June 2012

151 Slater Street, Suite 710
Ottawa, Ontario K1P 5H3
613-233-8891, Fax 613-233-8250
csls@csls.ca

CENTRE FOR THE STUDY OF LIVING STANDARDS

A DETAILED ANALYSIS OF NOVA SCOTIA'S PRODUCTIVITY PERFORMANCE, 1997-2010

CSLS Research Report 2012-05

Andrew Sharpe and Ricardo de Avillez

June 2012

Prepared for the Nova Scotia Department of Labour and Advanced Education,
the Nova Scotia Department of Economic and Rural Development and Tourism,
and the Atlantic Canada Opportunities Agency|
By the Centre for the Study of Living Standards

A Detailed Analysis of Nova Scotia's Productivity Performance, 1997-2010

Abstract

Despite labour productivity growth somewhat above the national average over the 1997-2000 period, Nova Scotia's level of business sector output per hour in 2010 was only 75.7 per cent that of Canada. This report provides a detailed analysis of Nova Scotia's labour and capital productivity performance and the factors behind this performance. It identifies weak machinery and equipment investment and low levels of business R&D as the two factors most responsible for the province's productivity gap.

A Detailed Analysis of Nova Scotia's Productivity Performance, 1997-2010

Table of Contents

List of Charts, Exhibits, and Tables

Charts

Exhibits

Tables

A Detailed Analysis of Nova Scotia's Productivity Performance, 1997-2010

Executive Summary

Productivity growth in Canada has slumped in the past decade, both from a historical and an international perspective. During this period, however, Nova Scotia's business sector managed to maintain above average productivity growth rates. At the same time, the province's productivity levels remained significantly below the national average. The objective of this report is to understand these and other productivity trends in Nova Scotia, emphasizing developments in labour and capital productivity during the 1997-2010 period.

The executive summary is divided into two parts. The first part highlights the main findings of the report. The second one discusses key output, input, and productivity trends observed in Nova Scotia during the 1997-2010 period and as well summarizes the performance of the key productivity drivers.

Highlights

- In 2010, the business sector labour productivity level in Nova Scotia was 75.7 per cent of the national average, at $29.03 per hour (chained 2002 dollars) versus $38.37 per hour (chained 2002 dollars). Given that Canada's labour productivity level in 2010 was only 70.7 per cent of that in the United States, Nova Scotia's level was only slightly above one half the U.S. level (53.5 per cent).

- Industry-specific differences in labour productivity levels between Nova Scotia and Canada accounted for 70.0 per cent of the gap. Indeed, 18 out of the 20 of Nova Scotia's two-digit NAICS industries had labour productivity levels below the national average. The largest industry contributions to the gap were from manufacturing, retail trade, and FIRE. Differences between Nova Scotia's and Canada's sectoral composition accounted for the remaining 30.0 per cent of the level gap.

- However, business sector labour productivity in Nova Scotia grew at a faster pace than the national average during the 1997-2010 period (1.56 per cent vs. 1.29 per cent), which caused the province's relative labour productivity level to increase from 73.1 per cent of the national level in 1997 to 75.7 per cent in 2010. The sectors that contributed the most to this positive productivity growth differential were: other private services; retail trade; and mining and oil and gas extraction.

- One of the main reasons behind the below average labour productivity level in Nova Scotia was the province's below average capital intensity level. In particular, M&E capital intensity in Nova Scotia represented only 72.7 per cent of the national average in 2010, down from 94.9 per cent in 1997. The key reason for this increase in the M&E capital intensity gap was the slow growth in non-ICT M&E capital stock. The ICT capital stock in Nova Scotia grew at a robust pace when compared to other asset categories, albeit slower than the national average.

- In terms of human capital, Nova Scotia's overall performance has been in line with the national average. Formal educational attainment, represented by average years of schooling, was the same among workers in Nova Scotia and Canada as a whole. Employer-supported training rates, managerial quality, and adult literacy scores were also in the same range as the national estimates. The major deficiency in the human capital area was Nova Scotia's apprenticeship system. Apprenticeship registrations in Nova Scotia increased at a very weak rate of 1.3 per cent per year during the 1991-2009 period, well below the national rate of 4.3 per cent. Furthermore, Nova Scotia was the only province were apprenticeship completion numbers have actually declined during the period (-1.8 per cent per year).

- Nova Scotia had a poor innovation performance compared to the Canadian average. The province experienced nominal R&D expenditures growth below the national average during the 1984-2010 period (4.99 per cent versus. 6.72 per cent). Unlike the national picture, where the business sector plays a fundamental role in performing R&D, in Nova Scotia it had a supporting role, with the bulk of R&D expenditures being performed by the higher education sector. BERD (business expenditures in R&D) intensity in Nova Scotia was only a third of the Canadian average during the 2000-2008 period.

Output Trends

Nominal GDP

Nominal GDP in Nova Scotia's business sector grew at a compound annual rate of 5.24 per cent during the 1997-2008 period, from $11,780 million in 1997 to $20,661 million in 2008. Nominal GDP in Canada increased at a slightly faster pace, 5.95 per cent per year, which explains why Nova Scotia's nominal GDP as a share of Canada's nominal GDP declined slightly from 1.92 per cent in 1997 to 1.79 per cent in 2008.

In relative terms, Nova Scotia's business sector was considerably smaller than Canada's during the 1997-2008 period, accounting for approximately 66.1 per cent of the total economy

(while in Canada it represented 76.4 per cent of total economy). This difference is explained in large part by the greater importance of the public administration sector in the province.

Overall, Nova Scotia's sectoral composition was quite similar to Canada's in terms of nominal GDP shares. The two largest sectors in both Nova Scotia and Canada as a whole were FIRE (finance, insurance, real estate, rental and leasing) and manufacturing, which accounted jointly for 26.3 per cent of the province's business sector in 2008 and 29.2 per cent of Canada's. There were, however, notable differences in sectoral composition that are worth highlighting:

- Mining and oil and gas extraction represented only 8.5 of Nova Scotia's business sector nominal GDP in 2008, whereas in Canada it accounted for 13.4 per cent.

- Manufacturing represented 11.9 per cent of Nova Scotia's business sector nominal GDP in 2008, and 15.0 per cent of Canada's. Furthermore, non-durable manufacturing industries were more important in the province, while durable manufacturing industries played a larger role at the national level.

- Retail trade represented 10.8 per cent of Nova Scotia's business sector nominal GDP in 2008, while accounting for only 7.2 per cent in Canada.

Real GDP

Real GDP in Nova Scotia's business sector grew at a compound annual rate of 2.51 per cent during the 1997-2010 period, practically the same rate as the national average, 2.50 per cent. The province's real GDP increased from $12,619 million (chained 2002 dollars) in 1997 to $17,428 million (chained 2002 dollars) in 2010. The impact of the recent economic downturn was much weaker in Nova Scotia than in Canada, with the province's real business sector GDP declining only 1.06 per cent in 2009, while Canada's real GDP dropped 4.81 per cent.

Input Use Trends

Labour Input

Hours worked increased at a slower pace in Nova Scotia than in Canada during the 1997-2010 period (0.94 per cent per year vs. 1.19 per cent per year), leading to a small decline in the province's share of total hours worked, from 2.60 per cent in 1997 to 2.52 per cent in 2010.

In terms of hours worked shares, Nova Scotia's sectoral composition was even more similar to Canada's than it was in terms of nominal GDP shares. The main differences between the two were:

- Retail trade in Nova Scotia represented 17.8 per cent of total hours worked in the province's business sector in 2008, but only 12.8 per cent in Canada;

- Manufacturing in Nova Scotia accounted for 12.0 per cent of total hours worked in the province's business sector in 2008, 2.1 percentage points less the overall manufacturing sector in Canada.

Capital Input

Real gross investment in fixed, non-residential capital goods grew 0.65 per cent per year during the 1997-2010 period in Nova Scotia's business sector, significantly less than the growth experienced by the Canadian business sector as a whole, 3.10 per cent per year. Taking into account depreciation, net real investment in the province has been either zero or negative since 2004 (with the exception of 2007, when it was slightly positive).

Real gross M&E investment in Nova Scotia declined 0.99 per cent per year during the 1997-2010 period (vs. an increase of 3.96 per cent per year in Canada). Despite the decline of overall M&E investment, real ICT investment in the province grew at a robust pace of 7.11 per cent per year (vs. 9.56 per cent in Canada)

Real net (fixed, non-residential) capital stock in Nova Scotia increased 1.20 per cent per year in Nova Scotia during the 1997-2010 period (vs. 2.09 per cent per year in Canada), from $16,369 million (chained 2002 dollars) in 1997 to $19,106 million (chained 2002 dollars) in 2010. Real M&E capital stock in the province grew 0.93 per cent per year during the period (vs. 3.18 per cent in Canada), while real ICT capital stock increased 5.36 per cent per year (vs. 8.23 per cent per year in Canada).

Productivity Trends

Labour Productivity

During the 1997-2010 period, labour productivity in Nova Scotia's business sector increased 1.56 per cent per year (vs. 1.29 per cent in Canada as a whole), from $23.73 per hour (chained 2002 dollars) in 1997 to $29.03 per hour (chained 2002 dollars) in 2010. Compared to the other provinces, Nova Scotia ranked 6th in terms of labour productivity growth.

Despite above average labour productivity growth, the province's labour productivity levels were remarkably low, representing on average only 75.3 per cent of the Canadian level during the period. Differences between Nova Scotia's and Canada's sector composition – in

particular the relatively large retail sector and the relatively small non-durable manufacturing sector in the province – accounted for approximately 30.0 per cent of the province's labour productivity level gap.

Capital Productivity

Capital productivity, defined here as the ratio between real GDP and capital stock, increased 1.30 per cent per year in Nova Scotia during the 1997-2010 period, outpacing the growth experienced at the national level (0.40 per cent per year). This reflects the slow rate of capital input growth in comparison to output growth in the province. Looking at the two-digit NAICS level, it can be seen that Nova Scotia outpaced Canada as a whole in eight of the 12 sectors for which capital productivity estimates were available (for the province). The only exceptions were retail trade; transportation and warehousing; professional, scientific and technical services; and accommodation and food services, all of which grew faster at the national level. Due to the above average growth, Nova Scotia's overall capital productivity level rose steadily, surpassing Canada's in 2010.

Productivity Drivers

Productivity growth is driven by a variety of factors, which include physical capital, human capital, innovation, industrial structure and intersectoral shifts, among others. Below, we highlight some of the key factors that potentially affected Nova Scotia's productivity performance.

Human Capital

- In general, Nova Scotia's human capital indicators are on par with the national average. The average educational attainment level in Nova Scotia, for instance, was identical to that of Canada, with workers having, on average, 14.0 years of schooling.

- The one exception is the poor performance seen on apprenticeship registrations and completions. Apprenticeship registrations increased 1.30 per cent per year in Nova Scotia during the 1991-2009 period, significantly less than the growth experienced at the national level, 4.26 per cent per year. Furthermore, apprenticeship completions in the province declined 1.81 per cent per year (vs. an increase of 2.52 per cent at the national level). In both Nova Scotia and Canada as a whole, apprenticeship registrations and completions picked up pace in the post-2000 period, although the improved performance in the province was lacklustre when compared to that of Canada as a whole.

Physical Capital

- During the 1997-2010 period, Nova Scotia lagged behind Canada in terms of capital intensity growth, defined here as real capital stock per hour worked (0.26 per cent per year vs. 0.89 per cent per year in Canada). At the two-digit NAICS level, Nova scotia outpaced Canada in only five of the 12 sectors for which capital intensity estimates were available (for the province) – namely: mining and oil and gas extraction, retail trade, transportation and warehousing, accommodation and food services, and other private services.

- Although M&E capital intensity growth in the province was stagnant during the 1997-2010 period (0.00 per cent per year vs. 1.97 per cent per year in Canada), ICT capital intensity saw significant growth (4.42 per cent per year vs. 6.95 per cent in Canada). The economics literature finds high returns and substantial productivity gains associated with ICT use in the medium-run (three to seven years). These potential benefits should not, however, be taken for granted. There is strong evidence that ICT is a general purpose technology, i.e. a technology that fundamentally changes the production process of firms that make use of them. For the gains of these technologies to be realized, firms often have to reorganize their activities, which can be both costly and time consuming.

Innovation

- Although Nova Scotia ranked third when compared to other provinces in terms of overall R&D intensity (defined here as nominal R&D expenditures divided by nominal GDP), behind Ontario and Quebec, the province's performance was still below the national average.

- A major difference between Nova Scotia's and Canada's R&D profiles is that most of the province's R&D was performed by the higher education sector, which accounted for 60.9 per cent of total R&D expenditures in the 2000-2008 period, with the business sector taking a much smaller role (20.7 per cent). At the national level, however, the situation is reversed, with the higher education sector accounting for 32.9 per cent of total R&D expenditures and the business sector accounting for 57.1 per cent.

- Nova Scotia had low BERD intensity, 0.50 per cent (1997-2008 period average), less than a third of Canada's BERD intensity (1.57 per cent). Compared to the other provinces, Nova Scotia ranked 9th in terms of BERD intensity.

Sources of Labour Productivity Growth in Nova Scotia

Nova Scotia lagged Canada in terms of both capital intensity growth and innovation (as measured by R&D expenditures), while education outcomes were, in general, on par with the national average. Despite these facts, Nova Scotia observed above average labour productivity growth during the period (1.56 per cent vs. 1.29 per cent). What accounts for this productivity rate differential?

A previous CSLS study has shown that labour productivity growth in the province outpaced Canada's due to strong multifactor productivity growth (MFP). MFP growth reflects output growth that is not accounted for by combined input growth. It can be explained by a number of very different factors, such as improvements in technology and organization, capacity utilization, increasing returns to scale, etc. It also embeds errors due to the mismeasurement of inputs.

Unfortunately, it is hard to pinpoint exactly why MFP growth in Nova Scotia was higher than in Canada during the period. By definition, MFP growth is a residual. It encapsulates the influence of a variety of factors. In this sense, it can be thought of as a "black box". Disentangling the influence of each potential factor to productivity growth is by no means trivial. One possible explanation is that the growth Nova Scotia is experiencing "catch-up" growth, with the province's labour productivity converging to the national average.

Productivity and Public Policy

- Using OECD figures, the report estimates that the lower level of spending on investment and on R&D by business account for most of the labour productivity gap and that the BERD intensity gap is twice as important as the investment gap. Human capital bears much less responsibility for the gap.

- The policy implications follow from the key findings of the study. If Nova Scotia wants to close the business sector labour productivity gap with Canada, it must close the business investment and R&D gaps. Public policy must encourage business to invest more in capital goods, particularly machinery and equipment and in R&D. While human capital is as important to productivity growth as physical capital and innovation, Nova Scotia does relatively well on indicators in this field (with the important exception of apprenticeship). In this sense, education should not be as high a priority as the other two areas.

A Detailed Analysis of Nova Scotia's Productivity Performance, 1997-2010[1]

I. Introduction

Productivity growth in Canada has slumped in the past decade, both from a historical and an international perspective. During this period, however, Nova Scotia's business sector managed to maintain above average productivity growth rates. At the same time, the province's productivity levels remained significantly below the national average.

The objective of this report is to understand these and other productivity trends in Nova Scotia, emphasizing developments in labour and capital productivity during the 1997-2010 period. Identifying the main sources and drivers of productivity growth is a necessary first step towards developing effective productivity-enhancing policies.

The report is organized as follows. Part two discusses definitions, concepts, and data sources used in this report. It also contains a short primer on some of the main issues related to productivity analysis. Part three analyzes output and input (labour and capital) trends in Nova Scotia during the 1997-2010 period. The fourth part looks at the evolution of labour and capital productivity in the province, comparing Nova Scotia's performance to that of Canada as a whole. The fifth part identifies and discusses the fundamental factors that influence productivity growth in general, highlighting their possible effect in driving productivity growth in Nova Scotia. Part six delineates possible policy implications of the previous analysis, and part seven concludes.

[1] This research report was prepared by Andrew Sharpe and Ricardo de Avillez. It represents the views of the Centre for the Study of Living Standards (CSLS). The CSLS would like to thank the Nova Scotia Department of Labour and Advanced Education and the Atlantic Canada Opportunities Agency for the financial support. The CSLS would also like to thank Charles Martin (Altantic Canada Opportunities Agency), Greg Landry (Nova Scotia Department of Economic and Rural Development and Tourism), and Kimberly Buckle (Nova Scotia Department of Labour and Advanced Education). For comments, the authors can be contacted at andrew.sharpe@csls.ca and ricardo.avillez@csls.ca.

II. Definitions, Concepts and Data Sources

This part of the report is divided into two sections. In the first section, we review some of the key issues related to productivity analysis. In the second, we briefly discuss the data sources used in the report.

A. Understanding Productivity

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

i. Why Measure Productivity?

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

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

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

improved efficiency in individual establishments that make up the industry or to a shift of production towards more efficient establishments" (p.11).

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

- Measuring *improvements in living standards* – Productivity is linked to living standards via two fronts: 1) Value added labour productivity has a direct link to GDP per capita, which is a commonly used measure of living standards (the link between value added labour productivity and living standards is further explored in Appendix 1); 2) Long-term value added MFP growth can be used to evaluate the evolution of an economy's potential output.

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

ii. Gross Output Productivity vs. Value Added Productivity

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

Gross output consists of all goods and services produced by an economy, sector, industry or establishment during a certain period of time. Value added (or GDP at basic prices), on the other hand, measures the contribution of primary inputs (labour and capital) to the production process. While gross output refers to an actual physical quantity, there is no physical representation of value added.

When dealing with the economy as a whole, the value added approach is the natural choice, because it avoids double counting of intermediate inputs in the aggregate output. In practice, the value added approach is also the standard choice of most sectoral productivity analysis. Trueblood and Ruttan (1992) argue, however, that when investigating the productivity performance of a particular sector, the focus should be on the total input-output relationship in

order to evaluate the overall gains in both primary and intermediate input use. This is particularly true in the case of sectors that experienced significant shifts in the use of inputs through time, such as the primary agriculture sector, where intermediate inputs (feed, fertilizers, pesticides, etc.) play a much more prominent role nowadays than they did in the past.

iii. 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, capital, etc. Labour productivity, for example, is commonly defined as the ratio between output and hours worked in a certain activity, while capital productivity is the ratio of output to capital stock (or capital services).

MFP, in turn, is the ratio between output and *combined* inputs used in the production process, e.g. value added MFP is calculated as the ratio of value added to *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, increasing returns to scale, etc. It also embeds errors due to the mismeasurement of inputs.

iv. Productivity Growth Rates vs. Productivity Levels

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

In this report, however, we are also interested in making *level* comparisons between Nova Scotia and Canada (or other provinces). Productivity level comparisons are often done in current dollars (i.e., using nominal output), as these estimates capture changes in relative prices, whereas estimates in *constant dollars* do not. However, when real output is calculated using *chained dollars*,[2] changes in relative prices are also incorporated to the estimate, and goods and services which experienced relative price increases receive higher weights than goods and services that experienced price decreases. Productivity level discussions in this report focus on real levels instead of nominal levels for two reasons: 1) Consistency, i.e. since growth rates are calculated

[2] Constant dollar and chained dollar measures are calculated using fixed-base quantity indexes and chained quantity indexes, respectively. As the name implies, a fixed-base index has a fixed base period, which is used as a basis of comparison with all the other periods. A chained index, on the other hand, has no fixed base period, but rather takes into account data from two successive periods. For a detailed discussion on this issue, see Appendix A in Sharpe and de Avillez (2010).

based on real output, having real productivity levels produces a consistent set of estimates; 2) The real output measures used in the report are based on chained dollars, and thus the impact of shifts in relative prices is captured. Nominal productivity levels are also discussed whenever they might provide additional insights. Regardless of whether nominal or real GDP figures are used for interprovincial productivity level comparisons, it is important to note that these comparisons should be used with caution, due not only to differences in industry composition between provinces, but also due to the lack of industry purchasing power parities (PPPs) estimates at the provincial level.

v. Productivity Measures Used in this Report

This report focuses on two value added, partial productivity measures:

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

- *Value added capital productivity*, defined here as real GDP (at basic prices) per unit of capital stock. A better capital productivity measure would have been GDP per unit of capital services. However, Statistics Canada does not make capital services data for the provinces available on CANSIM.[3] The difference between capital stock and capital services is explained in section III-C-iii.

vi. Interpreting Productivity Measures

Productivity is a multi-dimensional concept, and different productivity measures capture different aspects of reality. Gross output MFP, for instance, can capture efficiency improvements much better than other productivity measures because it captures the effects of substitution between inputs. Value added labour productivity, on the other hand, is a better tool for understanding improvements in overall living standards. Exhibit 1 discusses how the main productivity measures used in the literature should be interpreted, their purposes, advantages, and limitations.

[3] Capital productivity estimates based on capital services can be found in the CSLS Provincial Productivity Database.

