73.3
Management of companies and enterprises	0.0	..	..	..	..	..
ASWMRS	64.9	..	..	..	..	..
	2010/2012					
All surveyed industries	63.5	45.8	60.9*	71.2	62.1	58.7
Agriculture, forestry, fishing and hunting	..	..	5.6	3.4	..	..
Mining, quarrying, and oil and gas extraction	56.3*	28.4	63.9	70.3	54.8*	57.0
Utilities	73.0	..	51.1	78.0*	75.2*	..
Construction	61.1	..	.	68.4	.	..
Manufacturing	74.8*	64.8*	82.6*	74.2*	68.3	68.0*
Wholesale trade	56.7*	57.1	54.6	63.7	58.8	..
Retail trade	59.5	..	73.9	..	..	..
Transportation and warehousing	55.9	55.7	48.8	54.4	74.1	56.9*
Information and cultural industries	70.7	90.1	73.2	61.7	81.8*	82.0
Finance and insurance	73.6	66.2	68.6	77.9*	56.2	83.5
Real estate and rental and leasing	67.7*	..	..	..	..	66.7
Professional, scientific and technical services	77.1	70.3*	67.5*	90.7*	53.5*	72.3
Management of companies and enterprises	..	..	..	..	..	..
ASWMRS	70.7	..	..	95.1	..	..

Source: Statistics Canada, CANSIM Table 358-0221
*Indicates the change from the previous period is statistically significant at the 95% level

Appendix Table 26: Percentage of Enterprises that Deployed Innovation by Type of Innovation, Ontario, 2007-2009 and 2010-2012

	Innovative	Product innovation	Process innovation	Organizational innovation	Marketing innovation
			2007/2009		
All surveyed industries	66.5	32.9	39.0	33.3	35.2
Agriculture, forestry, fishing and hunting	..	..	..	..	..
Mining, quarrying, and oil and gas extraction	63.1	14.8	51.0	37.9	14.8
Utilities	66.6	26.9	36.8	49.7	33.4
Construction	..	..	..	..	..
Manufacturing	84.9	51.2	60.0	54.7	41.1
Wholesale trade	65.6	26.6	31.5	41.2	41.2
Retail trade	..	..	..	..	..
Transportation and warehousing	60.7	20.1	36.6	30.4	33.2
Information and cultural industries	68.1	48.6	42.2	57.8	44.5
Finance and insurance	62.1	25.9	23.7	41.5	39.0
Real estate and rental and leasing	..	..	..	..	..
Professional, scientific and technical services	75.0	50.8	43.8	60.9	58.0
Management of companies and enterprises	..	..	..	..	..
ASWMRS	..	..	..	..	..
			2010/2012		
All surveyed industries	71.2	49.3*	36	42.6*	35.2
Agriculture, forestry, fishing and hunting	3.4	0.8	3.4	0.8	3.4
Mining, quarrying, and oil and gas extraction	70.3	29.7	32.8*	58.4*	31.6*
Utilities	78.0*	21.7	38.5	53.9	35.4
Construction	68.4	..	..	26.8	26.8
Manufacturing	74.2*	45.9*	48.6*	44.0*	31.8*
Wholesale trade	63.7	35.3	21.4	42.2	31.0
Retail trade	..	..	..	..	..
Transportation and warehousing	54.4	26.2	29.0*	36.1	25.9*
Information and cultural industries	61.7	39.8*	23.7*	35.5*	47.6
Finance and insurance	77.9*	35.8*	37.8*	56.4	28.5
Real estate and rental and leasing	..	..	..	..	..
Professional, scientific and technical services	90.7*	59.9*	39.9	74.9*	35.0*
Management of companies and enterprises	..	..	..	..	..
ASWMRS	95.1	90.2	..	90.2	..

Source: Statistics Canada, CANSIM Table 358-0221
*Indicates the change from the previous period is statistically significant at the 95% level

Appendix Table 27: Percentage of Enterprises that Reported Advanced Technology Use, Canada and Regions, Per Cent, 2009 and 2012