Exhibit 1: Interpreting Productivity Measures

	Gross Output	Value Added
Labour Productivity	*Purpose*: Can be useful in the analysis of labour requirements by industry. *Interpretation*: Describes how much (physical) output is produced per unit of labour used. Changes in gross output labour productivity can be decomposed into four sources (*proximate* causes of growth): 1) changes in labour quality; 2) changes in capital intensity; 3) changes in intermediate input intensity; 4) gross output MFP growth. *Advantages*: Easy to measure (only requires price indexes for gross output, not intermediate inputs) and understand. *Limitations*: As a partial productivity measure, it does not control for changes in the use of other inputs, and thus reflects the influence of several different factors. *Attention:* Gross output labour productivity is *not* a good measure of technical change.	*Purpose*: 1) Can help in the analysis of micro-macro links, e.g. understanding industry contributions to aggregate labour productivity and economic growth; 2) At the total economy level, can be used to analyze improvements in living standards; 3) Used as a reference statistic in wage bargaining. *Interpretation*: Describes how much value added is generated per unit of labour used. Changes in value added labour productivity can be decomposed into three main sources (*proximate* causes of growth): 1) changes in labour quality; 2) changes in capital intensity; 3) value added MFP growth. *Advantages*: Easy to measure and understand. *Limitations*: As a partial productivity measure, it does not control for changes in the use of other inputs, and thus reflects the influence of several different factors. *Attention:* Value added labour productivity is *not* a good measure of technical change.
Capital Productivity		*Purpose*: "Changes in capital productivity indicate the extent to which output growth can be achieved with lower welfare costs in the form of foregone consumption" (OECD, 2001, p. 17). *Interpretation*: Describes how much value added is generated per unit of capital used. *Advantages*: Easy to understand. *Limitations*: As a partial productivity measure, it does not control for changes in the use of other inputs, and thus reflects the influence of several different factors. *Attention:* Value added capital productivity should *not* be confused with the rate of return on capital.
Multifactor Productivity	*Purpose*: Can help in the analysis of industry-level disembodied technical change. *Interpretation*: Describes how productively capital, labour, and intermediate inputs are combined in order to generate (physical) output. When inputs are quality-adjusted, it captures disembodied technical change reasonably well. It should be clear, however, that it also incorporates other factors that have nothing to do with disembodied technical change, such as economies of scale, changes in capacity utilization, measurement errors, etc. *Advantages*: Industry-level gross output MFP growth can be combined using Domar weights in order to obtain an economy-wide or sectoral estimate of value added MFP growth (for details, see OECD, 2001). *Limitations*: Significant data requirements (input-output tables consistent with national accounts data).	*Purpose*: 1) Can help in the analysis of micro-macro links, e.g. understanding industry contributions to aggregate value added MFP growth; 2) At the total economy level, can be used to analyze improvements in living standards (can help track the evolution of an economy's potential output). *Interpretation*: Describes how productively capital and labour inputs are combined in order to generate value added. At the industry level, it can be seen as "an indicator of an industry's capacity to contribute to economy-wide growth of income per unit of primary input" (OECD, 2001, p. 16). *Advantages*: Easily aggregated across industries. *Limitations*: Not a good measure of technical change.

Source: Adapted from OECD (2001), pp. 14-18.

B. Data Sources

The main data source for this report is Statistics Canada's Canadian Productivity Accounts (CPA); more specifically, the CPA's provincial program on Labour Productivity Measures. This program provides detailed data for Canada, the provinces, and territories on real and nominal value added (GDP at basic prices), hours worked, number of jobs, total labour compensation, and labour productivity, among other variables. The data encompass the 1997-2010 period (except for nominal GDP data, which span the 1997-2008 period) and are broken

down at the two-digit NAICS[4] level (Exhibit 2), with total economy and business sector aggregates also being provided. The report incorporates the recently revised estimates of the CPA (November, 2011).

Exhibit 2: Two-Digit NAICS Sectors

Sector Code	Description
11	Agriculture, Forestry, Fishing and Hunting
21	Mining, and Oil and Gas Extraction
22	Utilities
23	Construction
31-33	Manufacturing
41	Wholesale Trade
44-45	Retail Trade
48-49	Transportation and Warehousing
51	Information and Cultural Industries
52	Finance and Insurance
53	Real Estate, Rental and Leasing
54	Professional, Scientific, and Technical Services
55	Management of Companies and Enterprises
56	Administrative and Support, Waste Management and Remediation Services (ASWMRS)
61	Education Services
62	Health Care and Social Assistance
71	Arts, Entertainment, and Recreation
72	Accommodation and Food Services
81	Other Services (except Public Administration)
92	Public Administration

Source: Statistics Canada (2007).

Although data for the total economy are provided by the CPA's Labour Productivity Measures program, this report focuses on business sector industries (both at an aggregate level and at the two-digit NAICS level). Output of non-business establishments (e.g. public hospitals, public universities, government departments) is notoriously hard to estimate accurately, which has a significant impact on productivity estimates for non-business sector industries and for the total economy aggregate. While marketed goods and services can be valued at the prices they are actually sold at, most government services are either provided free of charge or at subsidized prices. Due to a lack of reliable price data, output of non-business sector industries is valued based on the cost of inputs (labour, capital, and intermediate inputs). Furthermore, nominal outputs and nominal inputs for those industries are deflated using the same price index (based on

[4] The acronym NAICS refers to the North American Industry Classification System. NAICS categorizes establishments into industries based on the similarity of their production processes. It has a hierarchical structure that divides the economy into 20 sectors, which are identified by two-digit codes. Below the sector level, establishments are classified into three-digit subsectors, four-digit industry groups, and five-digit industries. At all levels the first two digits always indicate the sector, the third digit the subsector, the fourth digit the industry group, and the fifth digit the industry. For more information on NAICS, see Statistics Canada (2007).

input prices). As a consequence, real output growth of non-business sector industries equals real-input growth, which implies that there is no MFP growth. Even though partial productivity measures like labour and capital productivity will still experience changes, the inclusion of non-business sector industries in an industry aggregate tends to distort productivity data.[5]

Statistics Canada's general definition of the business sector includes four elements:

- The corporate sector (incorporated businesses);
- The unincorporated sector (self-employed and proprietorships);
- Government business enterprises (GBEs); and
- Owners who occupy their own dwelling.

The CPA's Labour Productivity Measures program adopts a stricter definition of the business sector than the one above, excluding owner occupied dwellings (which accounted for approximately 7.5 per cent of total economy nominal GDP in Canada as a whole and 10.0 per cent in Nova Scotia during the 1997-2008 period). The business sector definition adopted in this report is the one used by the CPA. Establishments included in NAICS code 92 (public administration) and all other non-business establishments (public hospitals, public universities, etc.) are excluded from the business sector aggregation. Table 1 breaks down nominal GDP in Canada by business sector and non-business sector shares at the two-digit NAICS level. In practice, a fairly good approximation of the business sector is the aggregation of all establishments categorized under NAICS codes 11 to 81.

It is important to note that the business sector definition used by the CPA's Labour Productivity Measures program includes business establishments classified under education services, as well as those under health care and social assistance. In practice, however, most of the establishments in those two sectors are part of the public sector in Canada, and thus *not* included in the business sector aggregation. As Table 1 shows, the business sector share of education represented on average only 4.7 per cent of total nominal GDP in the Canadian education sector during the 1997-2008 period, while the business sector share of health care and social assistance accounted for 39.6 per cent of total nominal GDP in that sector.

[5] For more on measuring output and productivity of non-business sector industries, see Yu (2004) and Diewert (2008).

Table 1: Business Sector and Non-Business Sector Nominal GDP Shares at the Two-Digit NAICS Level, Canada (1997-2008 Period Average)

	Business Sector	Non-Business Sector
	(as a share of the total economy)	
Agriculture, Forestry, Fishing and Hunting	97.1	2.9
Mining and oil and gas extraction	100.0	0.0
Utilities	94.5	5.5
Construction	100.0	0.0
Manufacturing	100.0	0.0
Wholesale trade	100.0	0.0
Retail trade	99.9	0.1
Transportation and warehousing	94.9	5.1
Information and cultural industries	94.8	5.2
FIRE*	98.8	1.2
Professional, scientific and technical services	99.4	0.6
ASWMRS**	99.7	0.3
Educational services	4.4	95.6
Health care and social assistance	39.6	60.4
Arts, entertainment and recreation	78.3	21.7
Accommodation and food services	99.2	0.8
Other private services	68.5	31.5
Public administration	0.0	100.0

* Finance, insurance, real estate, rental and leasing ** Administrative and support, waste management and remediation services

Source: Statistics Canada, GDP at basic price in current dollars, SNA benchmark values, by NAICS, annually (CANSIM Table 379-0023).

For practical purposes, two adjustments are made by the CPA's Labour Productivity Measures program to the two-digit NAICS breakdown shown in Exhibit 2. First, finance and insurance, real estate, rental and leasing, and management of companies and enterprises are grouped into a single sector, which will be referred to as the *finance, insurance, real estate, rental and leasing (FIRE)* sector. Second, unless stated otherwise, the business establishments classified under education services, and health care and social assistance are grouped together with establishments in other services (except public administration). This new aggregate is called *other private services*. Since these changes are only a slight departure from the standard NAICS breakdown, we will still refer to the resulting 15 sectors as two-digit NAICS sectors.

In addition to the business sector aggregation, this report also offers productivity estimates for other industry aggregations whenever data are available. These other aggregates include: the goods sector, the services sector, and the ICT sector. Exhibit 3 describes the industries included in each of those aggregations.

Exhibit 3: Other Industry Aggregations

Aggregation	Industries Included
Goods Sector	*Definition from the CPA'S Labour Productivity Measures program*: Agriculture, forestry, fishing and hunting (11); Mining, and oil and gas extraction (21); Utilities (22); Construction (23); Manufacturing (31-33).
Services Sector	*Definition from the CPA'S Labour Productivity Measures program*: Wholesale trade (41); Retail trade (44-45); Transportation and warehousing (48-49); Information and cultural industries (51); FIRE (52-53, 55); Professional, scientific, and technical services (54); ASWMRS (56); Education services (61); Health care and social assistance (62); Arts, entertainment and recreation (71); Accommodation and food services (72); Other services (except public administration) (81).
ICT Sector	*Definition from the GDP by industry survey*: Commercial and service industry machinery manufacturing (3333); Computer and peripheral equipment manufacturing (3341); Telephone apparatus manufacturing (33421); Radio and television broadcasting and wireless communications equipment manufacturing (33422); Semiconductor and other electronic component manufacturing (3344); Navigation, measuring, medical and control instruments manufacturing (3345); Communication and energy wire and cable manufacturing (33592); parts of Wholesale trade (41); Software publishers (5112); Pay and specialty television (5152); Telecommunications (517); Data processing, hosting, and related services (518); Other information services (519); Rental and leasing services and lessors of non-financial intangible assets (except copyrighted works (5A0520); Computer systems design and related services (5415).

Source: Statistics Canada, 1) Fixed Investment Flows and Stocks (CANSIM Tables 031-0002/03/04); 2) GDP by Industry – Provincial and Territorial (Annual) (CANSIM Table 379-0026); 3) Labour Productivity Measures – Provinces and Territories (Annual) (CANSIM Table 383-0011).

Another important data source for this report is Statistics Canada's Fixed Investment Flows and Stocks (FIFS) survey, which (as the name implies) provides data for fixed, non-residential investment and capital stock broken down by asset type and industry. The data span the 1961-2010 period and are available for Canada, the provinces, and territories. Since no official capital productivity data are available, capital stock data from FIFS are used with LPM value added data to calculate capital productivity estimates for Nova Scotia and Canada.

Finally, the report also makes use of labour and capital composition estimates present in the CSLS's Provincial Productivity Database. This database has detailed output, input, and productivity data for Canada and the provinces encompassing the 1997-2007 period. The estimates in it were calculated by Statistics Canada upon special request by the CSLS (see Sharpe and Thomson, 2010a). All of the sources described above were used to construct the CSLS Nova Scotia Productivity Database, which will be posted with this report at http://www.csls.ca/.

III. An Overview of Nova Scotia's Economy

This report focuses on two specific productivity measures, value-added labour productivity and value-added capital productivity, which are calculated from data on nominal GDP, price deflators, labour input, and capital input. Before analyzing and discussing how trends in these productivity measures evolved in Nova Scotia in recent years, it is important to look at the underlying data used to construct these productivity measures. This serves a double-purpose: first, it allows us to look at the components of labour and capital productivity independently, which can help us identify important trends; second, it highlights key facts about Nova Scotia's economy at a macro-level.

This part of the report first explores output trends in Nova Scotia during the 1997-2010 period (or, in the case of nominal GDP, 1997-2008 period). Next, labour input and capital input trends in the province are analyzed.

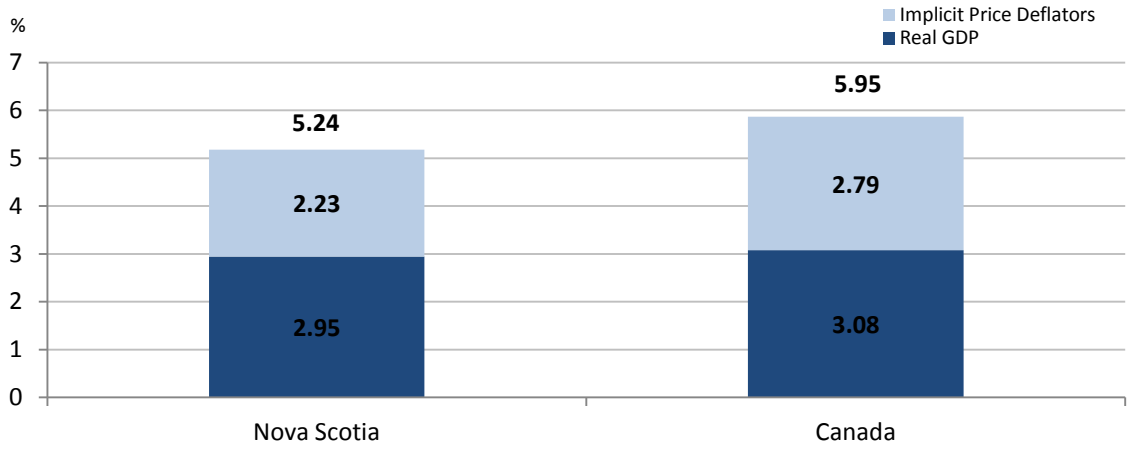
A. GDP

In this section, we outline the recent evolution of Nova Scotia's business sector output, looking at nominal GDP, real GDP, and implicit price deflator estimates for the 1997-2008 period (real GDP estimates are available for the 1997-2010 period). We also describe the province's sectoral composition in terms of nominal GDP.

i. Nominal GDP

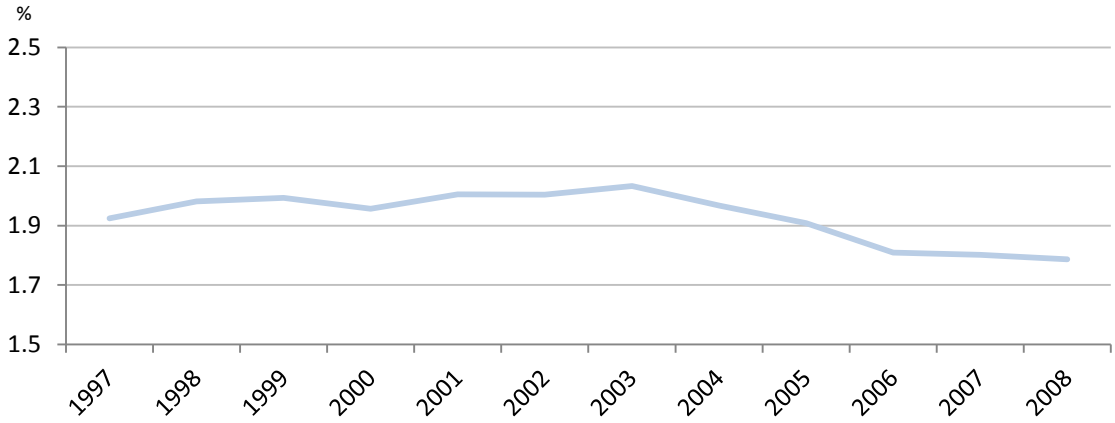
Nominal GDP in Nova Scotia's business sector grew at a compound annual rate of 5.24 per cent during the 1997-2008 period (Chart 1), from $11,780 million in 1997 to $20,661 million in 2008. Nominal GDP in Canada increased at a faster pace, 5.95 per cent per year, which explains why Nova Scotia's nominal GDP as a share of Canada's declined slightly from 1.92 per cent in 1997 to 1.79 per cent in 2008 (Chart 2). As we will see in the next subsections, Nova Scotia's slower nominal GDP growth was due to both slower *real* growth (2.95 per cent vs. 3.08 per cent in Canada), and slower price growth (2.23 per cent vs. 2.79 per cent in Canada).

Chart 1: Nominal GDP Growth Breakdown in Nova Scotia and Canada, Business Sector, 1997-2008 (Compound Annual Growth Rates)



Note: Contributions do not sum to total growth rates due to rounding.
Source: CSLS Nova Scotia Productivity Database.

Chart 2: Nova Scotia's Nominal GDP as a Share of Canada's, Business Sector, 1997-2008



Source: CSLS Nova Scotia Productivity Database.

During the 1997-2008 period, Nova Scotia's business sector represented, on average, 66.1 per cent of total economy nominal GDP in the province, considerably less than the Canadian business sector as a whole, which accounted for approximately 76.4 per cent of total economy nominal GDP (Table 2).[6]

[6] Again, it is important to emphasize that these figures do not consider the imputed value of owner occupied dwellings as part of the business sector. If we had used Statistics Canada's general definition of business sector, Nova Scotia's business sector would represent approximately 76.0 per cent of the province's total economy nominal GDP, while in Canada the business sector would account for 84.0 per cent of total economic activity.

Table 2: Nominal GDP Breakdown, Nova Scotia and Canada, 1997-2008 (as a Share of the Total Economy)

	Nova Scotia			Canada		
	1997-2008	1997	2008	1997-2008	1997	2008
	(as a share of the total economy, per cent)					
Total Economy	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Business sector industries*	66.1	64.1	65.3	76.4	74.9	76.6
Owner-Occupied Dwellings	10.0	11.0	10.1	7.5	8.3	7.3
Other Private Services (Non-Business Sector Component)**	12.0	12.1	12.6	9.2	9.5	9.4
Public Administration	10.8	11.7	10.9	5.7	6.1	5.6
Other***	1.1	1.1	1.1	1.1	1.2	1.1

* Unlike Statistics Canada's general definition of the business sector, the CPA's definition of the business sector, which is used here, excludes owner-occupied dwellings.

** Includes non-business establishments classified under education services (NAICS code 61), health care and social assistance (NAICS code 62), and other services (except public administration) (NAICS code 81)

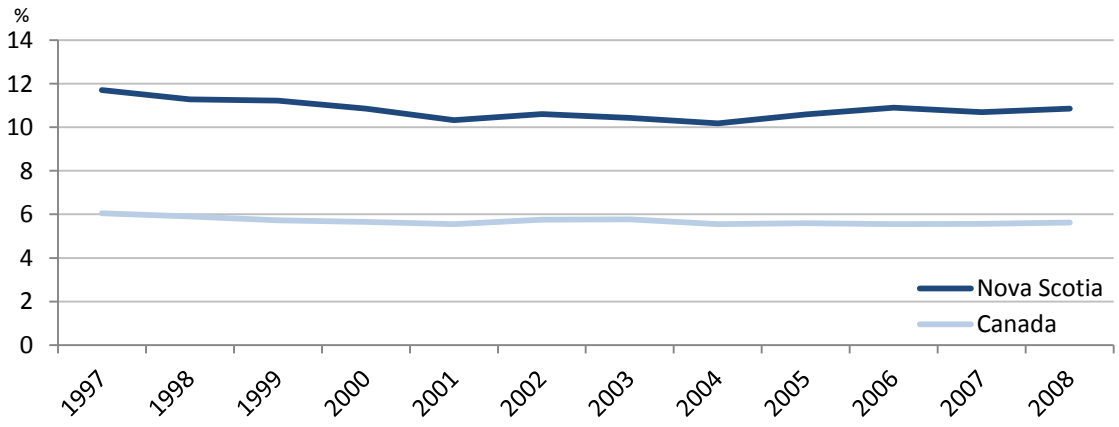
*** Includes non- business establishments classified under NAICS codes 11-56, 71, and 72.

Source: Statistics Canada, 1) Input-Output Structure of the Canadian Economy in Current Prices (CANSIM Tables 379-0023 and 379-0024); 2) GDP at basic prices, by NAICS and province, annually (CANSIM Table 379-0025); 3) LPM – Provinces and Territories (Annual) (CANSIM Table 383-0011).

There are three main reasons why Nova Scotia's non-business sector is proportionally greater than the national average:

1) The size of the public administration sector (in relative terms). During the 1997-2008 period, the public administration sector represented, on average, 5.7 per cent of total economy nominal GDP in Canada, while in Nova Scotia it accounted for 10.8 per cent of total economy nominal GDP, a difference of 5.1 percentage points. As Chart 3 shows, the relative size of the public administration sector has declined slightly in both Nova Scotia and Canada since 1997.

Chart 3: The Public Administration Sector as a Share of the Total Economy, Nova Scotia and Canada, 1997-2008

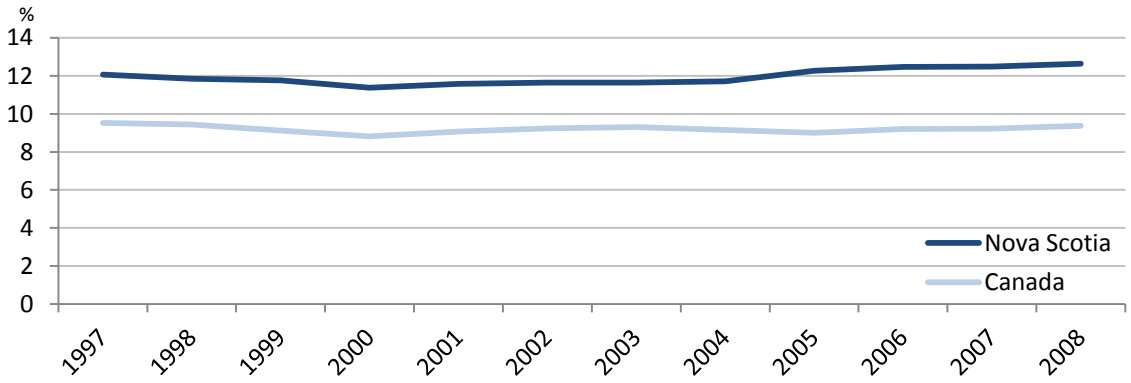


Source: Statistics Canada, 1) GDP at basic prices in current dollars, SNA benchmark values, by NAICS, annually (CANSIM Tables 379-0023 and 379-0024); 2) GDP at basic prices, by NAICS and province, annually (CANSIM Table 379-0025).

2) The non-business components of education services, health care and social assistance, and other services (except public administration) accounted jointly for 11.9 per cent of Nova Scotia's economy from 1997 to 2008, but only 9.2 per cent of the Canadian economy (Chart 4).

3) During the 1997-2008 period, the imputed value of owner occupied dwellings accounted, on average, for 10.0 per cent of Nova Scotia's economy, while it represented only 7.5 per cent of the Canadian economy as a whole, reflecting the higher home ownership rates in Nova Scotia.

Chart 4: Non-Business Components of Education Services, Health Care and Social Assistance, and Other Services (Except Public Administration) as a Share of the Total Economy, Nova Scotia and Canada, 1997-2008



Source: Statistics Canada, 1) GDP at basic prices in current dollars, SNA benchmark values, by NAICS, annually (CANSIM Tables 379-0023 and 379-0024); 2) GDP at basic prices, by NAICS and province, annually (CANSIM Table 379-0025); 3) LPM – Provinces and Territories (Annual) (CANSIM Table 383-0011).

In terms of nominal GDP shares, the sectoral composition of Nova Scotia's business sector was quite similar to Canada's during the 1997-2008 period (Table 3). In particular, the two sectors that contributed the most to nominal GDP in Nova Scotia and in Canada were the same: FIRE (which accounted in 2008 for 14.4 per cent of business sector nominal GDP in Nova Scotia and 14.2 per cent in Canada), and manufacturing (11.9 per cent and 15.0 per cent, respectively).

There were, however, notable differences that are worth highlighting – and, since there were few drastic changes in industry composition during the period, we focus on the most recent nominal GDP data, which refer to 2008. First, the goods sector represented a smaller share of nominal GDP in Nova Scotia than in Canada (35.9 per cent vs. 43.1 per cent, respectively). This difference of 7.2 per cent is due mainly (although not exclusively) to the smaller role in Nova Scotia of mining and oil and gas extraction (8.5 per cent vs. 13.4 per cent in Canada), and durable manufacturing industries (4.6 per cent vs. 8.6 per cent). Conversely, the services sector

accounted for a larger share of nominal GDP in Nova Scotia than in Canada (64.1 per cent vs. 56.9 per cent, respectively). The relatively larger importance of the services sector in Nova Scotia is explained by the greater role of retail trade in the province (10.8 per cent vs. 7.2 per cent in Canada), and other private services (8.0 per cent vs. 5.8 per cent). One perhaps surprising finding is that the ICT sector in 2008 accounted for a greater share of Nova Scotia's business sector nominal GDP than of Canada's (7.0 per cent vs. 5.4 per cent), even though the relative size of Nova Scotia's ICT sector had been smaller than Canada's in 2000 (5.1 per cent vs. 6.3 per cent).

Table 3: Nominal GDP Shares by Two-Digit NAICS Sectors and Special Industry Aggregations, Nova Scotia and Canada, 1997, 2000 and 2008

	Nova Scotia			Canada		
	1997	2000	2008	1997	2000	2008
	(as a share of business sector industries, per cent)					
Business sector industries	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Business sector, goods	*35.2*	*39.7*	*35.9*	*43.2*	*45.0*	*43.1*
Agriculture, forestry, fishing and hunting	4.3	4.5	3.0	3.2	2.9	2.4
Mining and oil and gas extraction	2.6	6.6	8.5	5.5	7.9	13.4
Utilities	3.8	3.3	3.0	4.2	3.4	3.0
Construction	8.3	8.2	9.4	7.0	6.5	9.3
Manufacturing	16.2	17.1	11.9	23.2	24.4	15.0
Non-durable manufacturing industries	10.1	10.8	7.3	10.0	9.7	6.4
Durable manufacturing industries	6.1	6.3	4.6	13.2	14.7	8.6
Business sector, services	*64.8*	*60.3*	*64.1*	*56.8*	*55.0*	*56.9*
Wholesale trade	7.3	6.9	7.1	7.1	6.6	6.8
Retail trade	9.8	9.4	10.8	6.9	6.7	7.2
Transportation and warehousing	6.6	6.3	5.5	6.2	5.7	5.4
Information and cultural industries	5.5	4.8	5.3	4.3	4.2	4.3
FIRE	16.6	14.8	14.4	15.0	14.1	14.2
Professional, scientific and technical services	4.7	3.9	5.2	4.9	5.7	6.3
ASWMRS	1.8	2.4	3.3	2.5	2.6	3.2
Arts, entertainment and recreation	1.0	0.8	0.8	0.9	0.9	0.9
Accommodation and food services	4.1	3.8	3.8	3.2	3.0	2.8
Other private services	7.4	7.2	8.0	5.7	5.5	5.8
ICT Sector	**5.1**	**5.1**	**7.0**	**5.3**	**6.3**	**5.4**

Source: Statistics Canada, 1) GDP at basic prices in current dollars, SNA benchmark values, by NAICS, annually (CANSIM Tables 379-0023 and 379-0024); 2) GDP at basic prices, by NAICS and province, annually (CANSIM Table 379-0025); 3) LPM – Provinces and Territories (Annual) (CANSIM Table 383-0011).

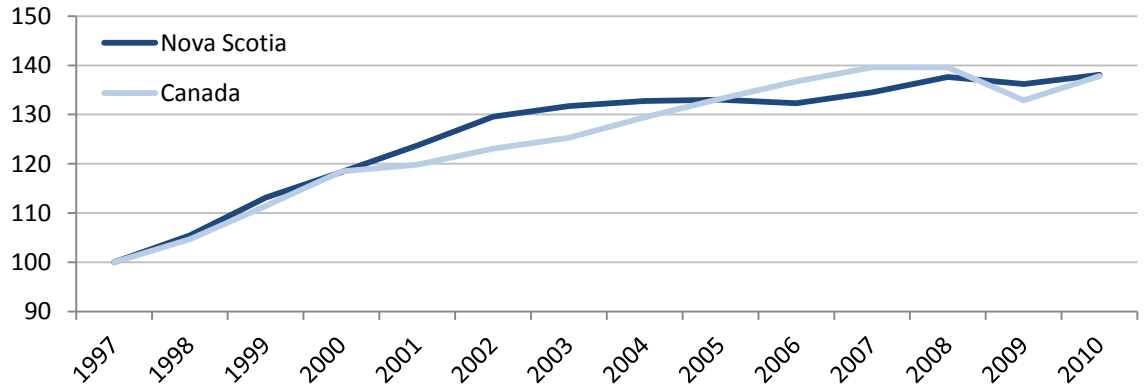
ii. Real GDP

Real GDP in Nova Scotia's business sector grew at a compound annual rate of 2.51 per cent during the 1997-2010 period, practically the same rate as the national average, 2.50 per cent). During the period, the province's real GDP increased from $12,619 million (chained 2002 dollars) in 1997 to $17,428 million (chained 2002 dollars) in 2010.

Chart 5 shows that real GDP in Nova Scotia and Canada increased at about the same rate during the 1997-2000 period (5.77 per cent vs. 5.80 per cent, respectively), after which real GDP growth in the province gained momentum, surpassing that of Canada up until 2002 (4.64 per cent vs. 1.93 per cent during the 2000-2002 period). Starting in 2003, however, Nova Scotia's real

GDP stagnated, growing at a slow pace. It is interesting to note that the impact of the recent economic downturn was much weaker in Nova Scotia than in Canada, with the province's real GDP declining only 1.06 per cent in 2009, while Canada's real GDP dropped 4.81 per cent.

Chart 5: Real GDP Growth in Nova Scotia and Canada, Business Sector, 1997-2010 (1997=100)



Source: CSLS Nova Scotia Productivity Database.

Table 4 details real GDP growth rates and levels among the provinces during the 1997-2010 period. Compared to the other provinces, Nova Scotia ranked 3rd in terms of real GDP growth, behind only Newfoundland and Labrador (4.55 per cent per year) and Alberta (2.71 per cent per year).

Table 4: Real GDP in Canada and the Provinces, Business Sector, 1997-2010

	1997-2010	1997-2000	2000-2010
	(compound annual growth rates, per cent)		
Canada	**2.50**	**5.80**	**1.53**
Newfoundland and Labrador	4.55	8.70	3.33
Prince Edward Island	2.23	4.35	1.60
Nova Scotia	**2.51**	**5.77**	**1.56**
New Brunswick	2.51	5.49	1.64
Quebec	2.41	5.97	1.37
Ontario	2.45	7.54	0.98
Manitoba	2.42	3.97	1.95
Saskatchewan	1.71	2.64	1.43
Alberta	2.71	4.37	2.22
British Columbia	2.29	3.04	2.07
	1997	2000	2010
	(millions, chained 2002 dollars)		
Canada	662,924	785,154	913,621
Newfoundland and Labrador	6,826	8,766	12,166
Prince Edward Island	1,761	2,001	2,346
Nova Scotia	**12,619**	**14,932**	**17,428**
New Brunswick	10,643	12,492	14,693
Quebec	137,154	163,217	187,026
Ontario	265,745	330,466	364,187
Manitoba	20,751	23,323	28,302
Saskatchewan	23,641	25,565	29,455
Alberta	100,695	114,495	142,617
British Columbia	80,492	88,055	108,039

Source: CSLS Nova Scotia Productivity Database.

Table 5 shows that real GDP increased faster in Nova Scotia's goods sector than in Canada's during the 1997-2010 period (1.82 per cent per year vs. 1.32 per cent per year, respectively), driven in large part by stronger manufacturing growth in the province (1.05 per cent vs. 0.33 per cent in Canada). On the other hand, real GDP growth of Nova Scotia's services sector lagged behind Canada's (2.93 per cent vs. 3.38 per cent).

At the two-digit NAICS level, Nova Scotia's three most important sectors in terms of nominal GDP shares – namely, FIRE, manufacturing, and retail trade – had a mixed performance when compared to Canada as a whole. While Nova Scotia's manufacturing sector outperformed Canada's during the 1997-2010 period in terms of real GDP growth, the province's FIRE and retail trade sectors grew slower than the national average (2.96 per cent vs. 3.32 per cent and 3.71 per cent vs. 4.16 per cent). It is interesting to note that Nova Scotia's ICT sector experienced faster real GDP growth than the national ICT sector (6.73 per cent per year vs. 6.08 per cent per year). Looking at the sub-periods, it can be seen that the ICT sector in Nova Scotia and Canada grew at very robust rates during the 1997-2000 period (12.52 per cent per year vs. 19.08 per cent per year, respectively), after which there was a significant slowdown at both the provincial and national levels during the 2000-2010 period (5.05 per cent per year vs. 2.46 per cent per year). Note that the slowdown of real GDP growth in the ICT sector was more pronounced in Canada as a whole than in Nova Scotia.

Table 5: Real GDP Growth by Two-Digit NAICS Sectors and Special Industry Aggregations, Nova Scotia and Canada, 1997-2010

	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(compound annual growth rates, per cent)					
Business sector industries	**2.51**	**5.77**	**1.56**	**2.50**	**5.80**	**1.53**
Business sector, goods	*1.82*	*6.44*	*0.48*	*1.32*	*5.49*	*0.11*
Agriculture, forestry, fishing and hunting	2.76	6.01	1.80	1.61	4.67	0.71
Mining and oil and gas extraction	0.76	23.89	-5.29	0.82	1.52	0.61
Utilities	1.14	1.68	0.98	0.76	-0.21	1.06
Construction	3.81	5.78	3.22	3.76	4.45	3.55
Manufacturing	1.05	3.79	0.25	0.33	7.68	-1.78
Non-durable manufacturing industries	0.36	2.78	-0.36	0.01	4.49	-1.30
Durable manufacturing industries	2.79	7.49	1.42	0.51	9.93	-2.15
Business sector, services	*2.93*	*5.31*	*2.23*	*3.38*	*6.03*	*2.60*
Wholesale trade	2.99	6.05	2.08	3.71	7.03	2.74
Retail trade	3.71	5.84	3.08	4.16	5.70	3.70
Transportation and warehousing	1.27	5.38	0.07	2.09	4.47	1.39
Information and cultural industries	3.80	7.61	2.68	4.43	9.55	2.94
FIRE	2.96	4.01	2.65	3.32	4.67	2.92
Professional, scientific and technical services	2.83	0.13	3.66	4.46	11.05	2.56
ASWMRS	7.67	16.08	5.27	4.30	7.49	3.36
Arts, entertainment and recreation	-1.05	-1.81	-0.83	2.43	4.49	1.82
Accommodation and food services	1.34	4.84	0.31	1.60	4.34	0.80
Other private services	2.43	6.37	1.27	2.29	3.76	1.86
ICT Sector	**6.73**	**12.52**	**5.05**	**6.08**	**19.08**	**2.46**

Source: CSLS Nova Scotia Productivity Database.

iii. Implicit Price Deflators

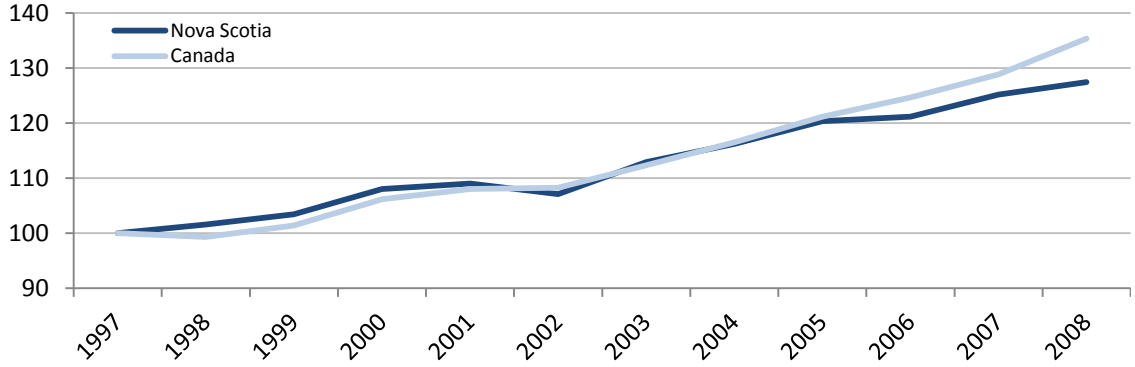
The implicit price deflator in Nova Scotia's business sector grew at a slower pace than the national average during the 1997-2008 period (2.23 per cent vs. 2.79 per cent) (Table 6). As Chart 6 shows prices in Nova Scotia increased in tandem with national prices up until 2005, after which there was a divergence in trends, with prices in Canada as a whole rising at a faster pace than prices in Nova Scotia. Prices in the goods sector increased much faster than prices in the services sector both in Nova Scotia and in Canada as a whole. More specifically, goods sector prices grew 2.82 per cent per year in Nova Scotia and 3.87 per cent per year in Canada, while services sector prices increased by only 1.85 per cent per year in Nova Scotia and 1.98 per cent in Canada.

Table 6: Implicit Price Deflator Growth by Two-Digit NAICS Sectors and Special Industry Aggregations, Nova Scotia and Canada, 1997-2008

	Nova Scotia			Canada		
	1997-2008	1997-2000	2000-2008	1997-2008	1997-2000	2000-2008
	(compound annual growth rates, per cent)					
Business sector industries	**2.23**	**2.61**	**2.09**	**2.79**	**2.01**	**3.08**
Business sector, goods	*2.82*	*6.17*	*1.59*	*3.87*	*3.72*	*3.93*
Agriculture, forestry, fishing and hunting	-0.87	4.62	-2.86	0.74	-0.89	1.36
Mining and oil and gas extraction	10.32	19.39	7.10	13.40	19.71	11.11
Utilities	1.85	1.70	1.91	1.72	1.25	1.90
Construction	3.06	2.00	3.46	3.88	0.44	5.20
Manufacturing	0.98	6.54	-1.04	0.68	1.82	0.26
Non-durable manufacturing industries	1.31	8.07	-1.11	1.40	1.98	1.19
Durable manufacturing industries	-0.30	2.10	-1.19	0.18	1.74	-0.40
Business sector, services	*1.85*	*0.60*	*2.32*	*1.98*	*0.70*	*2.47*
Wholesale trade	1.60	0.48	2.03	0.87	-1.69	1.84
Retail trade	2.04	0.99	2.44	1.67	0.94	1.95
Transportation and warehousing	2.09	0.92	2.53	1.99	0.33	2.62
Information and cultural industries	0.56	-3.20	2.00	0.75	-2.13	1.86
FIRE	0.68	0.55	0.73	1.73	0.91	2.04
Professional, scientific and technical services	3.19	1.48	3.84	2.86	1.85	3.25
ASWMRS	2.24	2.37	2.19	3.00	2.28	3.26
Arts, entertainment and recreation	4.97	3.80	5.41	2.93	2.66	3.03
Accommodation and food services	2.61	1.16	3.16	2.81	1.70	3.24
Other private services	3.09	1.10	3.84	3.30	2.72	3.51
ICT Sector	**0.63**	**-3.98**	**2.41**	**-1.02**	**-4.27**	**0.22**

Source: CSLS Nova Scotia Productivity Database.

Chart 6: Implicit Price Deflator Growth in Nova Scotia and Canada, Business Sector, 1997-2007 (1997=100)



Source: CSLS Nova Scotia Productivity Database.

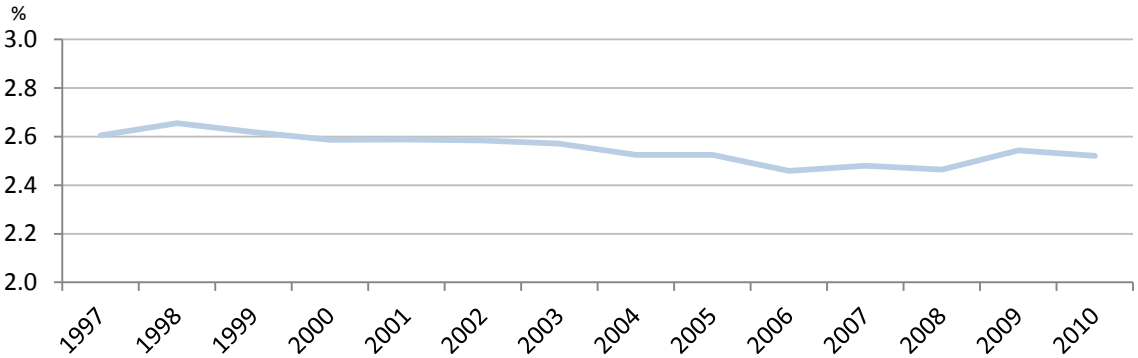
B. Labour Input

In this section, we analyze labour input trends in Nova Scotia, and compare them to trends observed at the national level. We start our discussion by providing a breakdown of hours worked at the two-digit NAICS level. Next, we look at number of jobs, average weekly hours worked, and labour compensation as a share of nominal GDP.

i. Hours Worked

In 2010, total hours actually worked in Nova Scotia reached 600 million, up from 532 million in 1997. During the 1997-2010 period, the increase in hours actually worked in Nova Scotia was slower than the rate observed for Canada as a whole (0.94 per cent per year vs. 1.19 per cent per year), leading to a small decline in the province's share in total hours worked, from 2.60 per cent in 1997 to 2.52 per cent in 2010 (Chart 7).