	Canada	Atlantic	Quebec	Ontario	Alberta	Rest of Canada
	2009					
All surveyed industries	49.9	..	56.5	46.4	55.9	39.5
Agriculture, forestry, fishing and hunting	..	..	..	..	..	..
Mining, quarrying, and oil and gas extraction	53.5	..	..	39.2	54.4	50.1
Utilities	73.0	91.8	..	77.7	67.4	53.0
Construction	56.1	..	..	..	..	..
Manufacturing	62.3	50.9	58.0	67.1	65.1	58.9
Wholesale trade	36.4	..	..	16.9	..	..
Retail trade	..	..	..	..	..	..
Transportation and warehousing	46.1	67.0	41.4	50.7	35.0	50.0
Information and cultural industries	60.3	..	48.7	67.4	84.6	63.1
Finance and insurance	40.4	..	37.2	44.9	28.6	43.2
Real estate and rental and leasing	30.1	..	..	..	..	..
Professional, scientific and technical services	64.9	..	82.8	65.3	63.5	53.6
Management of companies and enterprises	..	..	..	..	..	..
ASWMRS	..	..	..	..	..	..
	2012					
All surveyed industries	36.5	14.7	44.2	42.2	30.1	25.8
Agriculture, forestry, fishing and hunting	..	..	5.6	0.8	..	..
Mining, quarrying, and oil and gas extraction	40.8	37.2	50.2	35.3	42.6	36.8
Utilities	65.1	..	45.5	66.7	64.3	..
Construction	29.3	..	..	32.9	12.5	..
Manufacturing	53.1	38.2	57.0	55.0	57.8	41.4
Wholesale trade	33.0	14.3	45.0	26.8	29.4	..
Retail trade	15.9	0.0	25.2	..	10.0	2.0
Transportation and warehousing	35.2	24.7	41.4	35.3	32.1	32.8
Information and cultural industries	45.5	34.3	53.0	31.7	48.3	75.7
Finance and insurance	39.9	20.5	44.7	39.9	28.6	45.2
Real estate and rental and leasing	23.6	..	..	..	..	2.4
Professional, scientific and technical services	58.9	27.4	62.7	61.4	45.9	66.4
Management of companies and enterprises	..	..	..	..	..	..
ASWMRS	53.5	..	..	..	..	..

Source: Statistics Canada, CANSIM Table 358-0223

Appendix Table 28: Percentage of Enterprises Performing Production, Technical and Support Activities In and Outside of Canada by Region, Per Cent, 2012

	Canada	Atlantic Region	Quebec	Ontario	Alberta	Rest of Canada
Production of goods						
Performed in Canada	87.3	86.2*	82.6	93.9	83.4	83.8
Performed outside of Canada	13.7	6.3	11.9	19.4	11.6	8.8
Technical activities						
Performed in Canada	73.7	69.8*	64.9	87.1	78.2	57.8
Performed outside of Canada	10.1	4.2	5.9	13.9	14.3	7.5
Support activities						
Performed in Canada	94.6	94.9	93.7	95.3	90.4	97.1
Performed outside of Canada	12.9	8.7	10.8	17.3	12.1	8.9

Source: Statistics Canada, (Mar 10, 2014), The Daily, Survey of Innovation and Business Strategy, 2012, Accessed from http://www.statcan.gc.ca/daily-quotidien/140310/dq140310a-eng.htm
*Low data quality

Appendix Table 29: Production, Technical and Support Activities for Ontario's Business Sector, Per Cent, 2012

	Performed in Canada			Performed outside of Canada		
	Production activities	Technical activities	Support activities	Production activities	Technical activities	Support activities
Information and cultural industries	92.5	84.2	90.6	32.9	15.8	30.0
Professional, scientific and technical services	96.9	80.1	96.1	32.8	24.9	34.2
Transportation and warehousing	96.7	68.0	90.8	28.0	13.2	22.6
Wholesale trade	91.4	80.2	100.0	26.7	29.4	20.8
Manufacturing	98.2	89.3	95.3	25.6	21.4	33.2
All surveyed industries	93.9	87.1	95.3	19.4	13.9	17.3
Mining, quarrying, and oil and gas extraction	89.4	82.0	90.8	15.5	30.7	29.6
Construction	87.3	97.2	97.2	13.4	1.3	1.3
Utilities	100.0	94.4	100.0	10.1	11.4	14.3
Finance and insurance	91.4	78.4	98.0	8.8	23.6	19.2
Administrative and support, waste management and remediation services	100.0	95.1	100.0	4.9	0.0	4.9
Agriculture, forestry, fishing and hunting	100.0	100.0	100.0	0.0	0.8	0.0
Retail trade	..	..	..	..	..	..
Real estate and rental and leasing	..	..	..	..	..	..
Management of companies and enterprises	..	..	..	..	..	..

Source: Statistics Canada, CANSIM Table 358-0029