Chart 7: Hours Worked in Nova Scotia's Business Sector as a Share of Canada's, 1997-2010



Source: CSLS Nova Scotia Productivity Database.

In terms of hours worked shares, Nova Scotia's sectoral composition is even more similar to Canada's than it was in terms of nominal GDP shares. In 2008, the goods sector accounted for 30.5 per cent of total hours worked in Nova Scotia's business sector, while in Canada it accounted for 30.9 per cent (Table 7). Comparing Table 3 and Table 7, it is clear that, at both provincial and national levels, the share of the goods sector in terms of hours worked was much smaller than in terms of nominal GDP.

The three sectors that contributed the most to total hours worked in Nova Scotia and Canada in 2008 were the same: retail trade (17.8 per cent vs. 12.8 per cent, respectively), manufacturing (12.0 per cent vs. 14.1 per cent), and construction (12.1 per cent vs. 10.8 per cent).[7] It is also worth highlighting that, much like the pattern seen when we discussed trends in nominal shares, even though Nova Scotia's and Canada's manufacturing sectors have similar relative sizes, the focus of the province's manufacturing sector is on non-durable manufacturing industries, while at the national level durable manufacturing industries play a larger role.

Table 7: Hours Worked Shares by Two-Digit NAICS Sectors and Special Industry Aggregations, Nova Scotia and Canada, 1997, 2000, 2008, and 2010

	Nova Scotia				Canada			
	1997	2000	2008	2010	1997	2000	2008	2010
	(per cent)							
Business sector industries	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Business sector, goods	*32.0*	*31.6*	*30.5*	*30.4*	*35.1*	*33.3*	*30.9*	*29.9*
Agriculture, forestry, fishing and hunting	5.8	5.5	4.5	4.6	5.5	4.5	3.2	3.1
Mining and oil and gas extraction	1.4	0.9	1.2	0.9	1.7	1.5	2.1	1.9
Utilities	0.7	0.8	0.6	0.6	0.8	0.8	0.8	0.8
Construction	10.2	9.9	12.1	12.7	8.8	8.3	10.8	11.0
Manufacturing	13.9	14.5	12.0	11.6	18.4	18.3	14.1	13.1
Non-durable manufacturing industries	9.0	8.8	7.3	7.0	7.8	7.4	5.8	5.5
Durable manufacturing industries	5.0	5.8	4.7	4.5	10.6	10.9	8.3	7.6
Business sector, services	*68.0*	*68.4*	*69.5*	*69.6*	*64.9*	*66.7*	*69.1*	*70.1*
Wholesale trade	6.2	5.9	5.9	5.5	7.4	7.2	7.0	6.7
Retail trade	18.0	18.3	17.8	17.7	12.9	12.5	12.8	13.2
Transportation and warehousing	6.6	6.3	5.8	5.6	6.3	6.4	6.4	6.2
Information and cultural industries	2.5	2.4	2.5	2.1	2.4	2.9	2.8	2.9
FIRE	6.0	5.9	6.5	7.2	7.4	7.4	7.9	8.1
Professional, scientific and technical services	4.7	4.3	5.8	5.9	6.1	7.1	7.8	8.1
ASWMRS	2.8	3.8	5.6	6.4	4.0	4.6	5.8	5.9
Arts, entertainment and recreation	1.3	1.5	1.7	1.4	1.5	1.7	1.9	1.9
Accommodation and food services	8.4	8.7	8.0	7.8	7.4	7.5	7.4	7.2
Other private services	11.4	11.5	10.0	10.0	9.4	9.4	9.4	9.9
ICT Sector	..	..	..	..	..	..	..	..

Source: CSLS Nova Scotia Productivity Database.

Throughout the 1997-2010 period, hours worked growth was more robust in the services sector than in the goods sector for both Nova Scotia and Canada. Hours worked in the goods sector grew 0.52 per cent per year in Nova Scotia and -0.05 per cent per year in Canada, while

[7] Our emphasis here is on 2008 hours shares so the estimates discussed can be compared directly to the nominal GDP shares analyzed previously.

the growth observed in Nova Scotia's services sector was 1.13 per cent per year and in Canada's was 1.79 per cent per year (Table 8).

The main reason for the low growth rates of hours worked in the goods sector in Nova Scotia and Canada was the negative growth rate experienced by their respective manufacturing sectors (-0.49 per cent per year vs. -1.42 per cent per year). Other sectors that contributed to the low hours worked growth in Nova Scotia were agriculture, forestry, fishing and hunting (-0.94 per cent per year vs. -3.12 per cent per year in Canada), and mining and oil and gas extraction (-2.48 per cent per year vs. 2.20 per cent per year in Canada). In the services sector, the slower growth of hours worked in Nova Scotia can be attributed in large part to the wholesale and retail trade, with the former experiencing a small decline in hours worked (-0.09 per cent per year vs. 0.41 per cent per year in Canada), and the latter observing weak overall growth (0.78 per cent per year vs. 1.38 per cent per year in Canada).

Table 8: Hours Worked Growth by Two-Digit NAICS Sectors and Special Industry Aggregations, Nova Scotia and Canada, 1997-2010

	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(compound annual growth rates, per cent)					
Business sector industries	**0.94**	**2.41**	**0.50**	**1.19**	**2.65**	**0.76**
Business sector, goods	*0.52*	*1.90*	*0.11*	*-0.05*	*0.84*	*-0.32*
Agriculture, forestry, fishing and hunting	-0.94	0.14	-1.26	-3.12	-3.60	-2.98
Mining and oil and gas extraction	-2.48	-11.00	0.23	2.20	-2.31	3.60
Utilities	0.11	8.81	-2.37	1.31	-0.73	1.93
Construction	2.65	1.21	3.09	2.93	0.73	3.59
Manufacturing	-0.49	3.86	-1.76	-1.42	2.49	-2.56
Non-durable manufacturing industries	-0.92	1.56	-1.66	-1.46	1.07	-2.21
Durable manufacturing industries	0.23	7.78	-1.93	-1.39	3.51	-2.81
Business sector, services	*1.13*	*2.65*	*0.68*	*1.79*	*3.60*	*1.26*
Wholesale trade	-0.09	0.58	-0.29	0.41	2.09	-0.08
Retail trade	0.78	2.81	0.17	1.38	1.53	1.33
Transportation and warehousing	-0.34	0.74	-0.65	1.08	3.15	0.46
Information and cultural industries	-0.48	-0.29	-0.54	2.70	8.93	0.91
FIRE	2.34	1.78	2.51	1.91	2.76	1.65
Professional, scientific and technical services	2.76	-0.59	3.78	3.35	7.64	2.09
ASWMRS	7.63	13.28	5.99	4.30	7.60	3.33
Arts, entertainment and recreation	1.68	8.49	-0.28	2.90	5.34	2.18
Accommodation and food services	0.41	3.63	-0.53	0.97	3.17	0.31
Other private services	-0.04	2.71	-0.84	1.55	2.61	1.24
ICT Sector	..	..	..	..	..	..

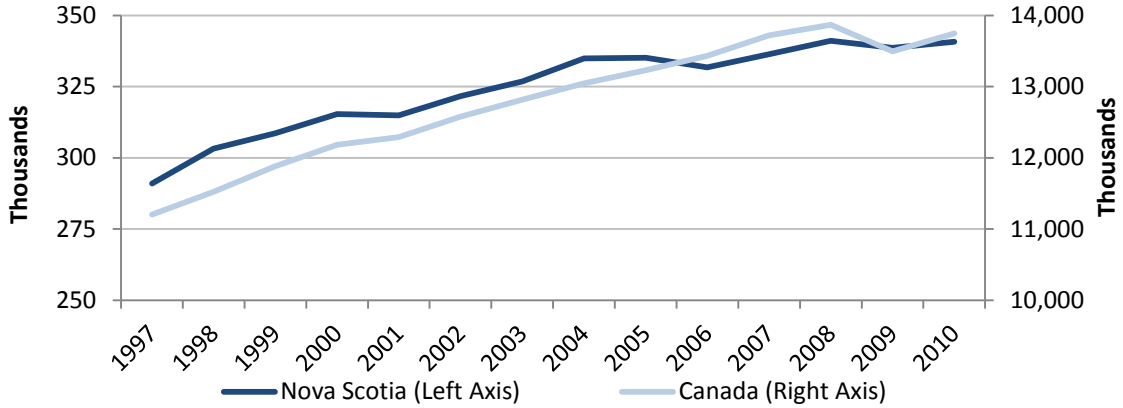
Source: CSLS Nova Scotia Productivity Database.

ii. Number of Jobs

As mentioned previously, hours actually worked is our preferred measure of labour input because it takes into account changes in the work week and shifts from full-time employment to part-time employment. It is still important, however, to look at overall trends in number of jobs in Nova Scotia and Canada.

In 2010, there were 340 thousand jobs in Nova Scotia's business sector, 17 per cent more than the number observed in 1997, 291 thousand (Chart 8). Mirroring the trends observed in hours actually worked, Nova Scotia's job creation rate was lower than Canada's (1.22 per cent per year vs. 1.59 per cent per year), leading to a small decline in the province's share in national employment, from 2.60 per cent in 1997 to 2.48 per cent in 2010.

Chart 8: Number of Jobs in Nova Scotia and Canada, Business Sector, 1997-2010

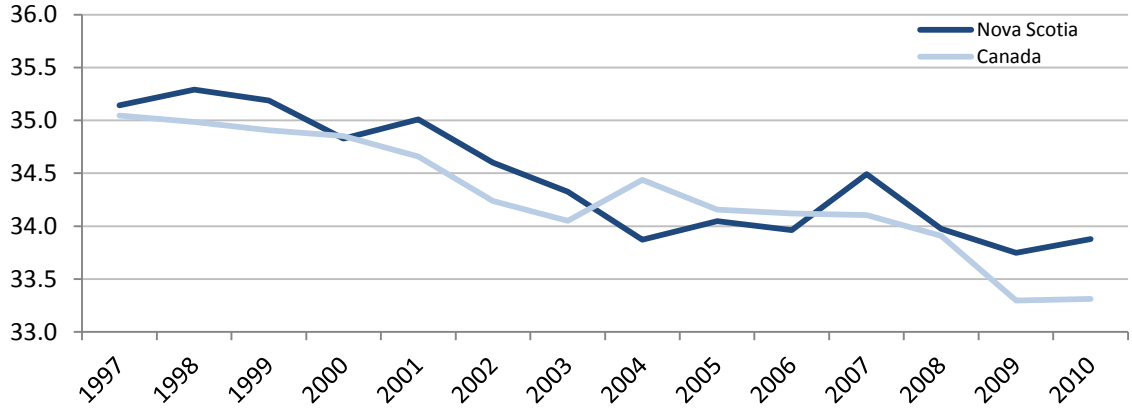


Source: CSLS Nova Scotia Productivity Database.

iii. Average Weekly Hours Worked

Combining the data on hours worked and number of jobs, we can estimate average weekly hours worked. Chart 9 shows that the average work week decline both in Nova Scotia and in Canada during the 1997-2010 period, although the fall was less steep at the provincial level (-3.61 per cent vs. -4.95 per cent in Canada). In Nova Scotia, the duration of the work week went from 35.1 hours in 1997 to 33.9 hours in 2010. In Canada, it went from 35.0 hours in 1997 to 33.3 in 2010.

Chart 9: Average Weekly Hours Worked per Worker in Nova Scotia and Canada, Business Sector, 1997-2010

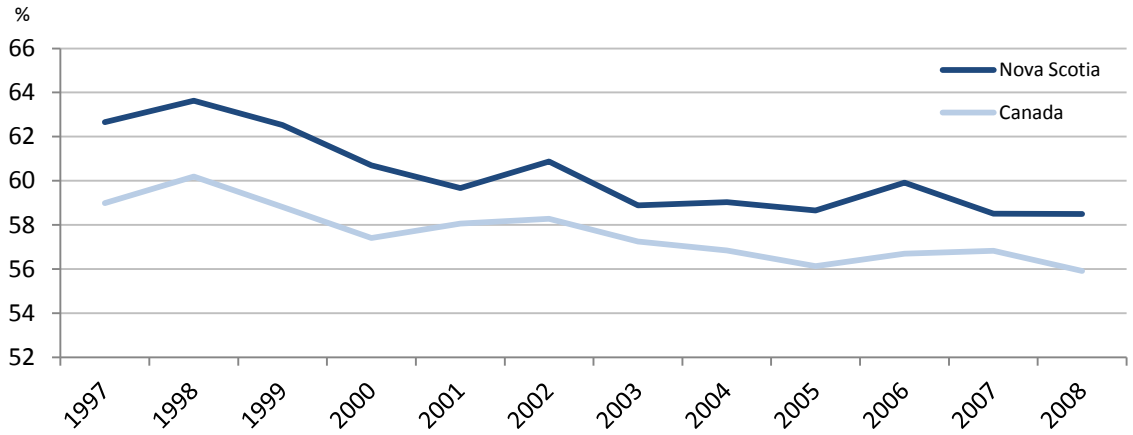


Source: CSLS Nova Scotia Productivity Database.

iv. Labour Compensation as a Share of Nominal GDP

Another important issue related to the use of labour input has to do with how much of nominal GDP goes to labour compensation (as opposed to capital compensation). In 1997, the labour compensation share of nominal business sector GDP in Nova Scotia was 62.7 per cent, higher than the national average of 59.0 per cent (Chart 10). By 2008, the labour compensation share in both the province and Canada had fallen, to 58.5 per cent and 55.9 per cent, respectively. Note that, although the labour compensation share in Nova Scotia remained above Canada's during the entire period, the gap between the two has narrowed, from 3.7 percentage points in 1997 to 2.6 percentage points in 2008.

Chart 10: Labour Compensation as a Share of Nominal GDP in Nova Scotia and Canada, Business Sector, 1997-2008



Source: CSLS Nova Scotia Productivity Database.

C. Capital Input

In this section, we analyze trends in the use of capital input in Nova Scotia and Canada during the 1997-2010 period. The focus of the section is on the estimates provided by Statistics Canada's Fixed Capital Flows and Stocks Survey, which looks at the evolution of the capital stock of fixed, non-residential, reproducible business assets. This definition of capital stock includes three broad categories of capital assets: machinery and equipment (M&E); buildings; and engineering structures. Furthermore, this report makes use of the geometric end-year net stock concept, which assumes that assets depreciate at a constant rate over time.

In addition to discussing growth rates and levels of capital stock (and investment) broken down by main asset types and industry, this section highlights the role of M&E capital in general and ICT capital in particular. The reason for this, as part five of the report will make clear, is that M&E capital plays an important role in increasing productivity. Information and communication

technologies (ICTs) are a sub-category of M&E, and recent research has shown that it also plays a fundamental role in productivity growth (this topic is discussed in part five).

Unfortunately, official investment and capital stock estimates for Nova Scotia have several data gaps, mainly due to confidentiality reasons. Data on nominal business sector investment for Nova Scotia, for example, span only the 2002-2010 period, whereas for Canada it spans the 1961-2010 period. In particular, ICT investment and capital stock estimates are not available for Nova Scotia's business sector, only for the province's total economy. It is important, therefore, to keep in mind the following facts:

- In general, (nominal or real) investment and capital stock figures discussed in this subsection refer to Nova Scotia's or Canada's business sector.

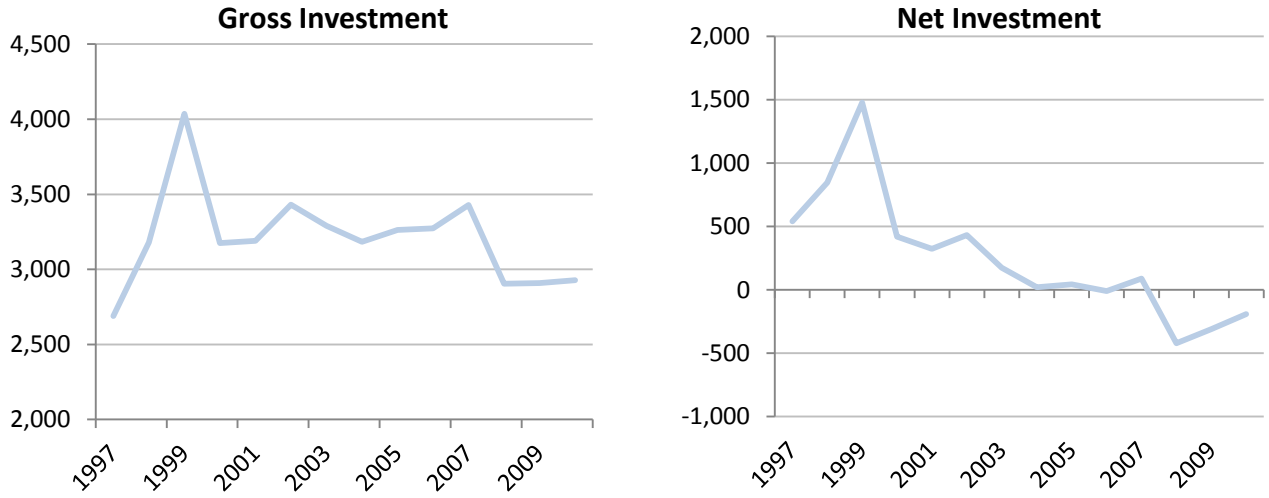
- However, capital flows and stocks data for non-ICT M&E and ICT were not available for Nova Scotia at the business sector level. As a consequence, total economy numbers were used. Although business sector estimates for these variables were available for Canada, total economy estimates were used for consistency. Furthermore, as mentioned above, nominal investment and capital stock estimates for Nova Scotia's business sector span a short time period (usually, 2003-2004 to 2010).

Finally, this section also discusses capital services trends in Nova Scotia. The relevant input in the production process is not capital stock *per se*, but capital services, i.e. the services provided by the capital stock during a period of time. This is an important distinction to remember because different capital goods provide services at different rates (this fact is explained in more detail later on). Estimates for capital services are taken from the CSLS Provincial Productivity Database.

i. Fixed Capital Flows

During the 1997-2010 period, real fixed non-residential investment in Nova Scotia's business sector grew at a compound annual rate of 0.65 per cent, from $2,690 million (chained 2002 dollars) in 1997 to $2,928 million (chained 2002 dollars) in 2010, significantly slower than investment growth in Canada as a whole (3.10 per cent per year). Chart 11 shows that real investment growth in Nova Scotia was positive mainly during the 1997-2000 period, after which it first declined in 2000 and then stagnated until 2007. More recently, real investment decreased substantially in the wake of the global crisis. When we take into account depreciation, net investment was actually negative during the 2008-2010 period.

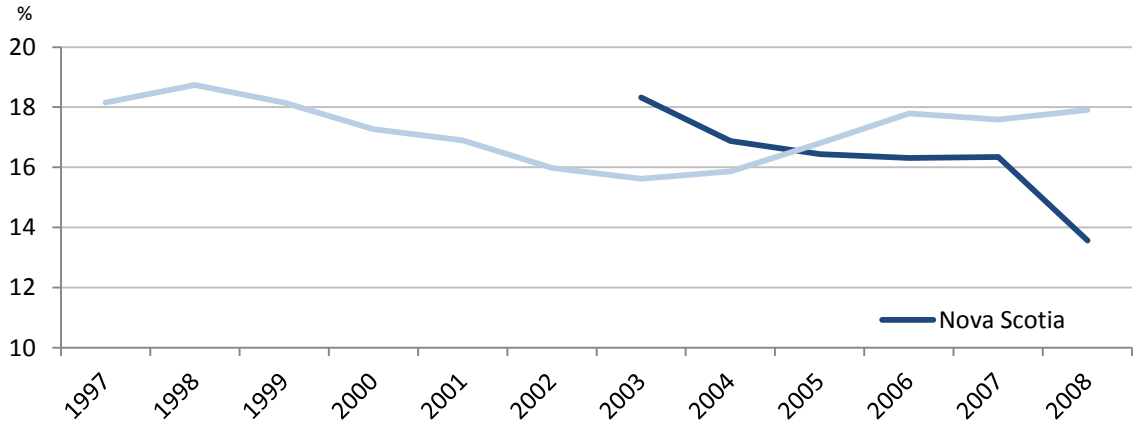
Chart 11: Real Investment (Fixed, Non-Residential) in Nova Scotia, Business Sector, 1997-2010 (Millions, Chained 2002 Dollars)



Source: CSLS Nova Scotia Productivity Database

Chart 12 plots investment (fixed, non-residential) as a share of business sector nominal GDP in Nova Scotia and Canada as a whole. As we can see, investment in Nova Scotia declined considerably as a share of GDP, from 18.3 per cent in 2003 (vs. 15.6 per cent in Canada) to 13.6 per cent in 2008 (vs. 17.9 per cent in Canada).

Chart 12: Gross Investment (Fixed, Non-Residential) as a Share of GDP in Nova Scotia and Canada, Business Sector, 1997-2008 (Nominal Shares)

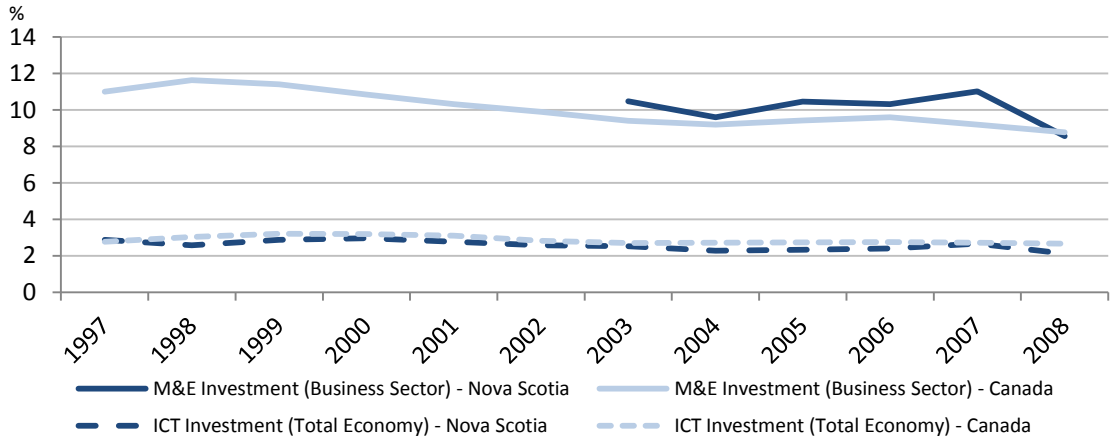


Source: CSLS calculations based on Statistics Canada data, 1) Fixed Investment Flows and Stocks (CANSIM Tables 031-0003/04); 2) LPM (CANSIM Table 383-0011).

Chart 13 plots M&E investment and ICT investment as a share of nominal business sector GDP in Nova Scotia and in Canada. In 2008, M&E investment accounted for 8.6 per cent of Nova Scotia's nominal GDP (vs. 8.8 per cent in Canada), down from 10.5 per cent in 2003

(vs. 9.4 per cent in Canada). M&E investment as a share of business sector nominal GDP was higher in Nova Scotia than in Canada from 2002 to 2007, falling below the Canadian average only in 2008. ICT investment as a share of nominal GDP also fell during the period, from 2.9 per cent in 1997 to 2.1 per cent in 2008. Overall, these numbers were in line with the national estimates.

Chart 13: M&E and ICT Investment as a Share of GDP in Nova Scotia and Canada, 1997-2008 (Nominal Shares)



Source: CSLS calculations based on Statistics Canada data, 1) Fixed Investment Flows and Stocks (CANSIM Tables 031-0003/04); 2) LPM (CANSIM Table 383-0011).

Breaking down real investment growth by major asset category, we can see that Nova Scotia outperformed Canada in engineering investment during the 1997-2010 period (9.21 per cent per year vs. 3.24 per cent per year). The bulk of this increase happened in the 1997-2000 period, during the Sable Island oil and gas development (Table 9). Building investment declined at approximately the same rate in Nova Scotia and Canada as a whole (-1.02 per cent per year vs. -1.09 per cent per year, respectively).

Real M&E investment in the province, on the other hand, declined 0.99 per cent per year, while increasing 3.96 per cent per year in Canada. The drop in Nova Scotia's M&E investment was driven by the sharp decrease in non-M&E ICT investment (-3.25 per cent per year vs. 1.76 per cent per year in Canada). ICT investment growth in the province, although strong when compared to other asset categories, was also lackluster when compared to the national average (7.11 per cent per year vs. 9.56 per cent per year). Looking at ICT components, real investment in computers observed the highest growth rate (13.49 per cent per year vs. 18.15 per cent per year in Canada), followed by software (4.81 per cent per year vs. 6.65 per cent per year in Canada) and telecommunications equipment (4.52 per cent per year vs. 4.84 per cent per year in Canada).

Nominal M&E investment accounted for 50.0 per cent of total investment (fixed, non-residential) in Nova Scotia and 49.8 per cent in Canada in 2010, down from 56.8 per cent in Nova Scotia in 2004 (first year in the series where data by major asset type was available) and 57.9 per cent in Canada (Table 9).[8] The share of ICT investment in total nominal investment, however, remained fairly constant during the 1997-2010 period, both in Nova Scotia and in Canada as a whole, averaging 16.5 per cent in Nova Scotia and 18.1 per cent in Canada. Since M&E investment declined as a share of total investment during the 1997-2010 period, the fairly constant ICT shares imply that the relative importance of ICT investment in overall M&E investment increased over time. It is also important to point out that Nova Scotia's and Canada's ICT investment profiles were very similar. In 2010, for example, software investment was responsible for approximately 55.0 per cent of total ICT investment in both Nova Scotia and Canada. Next came investment in computers (25.0 per cent of total ICT investment), and finally investment in telecommunications equipment (20.0 per cent).

Table 9: Gross Investment (Fixed, Non-Residential) in Nova Scotia and Canada, Business Sector, 1997-2010

	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(real investment - compound annual growth rates, per cent)					
Total	**0.65**	**5.68**	**-0.81**	**3.10**	**5.42**	**2.41**
Building	-1.02	1.02	-1.62	-1.09	-3.75	-0.28
Engineering	9.21	56.82	-2.03	3.24	4.76	2.79
Machinery and Equipment	-0.99	-3.09	-0.35	3.96	7.75	2.85
Non-ICT Machinery and Equipment*	-3.25	-5.70	-2.50	1.76	5.32	0.71
ICT*	7.11	12.25	5.61	9.85	16.31	7.98
Computers*	13.49	20.25	11.54	17.83	39.19	12.09
Telecommunication Equipment*	4.52	25.21	-0.99	4.48	11.80	2.39
Software*	4.81	-3.20	7.34	7.69	8.68	7.40
	1997	2004	2010	1997	2004	2010
	(nominal investment - share of total investment, per cent)					
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Building	..	13.6	15.2	14.8	12.5	13.0
Engineering	..	29.6	34.8	24.7	29.5	37.2
Machinery and Equipment	..	56.8	50.0	60.6	57.9	49.8
Non-ICT Machinery and Equipment*	52.1	37.7	25.4	38.8	38.3	26.1
ICT*	17.0	17.8	16.1	17.2	20.2	16.8
Computers*	5.6	4.8	4.3	5.5	7.2	4.9
Telecommunication Equipment*	4.5	7.7	4.0	4.4	5.2	2.8
Software*	6.9	5.3	7.8	7.3	7.8	9.0

*Non-ICT M&E and ICT estimates refer to Nova Scotia's and Canada's total economy.
Source: CSLS calculations based on Statistics Canada data (CANSIM Table 031-0002).

[8] The reader should bear in mind that using real shares when dealing with chained dollar estimates is incorrect. Chained indexes, which are used to calculate chained dollar estimates, have an important advantage over fixed-base indexes – namely, they capture relative price changes whereas fixed-base indexes do not. However, chained indexes are not additive, that is, the sum of the individual components of the indexes does not equal the total, and thus it makes little sense to talk about real shares. For a discussion on the subject, see Whelan (2002).

While the relative importance of nominal M&E investment declined over time in Nova Scotia and in Canada, the share of engineering investment in total nominal investment increased substantially. In Nova Scotia, engineering investment represented 29.6 per cent of total nominal business sector investment in 2004, but by 2010 it accounted for 34.8 per cent, an increase of 5.2 percentage points. In Canada, the relative importance of engineering investment also increased, from 29.5 per cent in 2004 to 37.2 per cent in 2010, 7.6 percentage points.

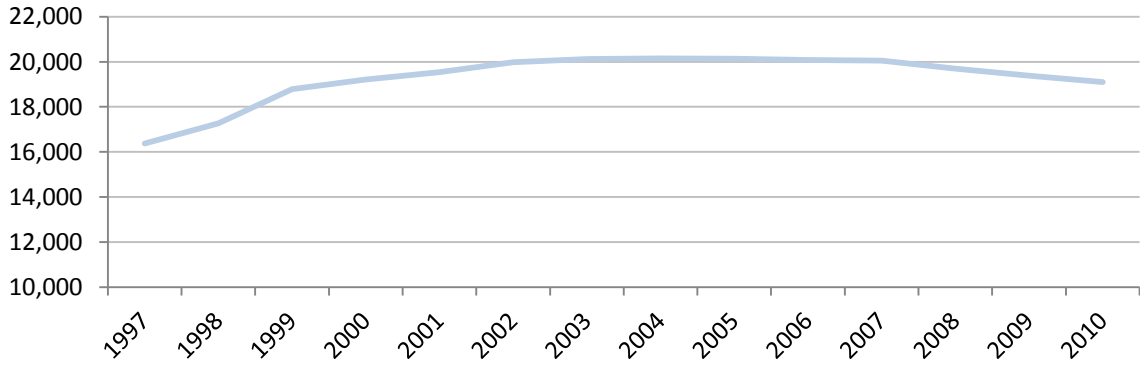
Given the relevance of M&E and ICT investment in productivity growth, it would also be interesting to look at how different sectors invested in these asset categories during the period in question. Unfortunately, ICT investment data broken down at the two-digit NAICS level are not available at the provincial level, only at the national level. M&E investment data are available for some sectors in Nova Scotia, such as retail trade, information and cultural industries, and FIRE, but the data are very limited. Due to confidentiality issues, Statistics Canada releases nominal M&E investment estimates only for the three aforementioned two-digit NAICS sectors in Nova Scotia (and the series encompass a very short time span, either from 2002 to 2010 or from 2005 to 2009). Real M&E investment estimates are available for a larger number of Nova Scotia's two-digit NAICS sectors, seven out of the 15 sectors, with most series spanning the 1997-2010 period. Since there are so many data gaps, however, any picture of M&E investment in Nova Scotia's two-digit NAICS sectors would be partial at best. Hence, we will not discuss these estimates here.[9]

ii. Fixed Capital Stocks

During the 1997-2010 period, Nova Scotia's real capital stock of fixed reproducible business assets grew at a compound annual rate of 1.20 per cent, from $16,369 million (chained 2002 dollars) in 1997 to $19,106 million (chained 2002 dollars) in 2010 (Chart 14). In nominal terms, Nova Scotia's capital stock accounted for 2.36 per cent of total capital stock in Canada in 2002 (first year in the series), but by 2010 the province's share had fallen to 1.80 per cent (Chart 15).

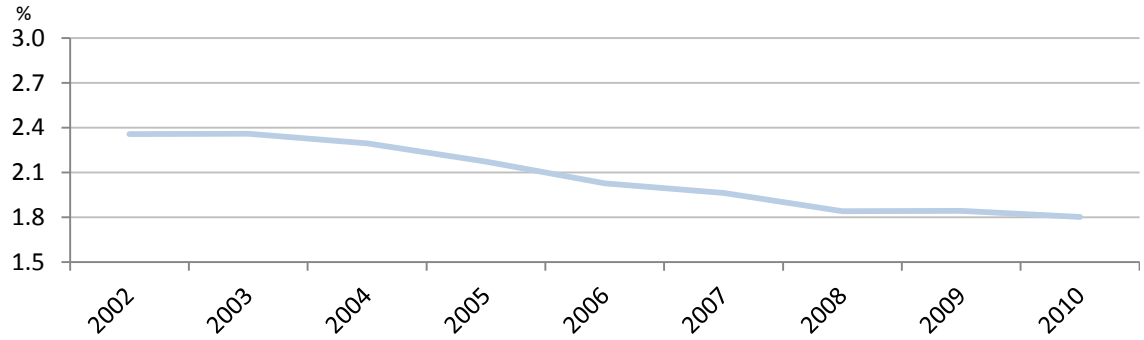
[9] See Tables 1 and 3 in the Data Appendix for growth rate estimates for total investment and M&E investment in Nova Scotia broken down at the two-digit NAICS level.

Chart 14: Fixed Non-Residential Net Capital Stock in Nova Scotia, Business Sector, 1997-2010 (Millions, Chained 2002 Dollars)



Source: CSLS Nova Scotia Productivity Database.

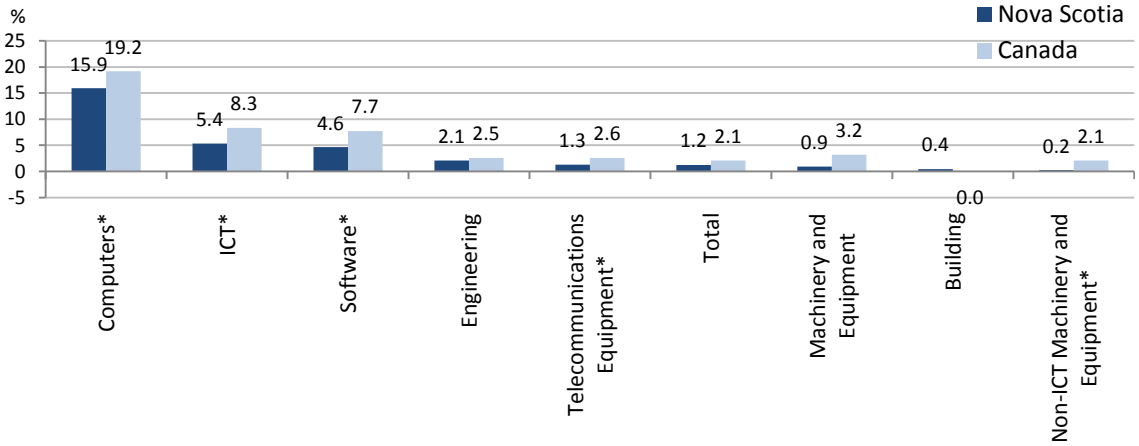
Chart 15: Fixed Non-Residential Net Capital Stock, Nova Scotia as a Share of Canada, Business Sector, 1997-2010 (Nominal Shares)



Source: Statistics Canada, Fixed Investment Flows and Stocks (CANSIM Tables 031-0003/04).

Table 10 and Chart 16 detail some of the key figures related to real capital stock growth and nominal capital stock shares by asset type. During the 1997-2010 period, real capital stock growth in Canada outpaced Nova Scotia's (2.09 per cent per year vs. 1.20 per cent per year). Looking at a breakdown by major asset type, we can see that engineering and M&E capital stock grew at a faster pace in Canada than in Nova Scotia, while the opposite was true in the case of building capital stock growth. The slow M&E capital stock growth in Nova Scotia was due to weak non-ICT M&E growth. Real ICT capital stock grew at very robust rates in both Nova Scotia and Canada (5.36 per cent per vs. 8.33 per cent per year, respectively), albeit at a faster pace in Canada.

Chart 16: Net Real Capital Stock Growth by Asset Type, Nova Scotia and Canada, Business Sector 1997-2010 (Compound Annual Growth Rates)



*Non-ICT M&E and ICT estimates refer to Nova Scotia's and Canada's total economy.
Source: Statistics Canada, Fixed Investment Flows and Stocks (CANSIM Tables 031-0003/04).

Table 10: Net Capital Stock by Asset Type in Nova Scotia and Canada, Business Sector, 1997-2010

	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(real capital stock - compound annual growth rates, per cent)					
Total	**1.20**	**5.49**	**-0.06**	**2.09**	**2.67**	**1.91**
Building	0.44	1.22	0.20	-0.01	0.92	-0.29
Engineering	2.07	12.49	-0.87	2.54	1.83	2.76
Machinery and Equipment	0.93	2.20	0.55	3.18	4.90	2.68
Non-ICT Machinery and Equipment*	0.22	1.14	-0.05	2.10	3.59	1.65
ICT*	5.36	6.26	5.09	8.33	11.16	7.50
Computers*	15.93	27.12	12.77	19.19	37.72	14.13
Telecommunications Equipment*	1.26	3.50	0.60	2.58	4.05	2.14
Software*	4.64	3.37	5.02	7.74	9.97	7.07
	1997	2004	2010	1997	2004	2010
	(nominal capital stock - share of total capital stock, per cent)					
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Building	..	24.0	30.5	27.6	27.5	25.9
Engineering	..	40.8	40.7	37.7	39.3	46.7
Machinery and Equipment	..	35.2	28.8	34.7	33.2	27.3
Non-ICT Machinery and Equipment*	23.8	23.0	17.6	23.0	24.0	16.9
ICT*	5.8	5.8	4.9	5.7	6.6	5.6
Computers*	1.1	1.2	1.1	1.2	1.6	1.3
Telecommunications Equipment*	2.7	2.6	1.5	2.3	2.3	1.2
Software*	2.0	2.0	2.3	2.3	2.7	3.2

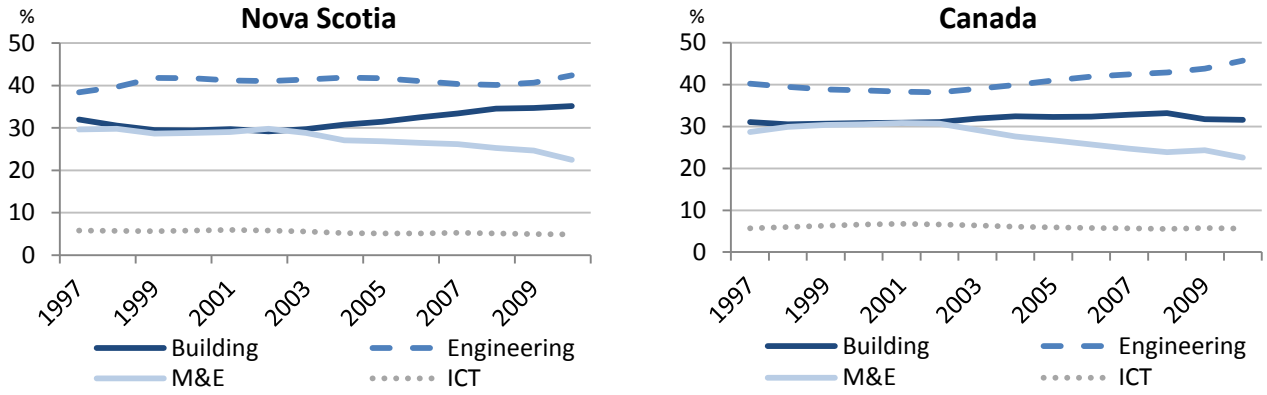
*Non-ICT M&E and ICT estimates refer to Nova Scotia's and Canada's total economy.
Source: Statistics Canada, Fixed Investment Flows and Stocks (CANSIM Tables 031-0003/04).

Breaking down the capital stock by major asset categories, we can see that, overall, Nova Scotia's capital composition is quite similar to Canada's (Table 10). In nominal terms, engineering capital stock accounted for the lion's share of total capital stock throughout the entire 1997-2010 period at both the provincial and national levels (Chart 17). The share of engineering capital in Nova Scotia changed little during the period, from 41.7 per cent in 2004 to

40.7 per cent in 2001. In Canada, the share of engineering capital stock in total capital stock saw more variation, from 39.3 per cent in 2004 to 46.7 per cent in 2010. Regarding buildings, its share in total capital stock increased in Nova Scotia (from 24.0 in 2004 to 30.5 in 2010), while decreasing at the national level (from 27.5 in 2004 to 25.9 in 2010). Machinery and equipment (M&E) capital stock, in turn, saw a substantial decline in both Nova Scotia (from 35.2 in 2004 to 28.8 in 2010) and Canada (from 33.2 in 2004 to 27.3 in 2010).

As we can see in Chart 17, the share of ICT capital stock in total nominal capital stock had a slight decline in Nova Scotia (from 5.8 per cent in 1997 to 4.9 per cent in 2010), while remaining almost constant in Canada (5.7 per cent in 1997 to 5.6 per cent in 2010) in the 1997-2010 period. It should be noted that, during the entire period, M&E prices in general, and ICT prices in particular were falling. As a consequence, (relatively) constant nominal shares imply that the importance of ICT real capital stock was actually increasing.

Chart 17: Capital Assets as a Share of Net Capital Stock in Nova Scotia and Canada, Total Economy, 1997-2010 (Nominal Shares)



Source: Statistics Canada, Fixed Investment Flows and Stocks (CANSIM Tables 031-0003/04).

A look at real capital stock growth by two-digit NAICS sectors can give us a more complete portrait of real capital stock trends in Nova Scotia and at the national level. Again, the importance of the Sable Island oil and gas development during the 1997-2000 period makes itself clear, with capital stock in the sector growing 27.52 per cent per year. As Table 11 shows, in terms of real capital stock growth, Canada outperformed Nova Scotia in most two-digit NAICS sectors during the 1997-2010 period. The few exceptions were: agriculture, forestry, fishing and hunting, ASWMRS, and accommodation and food services.

Table 11: Real Net Capital Stock Growth by Two-Digit NAICS Sectors and Special Industry Aggregations, Nova Scotia and Canada, 1997-2010

	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(compound annual growth rates, per cent)					
Business sector industries	**1.20**	**5.49**	**-0.06**	**2.09**	**2.67**	**1.91**
Business sector, goods	..	..	..	*1.72*	*0.99*	*1.94*
Agriculture, forestry, fishing and hunting	-0.12	0.76	-0.39	-0.46	0.32	-0.69
Mining and oil and gas extraction	4.48	27.52	-1.58	5.45	4.59	5.70
Utilities	..	..	..	0.85	-1.78	1.66
Construction	3.60	4.52	3.32	4.61	5.14	4.45
Manufacturing	-1.84	-2.85	-1.53	-1.61	0.93	-2.36
Non-durable manufacturing industries	..	..	..	..	..	..
Durable manufacturing industries	..	..	..	..	..	..
Business sector, services	..	..	..	*2.43*	*4.86*	*1.71*
Wholesale trade	2.57	12.11	-0.13	3.70	4.43	3.49
Retail trade	3.65	-2.36	5.52	3.91	3.50	4.03
Transportation and warehousing	3.21	13.27	0.36	2.67	5.87	1.73
Information and cultural industries	-0.32	2.98	-1.28	1.22	3.91	0.43
FIRE	..	..	..	1.51	4.78	0.55
Professional, scientific and technical services	8.17	21.33	4.51	9.72	23.93	5.79
ASWMRS	10.84	3.95	13.00	8.01	2.24	9.80
Arts, entertainment and recreation	..	..	..	4.02	3.76	4.10
Accommodation and food services	3.58	4.31	3.36	1.71	-0.33	2.33
Other private services	2.39	6.49	1.19	2.62	4.03	2.20
ICT Sector	**..**	**..**	**..**	**..**	**..**	**..**

Source: CSLS Nova Scotia Productivity Database.

iii. Capital Services

The capital stock held by firms can be seen as a repository of capital services, which represent the actual input used in the production process. The difference between capital stock and capital services stems from the fact that not all types of capital assets provide services at the same rate. Short-lived assets, such as a car or a computer, must provide all of their services in just a few years before they completely depreciate. Office buildings, on the other hand, provide their services over decades. As a consequence, over a single year, a dollar's worth of a car provides relatively more capital services than a dollar's worth of a building. Thus, capital services growth is driven by: 1) increases in the level of **capital stock**; and 2) shifts in the **capital composition** caused by more investment in assets that provided relatively more services per dollar of capital stock (i.e. short lived assets). The CSLS Provincial Productivity Database provides capital services and capital composition estimates for Canada and the provinces for the 1997-2007 period.[10]

Table 12 shows that capital services in Nova Scotia's market sector grew at a compound annual rate of 2.60 per cent from 1997 to 2010, whereas the growth rate observed at the national level was 4.19 per cent per year. At the two-digit NAICS level, the province outperformed Canada as a whole in terms of capital services growth in the following sectors: manufacturing (0.82 per cent per year vs. 0.52 per cent per year in Canada), ASWMRS (8.58 per cent vs. 6.31

[10] It is important to note that the estimates from the CSLS Provincial Productivity Database are not entirely consistent with the estimates from Statistics Canada's Fixed Capital Flows and Stocks survey. The differences may be to a variety of reasons, including: data revisions, different definitions, differences in methodology, etc.

per cent), arts, entertainment and recreation (5.33 per cent vs. 4.52 per cent), accommodation and food services (1.46 per cent vs. 1.33 per cent), and other private services (11.16 per cent vs. 10.22 per cent). Overall, these estimates are consistent with the capital stock estimates discussed in the previous subsection.

Table 12: Capital Services Growth in Nova Scotia and Canada, 1997-2010

	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(per cent)					
Business sector industries	**2.60**	**4.54**	**2.03**	**4.19**	**5.40**	**3.84**
Agriculture, forestry, fishing and hunting	-0.46	0.20	-0.66	-0.31	-0.65	-0.21
Mining and oil and gas extraction	-0.79	0.96	-1.32	6.50	4.56	7.09
Utilities	-0.49	-3.31	0.38	1.61	-0.74	2.32
Construction	4.15	4.20	4.13	5.85	4.11	6.37
Manufacturing	0.82	-0.46	1.21	0.52	3.53	-0.37
Wholesale trade	3.59	11.43	1.34	5.14	5.46	5.05
Retail trade	4.95	-1.74	7.04	5.77	4.91	6.03
Transportation and warehousing	3.10	9.17	1.35	4.66	8.37	3.57
Information and cultural industries	1.22	8.20	-0.78	3.26	9.76	1.38
FIRE	3.15	6.09	2.28	4.52	8.21	3.43
Professional, scientific and technical services	5.50	9.08	4.45	7.99	16.15	5.66
ASWMRS	8.58	-5.02	13.03	6.31	-2.96	9.26
Arts, entertainment and recreation	5.33	19.87	1.32	4.52	5.13	4.34
Accommodation and food services	1.46	-0.86	2.16	1.33	-2.29	2.44
Other private services	11.16	16.08	9.72	10.22	15.14	8.78

Source: CSLS Provincial Productivity Database.

Nova Scotia's business sector underperformed Canada's in terms of capital composition growth during the 1997-2010 period (0.69 per cent per year vs. 1.18 per cent per year in Canada) (Chart 13). At the two-digit NAICS level, the province's capital composition increased at a faster pace than Canada's in only two sectors: manufacturing (2.16 per cent per year vs. 1.35 per cent per year, respectively) and ASWMRS (1.56 per cent vs. 1.49 per cent).

Table 13: Capital Composition Growth in Nova Scotia and Canada, 1997-2010

	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(per cent)					
Business sector industries	**0.69**	**-0.88**	**1.17**	**1.18**	**2.19**	**0.88**
Agriculture, forestry, fishing and hunting	-0.01	0.30	-0.11	0.29	0.03	0.37
Mining and oil and gas extraction	-4.57	-18.50	0.05	0.40	0.31	0.43
Utilities	..	..	..	0.44	1.24	0.20
Construction	0.43	0.75	0.34	0.63	-0.37	0.94
Manufacturing	2.16	1.94	2.22	1.35	1.89	1.19
Wholesale trade	0.54	-0.14	0.74	0.56	1.24	0.36
Retail trade	0.44	0.20	0.51	0.53	0.93	0.41
Transportation and warehousing	-0.56	-2.62	0.07	1.30	2.94	0.81
Information and cultural industries	0.55	1.23	0.35	0.86	1.62	0.63
FIRE	..	..	..	1.16	3.24	0.55
Professional, scientific and technical services	0.23	-0.16	0.35	0.88	2.32	0.46
ASWMRS	1.56	-2.38	2.77	1.49	1.55	1.47
Arts, entertainment and recreation	..	..	..	2.50	4.78	1.82
Accommodation and food services	-0.16	-0.94	0.08	0.59	0.05	0.75
Other private services	4.08	6.51	3.36	4.69	9.26	3.36

Source: CSLS Provincial Productivity Database.

IV. Productivity Trends and Levels in Nova Scotia

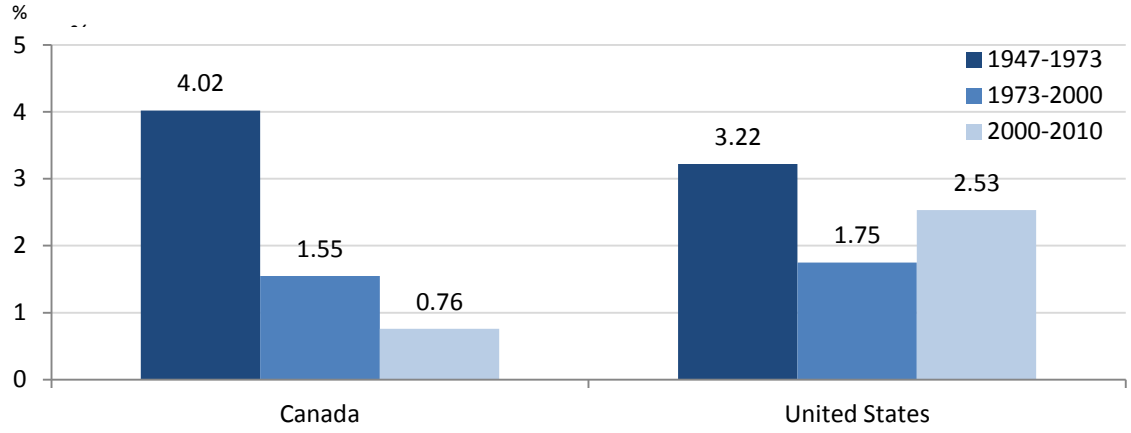
This section of the report provides a detailed examination of labour and capital productivity growth rates and levels in Nova Scotia relative to the national average, Before beginning this discussion however it is useful to put Nova Scotia's productivity performance in the Canadian context.

Relative to other developed countries, and particularly relative to the United States, Canada's performance on most economic indicators in the 2000s has been fairly good. However, this has not been the case for Canada's productivity performance, which has been abysmal.

Chart 18 shows that output per hour growth in the business sector in Canada fell to 0.76 per cent per year in the 2000-2010 period from 1.55 per cent in 1973-2000 and 4.02 per cent in 1947-1973. In contrast in the United States, output per hour growth between 2000 and 2010 was 2.53 per cent per year, over three times the rate experienced in Canada. Chart 19 show that this large gap in labour productivity growth rates between the two countries led to a precipitous fall in Canada's relative productivity level, from 84.3 per cent of the U.S. business sector level in 2000 to 70.7 per cent in 2010. The fall-off in productivity growth in Canadian manufacturing, linked to much slower foreign demand growth for manufactured goods, has been identified as the major industry source of this slower productivity growth after 2000 (Sharpe and Thomson, 2010 and Almon and Tang, 2011).

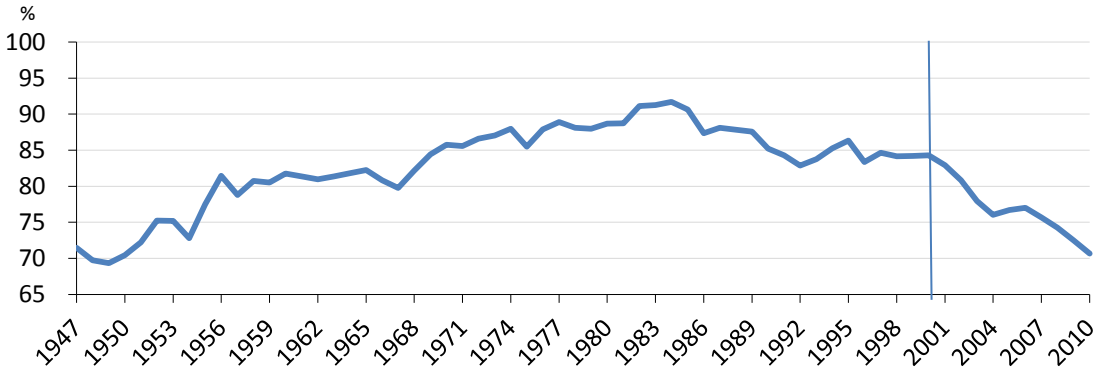
Given the role of productivity as the source of long run increases in living standards, discussed earlier in the report, policies to improve productivity performance lie at the core of the economic policy agenda for this country.

Chart 18: Labour Productivity Growth in Canada and the United States, Business Sector, 1947-2010 (compound annual growth rates, per cent)



Source: CSLS Provincial Productivity Database.

Chart 19: Relative Labour Productivity Levels in Canada, Business Sector, 1947-2010 (Canada as a per cent of the United States, U.S.=100.0)



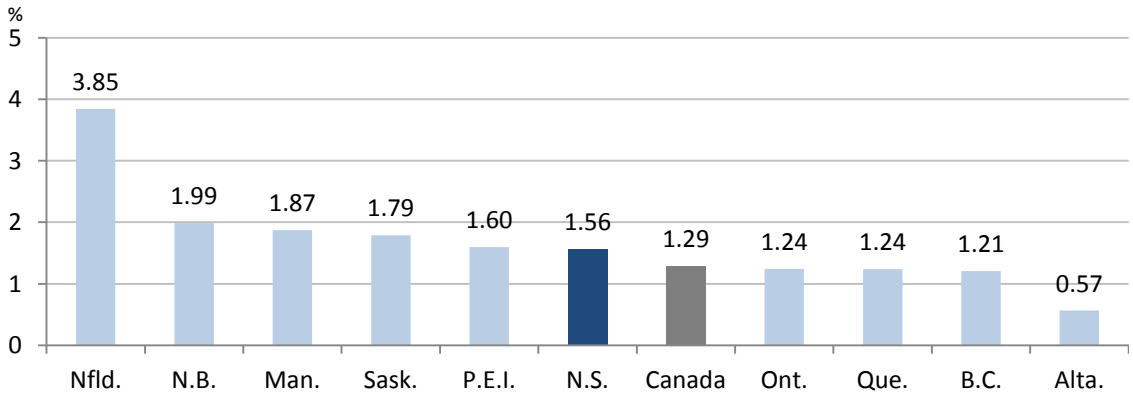
Source: CSLS Provincial Productivity Database.

This part of the report highlights Nova Scotia's productivity performance during the 1997-2010 period, comparing it to the performance of Canada as a whole. First, labour productivity figures are analyzed; next, capital productivity numbers are discussed.

A. Labour Productivity

Labour productivity, defined here as real GDP per hour worked, increased 1.56 per cent per year in Nova Scotia during the 1997-2010 period, above the national average of 1.29 per cent (Chart 20). Compared to the other provinces, Nova Scotia ranked 6th in terms of labour productivity growth, slightly below Prince Edward Island (which grew 1.60 per cent per year). Newfoundland and Labrador was the province that experienced the strongest labour productivity growth in the period (3.85 per cent per year), while Alberta observed the weakest growth (0.57 per cent per year), with both results being driven by the oil and gas extraction sector.

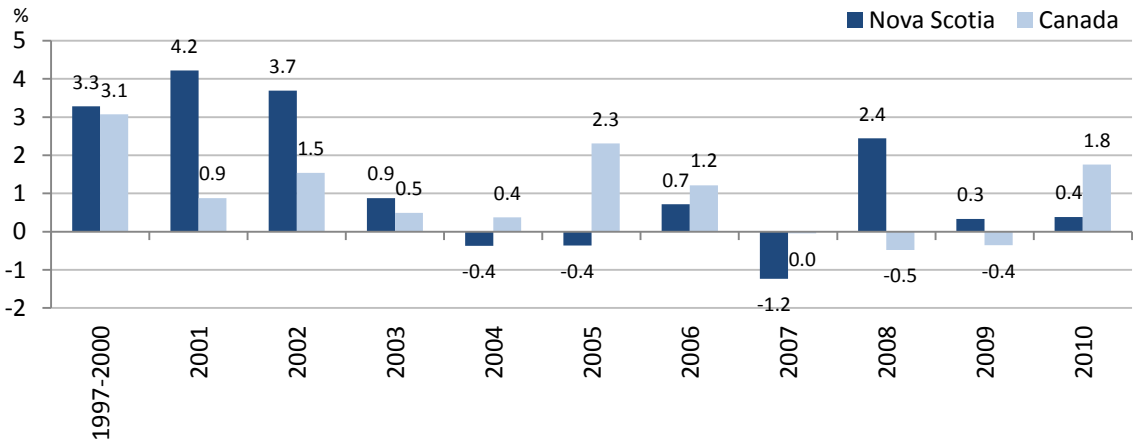
Chart 20: Labour Productivity Growth in Canada and the Provinces, Business Sector, 1997-2010 (Compound Annual Growth Rates)



Source: CSLS Nova Scotia Productivity Database.

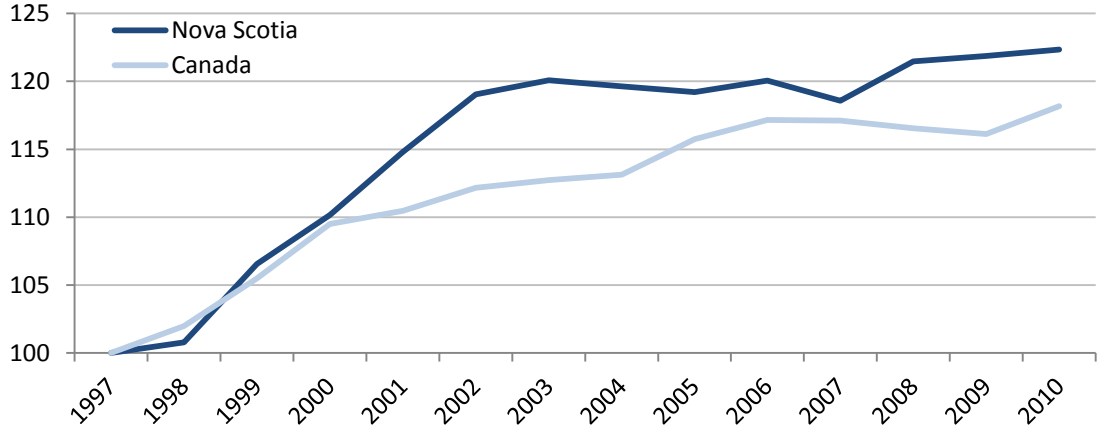
A more detailed look at what happened to Nova Scotia's labour productivity growth during the period shows that the province had an exceptional performance during the 1997-2002 period, outpacing Canada by far in 2001 and 2002 (Chart 21, Chart 22). Starting in 2003, however, provincial growth rates plummeted to numbers consistent with or below the national average (except in 2008).

Chart 21: Labour Productivity Growth in Nova Scotia and Canada, Business Sector, 1997-2010



Source: CSLS Nova Scotia Productivity Database.

Chart 22: Labour Productivity Growth in Nova Scotia and Canada, Business Sector, 1997-2010 (Index 1997=100.0)

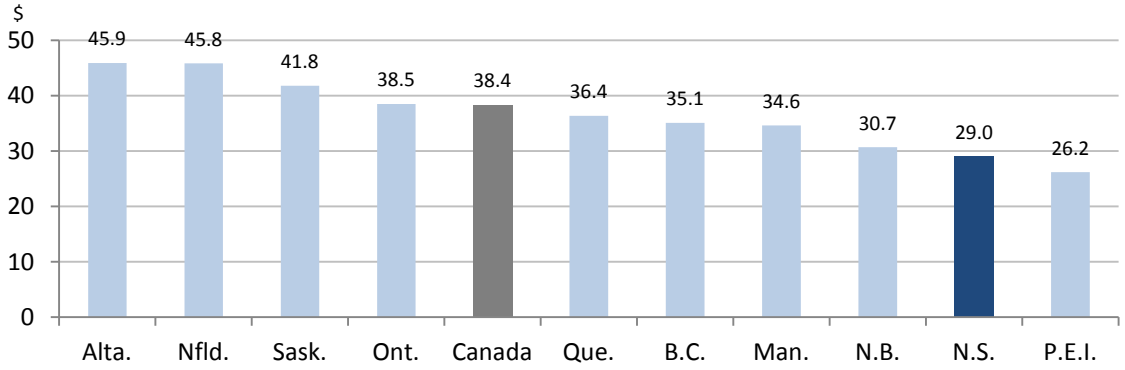


Source: CSLS Nova Scotia Productivity Database.

Despite the above average growth of labour productivity, Nova Scotia's labour productivity level, expressed in chained 2002 dollars, was $29.03 per hour in 2010, well below the national average of $38.37 per hour (Chart 23). In fact, the province's labour productivity

level was only higher than that of Prince Edward Island ($26.19 per hour). The provinces of Alberta and Newfoundland and Labrador had the highest labour productivity levels in the country ($45.87 per hour and $45.83 per hour, respectively).

Chart 23: Labour Productivity Levels in Canada and the Provinces, Business Sector, 2010 (Chained 2002 Dollars per Hour Worked)



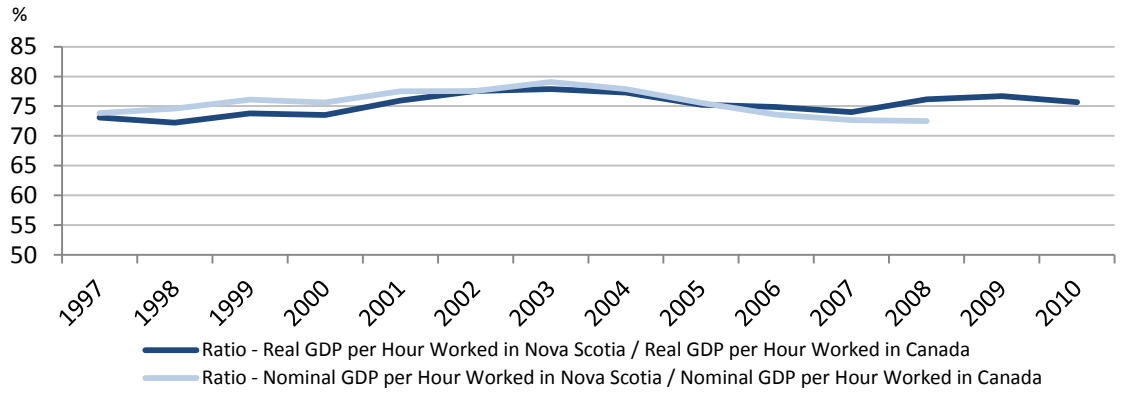
Source: CSLS Nova Scotia Productivity Database.

Given that Nova Scotia's labour productivity grew only slightly more than the national average (0.27 percentage points), it should not be surprising that the province's labour productivity level as a share of Canada's saw only a small increase during the 1997-2010 period, from 73.1 per cent in 1997 to 75.7 per cent in 2010 (although it reached 77.9 per cent in 2003) (Chart 24). The picture is similar if, instead of looking at *real* labour productivity levels we focus on *nominal* labour productivity levels (nominal GDP per hour worked), with the province's level as a share of Canada's going from 73.9 per cent in 1997 to 72.5 per cent in 2008 (last year of available data), after peaking at 79.1 in 2003. The similarity between nominal and real trends is due to the fact that the implicit price deflators for Nova Scotia and Canada evolved in very similar ways throughout the entire period (see section III-A-iii).

The finding that in 2010 the level of business sector labour productivity in Nova Scotia was 75.7 per cent of the national average can be expressed as a proportion of the US labour productivity level by applying the Canada/US productivity relative for that year. As noted earlier, output per hour in the Canadian business sector in 2010 was 70.7 per cent of the U.S. level. This means that Nova Scotia business sector labour productivity was just slightly above one half the U.S. level at 53.5 per cent. In other words, the average American worker was almost twice as productive as the average worker in Nova Scotia.

Table 14 summarizes the main points discussed up until this point regarding labour productivity growth rates and levels in Nova Scotia, the other provinces, and Canada as a whole. In addition, this table provides relative labour productivity levels, i.e. the provincial productivity levels as a per cent of Canada's.

Chart 24: Labour Productivity Levels in Nova Scotia as a Share of Canada, Business Sector, 1997-2010



Source: CSLS Nova Scotia Productivity Database.

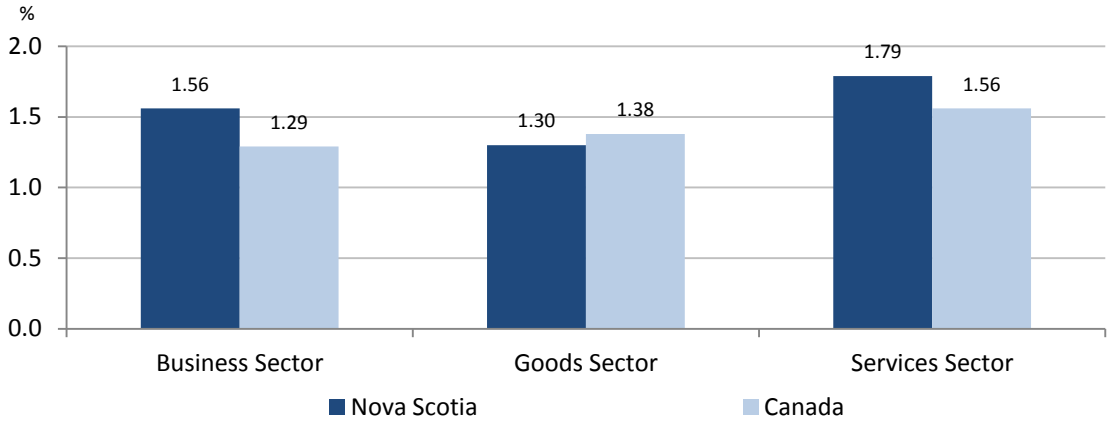
Table 14: Labour Productivity in Canada and the Provinces, Business Sector, 1997-2010

	1997-2010	1997-2000	2000-2010
	(compound annual growth rates, per cent)		
Canada	**1.29**	**3.07**	**0.76**
Newfoundland and Labrador	3.85	5.67	3.31
Prince Edward Island	1.60	2.05	1.46
Nova Scotia	**1.56**	**3.28**	**1.05**
New Brunswick	1.99	2.58	1.81
Quebec	1.24	2.79	0.78
Ontario	1.24	3.85	0.47
Manitoba	1.87	3.34	1.44
Saskatchewan	1.79	3.28	1.34
Alberta	0.57	1.84	0.19
British Columbia	1.21	2.16	0.92
	1997	2000	2010
	(chained 2002 dollars per hours worked)		
Canada	**32.5**	**35.6**	**38.4**
Newfoundland and Labrador	28.1	33.1	45.8
Prince Edward Island	21.3	22.7	26.2
Nova Scotia	**23.7**	**26.1**	**29.0**
New Brunswick	23.8	25.6	30.7
Quebec	31.0	33.7	36.4
Ontario	32.8	36.8	38.5
Manitoba	27.2	30.0	34.6
Saskatchewan	33.2	36.6	41.8
Alberta	42.6	45.0	45.9
British Columbia	30.0	32.0	35.1
	1997	2000	2010
	(as a per cent of Canada)		
Canada	**100.0**	**100.0**	**100.0**
Newfoundland and Labrador	86.4	93.1	119.4
Prince Edward Island	65.7	63.7	68.3
Nova Scotia	**73.1**	**73.5**	**75.7**
New Brunswick	73.2	72.1	80.0
Quebec	95.4	94.7	94.8
Ontario	101.1	103.4	100.4
Manitoba	83.8	84.4	90.2
Saskatchewan	102.3	102.9	109.0
Alberta	131.3	126.6	119.6
British Columbia	92.4	90.0	91.4

Source: CSLS Nova Scotia Productivity Database.

Labour productivity increased faster in Nova Scotia's services sector than in Canada's during the 1997-2010 period (1.79 per cent vs. 1.56 per cent, respectively) (Chart 25). In the goods sector, however, the opposite happened, with labour productivity in Canada growing faster than in Nova Scotia (1.38 per cent per year vs. 1.30 per cent per year).

Chart 25: Labour Productivity Growth in Nova Scotia's and Canada's Goods Sectors and Services Sector, 1997-2010 (compound annual growth rates, per cent)



Source: CSLS Nova Scotia Productivity Database.

At the two-digit NAICS level, two out of the three largest sectors in Nova Scotia (in terms of hours worked shares) outperformed their Canadian counterparts (Table 15). Labour productivity growth in the province's retail trade sector reached 2.91 per cent per year (vs. 2.74 per cent per year in Canada), while the growth rate in the province's construction sector was 1.14 per cent per year (vs. 0.81 per cent per year in Canada). Nova Scotia's manufacturing sector, however, underperformed Canada's in terms of labour productivity growth (1.56 per cent per year vs. 1.76 per cent per year).

As mentioned previously, the labour productivity level of Nova Scotia's business sector was significantly below the national average throughout the 1997-2010 period. Looking at the two-digit NAICS breakdown, it can be seen that the province's labour productivity levels were below Canada's in all but two two-digit NAICS sectors in 2010 – namely, utilities ($174.99 per hour vs. $152.09 per hour) and information and cultural industries ($72.51 per hour vs. $62.47 per hour). This issue is discussed in more detail in part five.

Table 15: Labour Productivity Growth Rates and Levels by Two-Digit NAICS Sectors and Special Industry Aggregations, Nova Scotia and Canada, 1997-2010

	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(compound annual growth rates, per cent)					
Business sector industries	**1.56**	**3.28**	**1.05**	**1.29**	**3.07**	**0.76**
Business sector, goods	*1.30*	*4.45*	*0.37*	*1.38*	*4.61*	*0.43*
Agriculture, forestry, fishing and hunting	3.73	5.86	3.10	4.88	8.58	3.80
Mining and oil and gas extraction	3.33	39.20	-5.51	-1.35	3.92	-2.88
Utilities	1.03	-6.55	3.43	-0.54	0.52	-0.85
Construction	1.13	4.52	0.13	0.81	3.69	-0.04
Manufacturing	1.56	-0.07	2.05	1.77	5.06	0.81
Non-durable manufacturing industries	1.29	1.21	1.32	1.49	3.39	0.93
Durable manufacturing industries	2.55	-0.27	3.42	1.92	6.21	0.67
Business sector, services	*1.79*	*2.59*	*1.55*	*1.56*	*2.34*	*1.32*
Wholesale trade	3.08	5.44	2.38	3.29	4.83	2.83
Retail trade	2.91	2.95	2.90	2.74	4.10	2.33
Transportation and warehousing	1.61	4.61	0.73	1.01	1.28	0.92
Information and cultural industries	4.30	7.93	3.24	1.68	0.57	2.01
FIRE	0.60	2.18	0.14	1.39	1.85	1.25
Professional, scientific and technical services	0.07	0.72	-0.12	1.08	3.17	0.46
ASWMRS	0.04	2.48	-0.68	0.00	-0.10	0.03
Arts, entertainment and recreation	-2.68	-9.49	-0.55	-0.46	-0.80	-0.35
Accommodation and food services	0.92	1.17	0.85	0.63	1.14	0.48
Other private services	2.47	3.57	2.14	0.73	1.12	0.61
ICT Sector*	**..**	**..**	**..**	**4.96**	**11.42**	**3.10**
	1997	2000	2010	1997	2000	2010
	(chained 2002 dollars per hour worked)					
Business sector industries	23.73	26.14	29.03	32.47	35.55	38.37
Business sector, goods	27.81	31.69	32.89	40.98	46.91	48.96
Agriculture, forestry, fishing and hunting	17.95	21.29	28.90	20.04	25.66	37.26
Mining and oil and gas extraction	57.15	154.13	87.49	141.69	159.01	118.67
Utilities	153.07	124.92	174.99	163.15	165.71	152.09
Construction	20.21	23.08	23.37	25.32	28.23	28.11
Manufacturing	29.20	29.14	35.69	40.35	46.80	50.71
Non-durable manufacturing industries	29.14	30.21	34.44	40.97	45.29	49.66
Durable manufacturing industries	27.27	27.05	37.85	39.98	47.89	51.22
Business sector, services	21.88	23.62	27.54	27.84	29.85	34.03
Wholesale trade	27.24	31.93	40.39	28.53	32.88	43.44
Retail trade	12.70	13.85	18.43	16.91	19.07	24.02
Transportation and warehousing	23.67	27.10	29.13	31.75	32.98	36.15
Information and cultural industries	41.94	52.73	72.51	50.31	51.17	62.47
FIRE	59.96	63.97	64.85	63.60	67.21	76.11
Professional, scientific and technical services	24.71	25.25	24.95	26.79	29.41	30.80
ASWMRS	16.35	17.60	16.44	21.53	21.46	21.52
Arts, entertainment and recreation	21.47	15.92	15.07	21.34	20.83	20.11
Accommodation and food services	11.66	12.07	13.14	14.18	14.67	15.39
Other private services	15.24	16.94	20.93	21.08	21.80	23.17
ICT Sector*	**..**	**..**	**..**	**33.76**	**46.69**	**63.35**

*Labour productivity estimates for the Canadian ICT sector were constructed by the CSLS using employment data from Statistics Canada's Survey of Employment, Payrolls and Hours (SEPH). Estimates for Nova Scotia's ICT sector could not be calculated because employment data were missing for most of the industries which are part of ICT sector. See Appendix Tables 9-12 for more details.

Source: CSLS Nova Scotia Productivity Database.

Table 16 and Chart 26 provide a breakdown of the contribution of each two-digit NAICS sector to the labour productivity growth differential (of 0.27 percentage points) between Nova

Scotia and Canada during the 1997-2010 period.[11] As the charts show, the sector that contributed the most to Nova Scotia's greater productivity growth was other private services (accounting for 0.18 percentage points of the gap or 67.6 per cent of the total gap), followed by retail trade (0.10 percentage points or 37.9 per cent of the gap) and mining and oil and gas extraction (0.08 percentage points or 30.1 per cent of the gap). Other sectors that had positive, albeit smaller contributions to the labour productivity growth differential include information and cultural industries; construction; transportation and warehousing; utilities; and accommodation and food services.

On the other hand, the Nova Scotia's manufacturing sector dragged down the province's overall productivity growth, reducing the labour productivity differential by 0.07 percentage points (28.8 per cent of the total gap). The FIRE and ASWMRS sectors also had relevant negative contributions to the overall productivity differential (0.07 and 0.05 percentage points, respectively), followed by agriculture, forestry, fishing and hunting; wholesale trade; professional, scientific and technical services; and arts, entertainment and recreation.

Table 16: Contribution to the Labour Productivity Growth Differential between Nova Scotia and Canada during the 1997-2010 period

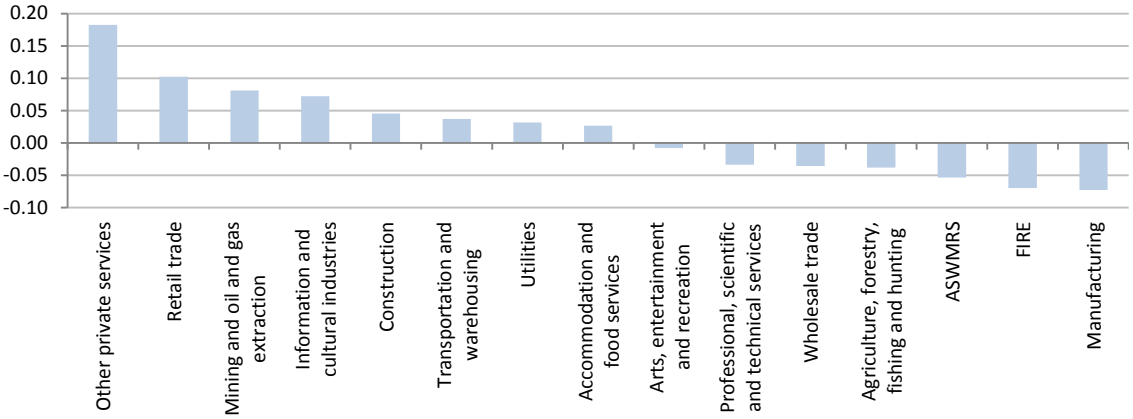
	Labour Productivity Growth (CAGR), 1997-2010			Average Hours Shares (1997 and 2010)		Contribution to Growth Rate Differential	
	Nova Scotia	Canada	Δ	Nova Scotia	Canada	Percentage Points	Per Cent
	A	B	C=B-A	D	E	F	G
Business Sector	**1.56**	**1.29**	**0.27**	**100.0**	**100.0**	**0.27**	**100.0**
Agriculture, forestry, fishing and hunting	3.73	4.88	-1.15	5.2	4.3	-0.04	-14.0
Mining and oil and gas extraction	3.33	-1.35	4.68	1.1	1.8	0.08	30.1
Utilities	1.03	-0.54	1.57	0.6	0.8	0.03	11.8
Construction	1.13	0.81	0.32	11.5	9.9	0.05	16.9
Manufacturing	1.56	1.77	-0.22	12.8	15.7	-0.07	-26.8
Wholesale trade	3.08	3.29	-0.21	5.9	7.0	-0.04	-13.1
Retail trade	2.91	2.74	0.17	17.9	13.0	0.10	37.9
Transportation and warehousing	1.61	1.01	0.60	6.1	6.3	0.04	13.8
Information and cultural industries	4.30	1.68	2.62	2.3	2.6	0.07	26.7
FIRE	0.60	1.39	-0.79	6.6	7.8	-0.07	-25.8
Professional, scientific and technical services	0.07	1.08	-1.01	5.3	7.1	-0.03	-12.5
ASWMRS	0.04	0.00	0.05	4.6	4.9	-0.05	-19.7
Arts, entertainment and recreation	-2.68	-0.46	-2.23	1.3	1.7	-0.01	-2.8
Accommodation and food services	0.92	0.63	0.29	8.1	7.3	0.03	10.0
Other private services	2.47	0.73	1.74	10.7	9.6	0.18	67.6

Source: CSLS Nova Scotia Productivity Database.

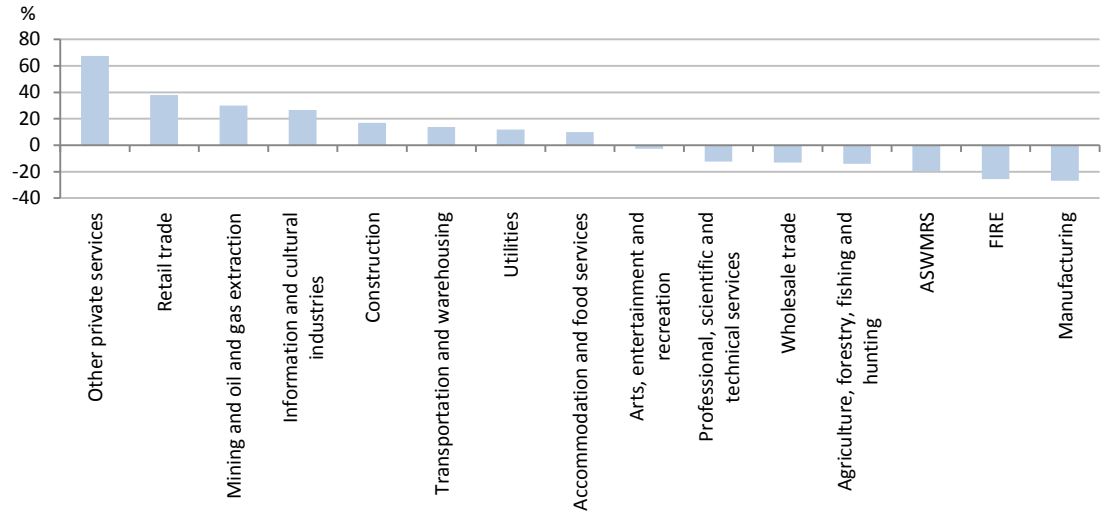
[11] This decomposition is a function of both the size of the industry-specific labour productivity growth gap and the importance of the sector as measured by its hours share. The formula for the decomposition of business sector labour productivity growth rate is found in Appendix 2.

Chart 26: Contribution to the Labour Productivity Growth Differential between Nova Scotia and Canada during the 1997-2010 Period

A) Percentage Points



B) Per Cent



Source: CSLS Nova Scotia Productivity Database.

B. Capital Productivity

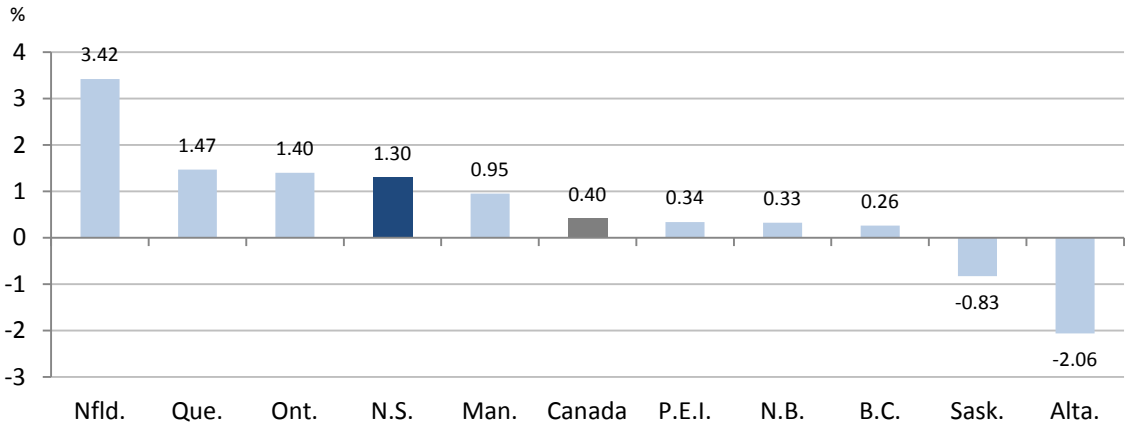
Capital productivity, defined here as real GDP per $1,000 of real capital stock, increased 1.30 per cent per year in Nova Scotia during the 1997-2010 period, more than three times the growth rate observed at the national level, 0.40 per cent per year (Table 17, Chart 27). Compared to the other provinces, Nova Scotia ranked 4th in terms of capital productivity growth, just below Ontario (1.40 per cent per year), and Quebec (1.47 per cent per year). Once again, Newfoundland and Labrador was the province which saw the strongest capital productivity growth in the period (3.42 per cent per year), while Alberta observed the weakest growth (-2.06 per cent per year).

Table 17: Capital Productivity in Canada and the Provinces, Business Sector, 1997-2010

	1997-2010	1997-2000	2000-2010
	(compound annual growth rates, per cent)		
Canada	**0.40**	**3.05**	**-0.38**
Newfoundland and Labrador	3.42	6.53	2.50
Prince Edward Island	0.34	2.00	-0.16
Nova Scotia	**1.30**	**0.26**	**1.62**
New Brunswick	0.33	1.59	-0.05
Quebec	1.47	4.17	0.67
Ontario	1.40	5.10	0.31
Manitoba	0.95	1.84	0.68
Saskatchewan	-0.83	0.59	-1.25
Alberta	-2.06	-1.26	-2.30
British Columbia	0.26	1.91	-0.23
	1997	2000	2010
	(chained 2002 dollars per unit of capital stock)		
Canada	**865**	**946**	**911**
Newfoundland and Labrador	440	531	680
Prince Edward Island	893	948	933
Nova Scotia	**771**	**777**	**912**
New Brunswick	755	792	788
Quebec	865	978	1,046
Ontario	1,002	1,163	1,200
Manitoba	801	846	906
Saskatchewan	668	680	600
Alberta	754	726	575
British Columbia	875	926	905

Source: CSLS Nova Scotia Productivity Database.

Chart 27: Capital Productivity Growth in Canada and the Provinces, Business Sector, 1997-2010 (Compound Annual Growth Rates)

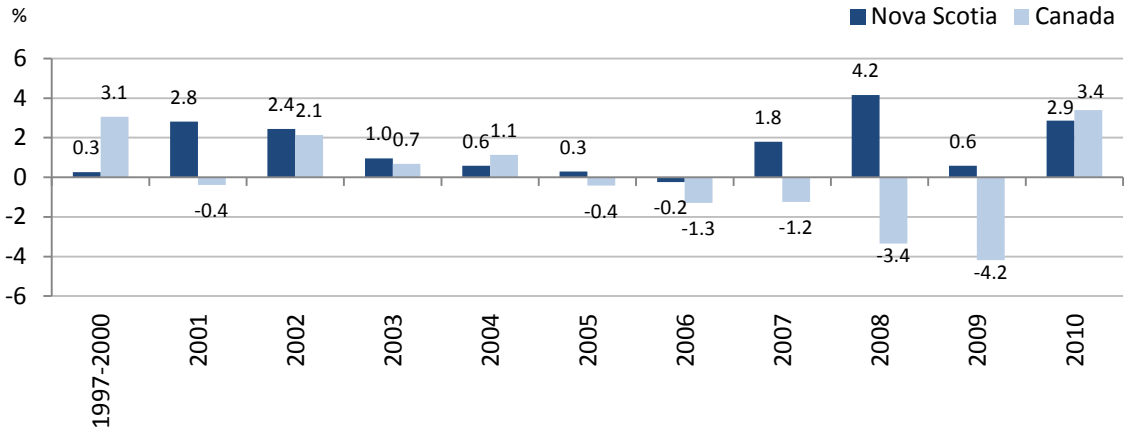


Source: CSLS Nova Scotia Productivity Database.

A closer look at Nova Scotia's capital productivity growth during the period shows that after experiencing below average growth during the 1997-2000 period (0.26 per cent per year vs. 3.05 per cent per year in Canada), there was a substantial increase of capital productivity in 2001 (2.82 per cent vs. -0.38 per cent in Canada) (Chart 28). Capital productivity growth in the

province then slowed down until 2006, after which it gained momentum once more. The difference between the capital productivity growth rates observed in Nova Scotia and Canada were especially acute during the 2007-2009 period, when the province saw relatively strong growth rates while Canada actually saw a decline in capital productivity.

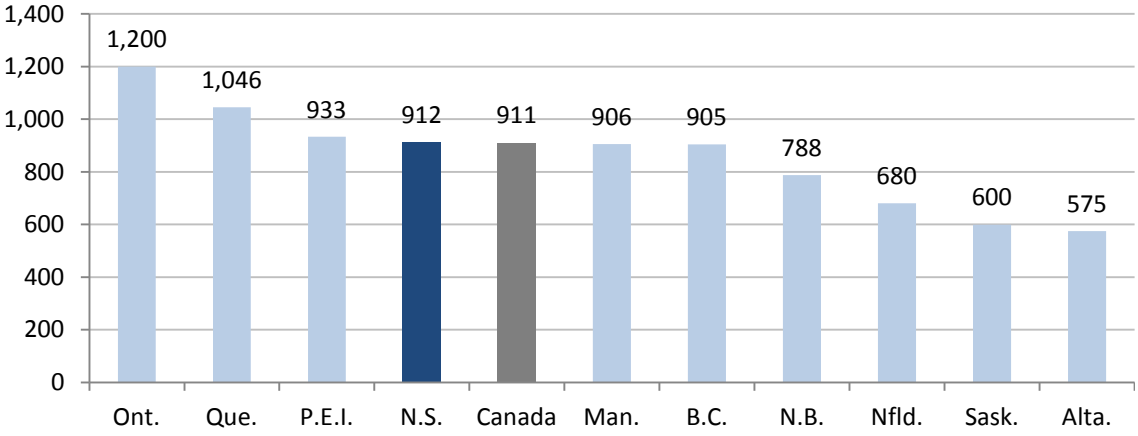
Chart 28: Capital Productivity Growth in Canada and the Provinces, Business Sector, 1997-2010



Source: CSLS Nova Scotia Productivity Database.

Nova Scotia also experienced a relatively high capital productivity level, with $912 of output being produced per $1,000 of capital stock in 2010, practically the same as the national average of $911 (Chart 29). Nova Scotia ranked 4th in terms of capital productivity levels when compared to other provinces, only behind Ontario ($1,200), Quebec ($1,046), and slightly below Prince Edward Island ($933).

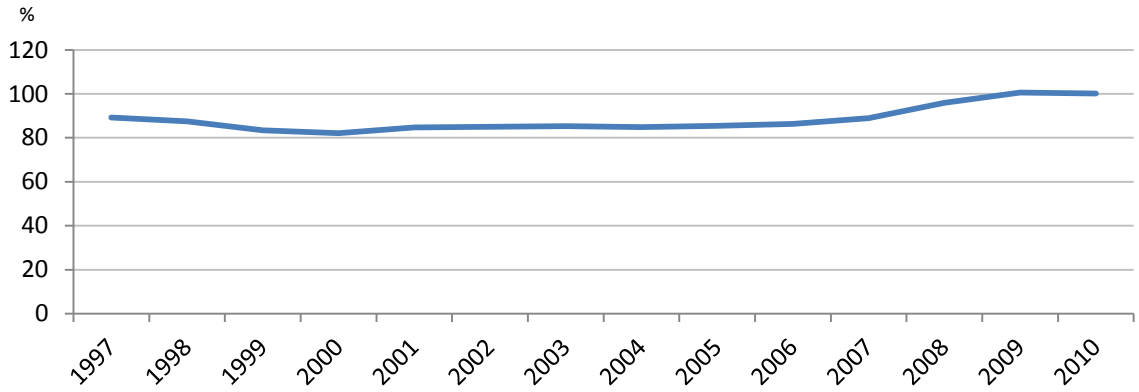
Chart 29: Capital Productivity Levels in Canada and the Provinces, Business Sector, 2010 (chained 2002 dollars of GDP per $1,000 of real capital stock)



Source: CSLS Nova Scotia Productivity Database.

During most of the 1997-2010 period, Nova Scotia's capital productivity level was below Canada's, representing 89.2 per cent of the national level in 1997 and 84.8 per cent in 2005. In 2006, however, the province's relative capital productivity level started to increase consistently, due both to capital productivity growth in Nova Scotia and to the sharp decline in capital productivity at the national level. By 2010, the province's capital productivity had caught up with Canada's (Chart 30).

Chart 30: Nova Scotia's Capital Productivity Level as a Share of Canada's, Business Sector, 1997-2010



Source: CSLS Nova Scotia Productivity Database.

Table 18 provides capital productivity growth rates and levels for two-digit NAICS sectors in Nova Scotia and Canada. Two out of three of Nova Scotia's largest sectors (in terms of hours worked shares) outperformed their counterparts at the national level in terms of capital productivity growth. Capital productivity in the province's manufacturing sector increased 2.95 per cent per year during the 1997-2010 period (vs. 1.97 per cent in Canada), while in the province's construction sector it grew 0.20 per cent per year (vs. -0.82 per cent per year in Canada). Nova Scotia's retail trade observed slightly lower capital productivity growth than Canada as a whole (0.06 per cent per year vs. 0.24 per cent per year). Overall, Nova Scotia outpaced Canada as a whole in eight of the 12 sectors for which capital productivity estimates were available (for the province). The only exceptions were retail trade; transportation and warehousing; professional, scientific and technical services; and accommodation and food services, all of which grew faster at the national level.

Table 18: Capital Productivity Growth Rates and Levels by Two-Digit NAICS Sectors and Special Industry Aggregations, Nova Scotia and Canada, 1997-2010

	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(per cent)					
Business sector industries	**1.30**	**0.26**	**1.62**	**0.40**	**3.05**	**-0.38**
Business sector, goods	..	..	..	*-0.39*	*4.46*	*-1.80*
Agriculture, forestry, fishing and hunting	2.89	5.21	2.20	2.08	4.34	1.41
Mining and oil and gas extraction	-3.56	-2.85	-3.77	-4.39	-2.94	-4.82
Utilities	..	..	..	-0.09	1.60	-0.59
Construction	0.20	1.20	-0.10	-0.82	-0.66	-0.86
Manufacturing	2.95	6.84	1.81	1.97	6.68	0.60
Non-durable manufacturing industries	..	..	..	..	..	..
Durable manufacturing industries	..	..	..	..	..	..
Business sector, services	..	..	..	*0.92*	*1.11*	*0.87*
Wholesale trade	0.40	-5.41	2.22	0.01	2.49	-0.72
Retail trade	0.06	8.39	-2.32	0.24	2.12	-0.32
Transportation and warehousing	-1.88	-6.97	-0.30	-0.56	-1.32	-0.34
Information and cultural industries	4.13	4.50	4.01	3.16	5.43	2.49
FIRE	..	..	..	1.79	-0.11	2.36
Professional, scientific and technical services	-4.93	-17.47	-0.81	-4.79	-10.39	-3.05
ASWMRS	-2.86	11.67	-6.84	-3.44	5.14	-5.87
Arts, entertainment and recreation	..	..	..	-1.53	0.70	-2.19
Accommodation and food services	-2.16	0.50	-2.95	-0.11	4.69	-1.50
Other private services	0.04	-0.11	0.08	-0.32	-0.26	-0.33
ICT Sector	**..**	**..**	**..**	**..**	**..**	**..**
	1997	2000	2010	1997	2000	2010
	(chained 2002 dollars of output per $1,000 of capital stock)					
Business sector industries	771	777	912	865	946	911
Business sector, goods	..	..	..	650	741	618
Agriculture, forestry, fishing and hunting	607	707	879	603	685	788
Mining and oil and gas extraction	227	208	142	441	404	246
Utilities	..	..	..	171	180	169
Construction	3,579	3,710	3,674	3,830	3,755	3,443
Manufacturing	698	852	1,019	1,168	1,418	1,505
Non-durable manufacturing industries	..	..	..	..	..	..
Durable manufacturing industries	..	..	..	..	..	..
Business sector, services	..	..	..	1,168	1,208	1,317
Wholesale trade	2,212	1,872	2,330	2,961	3,188	2,965
Retail trade	1,410	1,795	1,420	1,718	1,830	1,772
Transportation and warehousing	684	551	535	543	522	504
Information and cultural industries	458	522	774	573	671	859
FIRE	..	..	..	788	785	991
Professional, scientific and technical services	8,383	4,712	4,344	7,400	5,324	3,908
ASWMRS	3,864	5,382	2,651	6,713	7,802	4,260
Arts, entertainment and recreation	..	..	..	1,017	1,039	833
Accommodation and food services	2,276	2,310	1,712	1,525	1,750	1,504
Other private services	6,914	6,892	6,948	5,882	5,836	5,645
ICT Sector	..	..	..	..	..	..

Source: CSLS Nova Scotia Productivity Database.

In 2010, six of the 12 two-digit NAICS sectors in Nova Scotia for which data were available had capital productivity levels above the national average: other private services (123.1 per cent of the national average), accommodation and food services (113.8 per cent), agriculture, forestry, fishing and hunting (111.6 per cent), professional, scientific and technical services (111.2 per cent), construction (106.7 per cent), and transportation and warehousing (106.0 per cent) (Table 19).

Table 19: Nova Scotia's Capital Productivity Levels as a Share of Canada's, Business Sector Industries, 1997, 2000, and 2010 (Canada=100.0)

	1997	2000	2010
	(province's real labour productivity level as a per cent of Canada's)		
Business sector industries	**89.2**	**82.1**	**100.1**
Business sector, goods	..	..	..
Agriculture, forestry, fishing and hunting	100.8	103.3	111.6
Mining and oil and gas extraction	51.4	51.6	57.5
Utilities	..	..	..
Construction	93.4	98.8	106.7
Manufacturing	59.8	60.1	67.7
Non-durable manufacturing industries	..	..	..
Durable manufacturing industries	..	..	..
Business sector, services	..	..	..
Wholesale trade	74.7	58.7	78.6
Retail trade	82.1	98.1	80.2
Transportation and warehousing	126.0	105.6	106.0
Information and cultural industries	79.9	77.8	90.1
FIRE	..	..	..
Professional, scientific and technical services	113.3	88.5	111.2
ASWMRS	57.6	69.0	62.2
Arts, entertainment and recreation	..	..	..
Accommodation and food services	149.2	132.0	113.8
Other private services	117.5	118.1	123.1
ICT Sector	**..**	**..**	**..**

Source: CSLS Nova Scotia Productivity Database.

V. Productivity Drivers

Part IV described in detail the productivity performance of Nova Scotia's business sector over the 1997-2010 period, and how it compared to the performance of the Canadian business sector as a whole. It did not, however, analyze the factors behind productivity improvements in the province.

In order to develop policies to improve productivity performance, it is important to first identify the drivers of productivity growth. The standards starting point for the discussion of the dynamics of productivity growth is the simple neo-classical growth accounting model. In this model, there are three key factors determining labour productivity growth. The first is investment in human resources, which determines the quality of labour input. More human capital makes a worker more productive. The second is investment in capital goods, which determines the size of the capital stock and hence the amount of machinery and equipment and structures available to each worker and firm. Higher ratios of capital to labour, or capital intensity, boost labour productivity. The third is often referred to as the pace of technological progress (or innovation), but in fact encompasses all factors not captured by the previous two measures. It is very roughly proxied by the rate of total factor productivity growth. In this paper, we look at technological progress through one of its main drivers – the development of new knowledge through R&D. These three drivers are in turn affected by the industrial structure and resource base of the province as well as by both the macroeconomic and microeconomic environments and policies.

Exhibit 4 presents a framework for analyzing the drivers of productivity growth and the issues associated with these drivers. For each of the three drivers identified above, a number of more precise and relevant issues are identified. Each of the three drivers encompasses a large number of issues which do not overlap between drivers, or driver-specific issues, and each are important to any explanation of productivity growth.

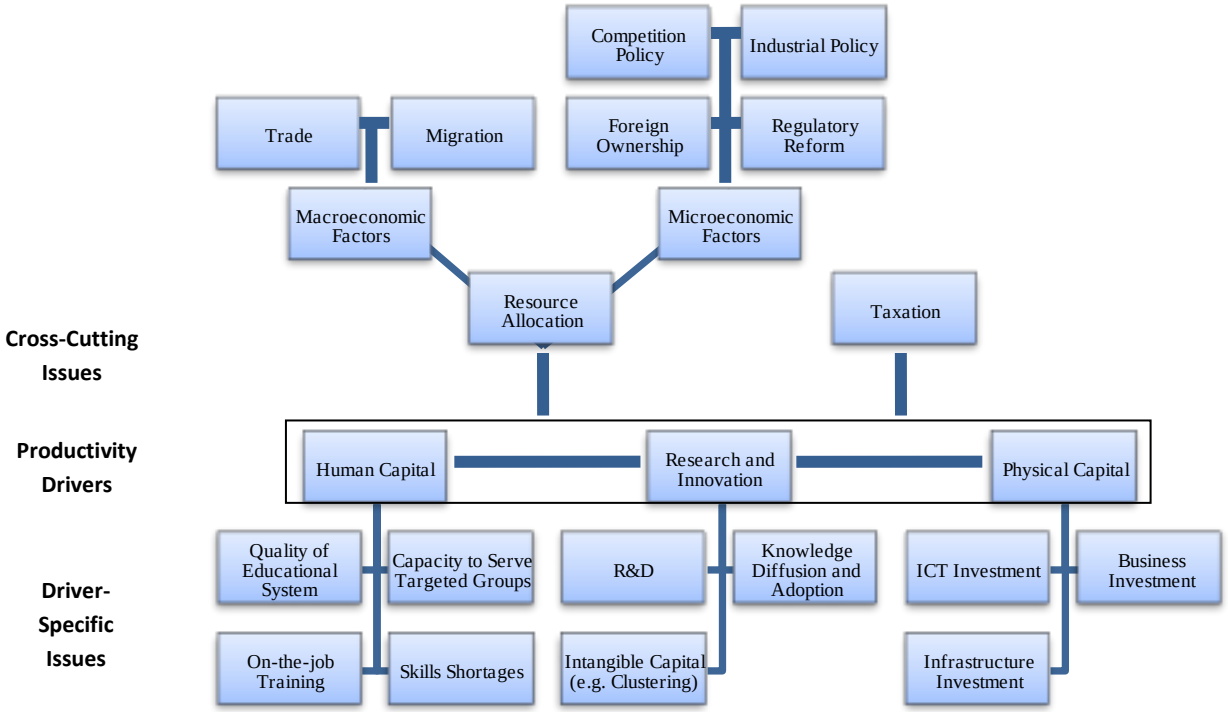
This leaves us with the cross-cutting issues, those which affect more than one of the productivity drivers through the general lens of resource allocation. The capacity of an economy to adapt and allocate resources efficiently is a central issue for productivity growth. Issues related to resource allocation can be divided, roughly and conveniently, between microeconomic and macroeconomic issues. We recognize that the differentiation between micro and macro factors in this fashion is somewhat artificial, but we believe that to deal with such an extensive issue as resource allocation, it is necessary to organize the issues in two distinct parts.

Microeconomic factors include issues such as competition policy, industrial policy, and market regulation and could be the subject of a report. Regulatory reform is also of paramount importance in this process.

Macroeconomic issues, mostly trade and migration, are rich territory in the context of productivity. They benefit from some commonality as trade relate to the movement of goods and services while migration relates to the movement of individuals.

In this context, after a brief review of the state of the three productivity drivers, we turn our attention to areas of importance for productivity which go beyond these three drivers, starting with the industrial structure, and followed by macroeconomic factors and microeconomic factors.

Exhibit 4: CSLS Framework for Analyzing Productivity



A. Investment and Capital Intensity

The relationship between physical capital and productivity is relatively direct. With more capital to work with, each worker can produce more output per hour. If, through investment, capital input increases at a faster pace than labour input, then the amount of capital per labour input increases, i.e. there is **capital deepening**. The main point to understand here is that what matters to productivity is not capital input in absolute terms, but capital per worker or, better yet, capital per hour worked.

Another reason why investment in physical capital is relevant is because it is the primary means by which technical change is introduced into the production process. Spending on R&D often leads to the creation of better quality machinery and equipment. With investment, these quality gains are gradually **embodied** in the capital stock.

i. Investment Intensity

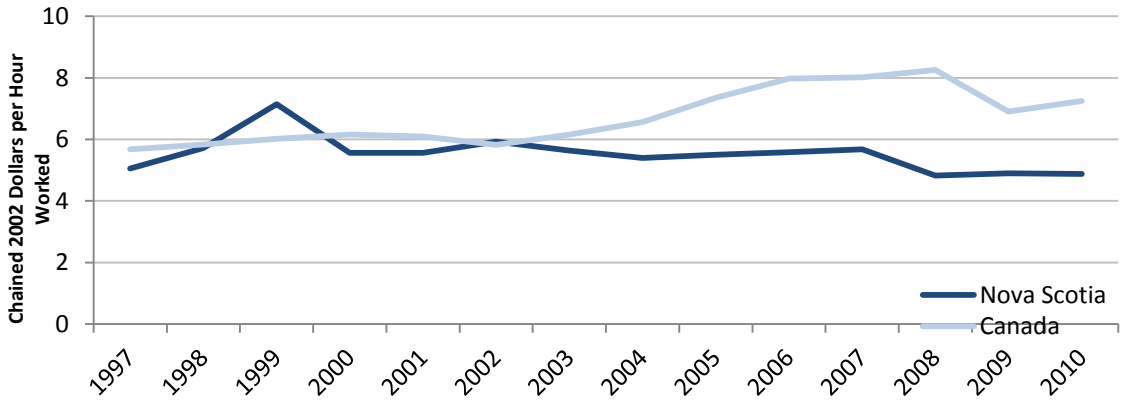
Fixed non-residential investment intensity (defined here as gross investment per hour worked) in Nova Scotia's business sector declined at a compound annual rate of -0.28 per cent during the 1997-2010 period, well below the growth of 1.88 per cent per year experienced by the Canadian business sector as a whole (Table 20). This poor performance caused the province's investment intensity level to decline from $5.06 per hour (chained 2002 dollars) in 1997 to $4.88 per hour (chained 2002 dollars) in 2010 (Chart 31, Chart 32).

Table 20: Real Gross Investment per Hour Worked in Nova Scotia and Canada, 1997-2010

	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(compound annual growth rates for real investment, per cent)					
Total	**-0.28**	**3.19**	**-1.30**	**1.88**	**2.70**	**1.64**
Building	-1.94	-1.35	-2.11	-2.26	-6.23	-1.03
Engineering	8.19	53.12	-2.51	2.03	2.06	2.01
Machinery and Equipment	-1.91	-5.37	-0.85	2.74	4.97	2.08
ICT	6.08	10.32	4.84	8.27	13.43	6.77
Computers	12.40	18.18	10.73	16.76	34.65	11.87
Telecommunication Equipment	3.52	23.06	-1.71	3.61	10.57	1.61
Software	3.81	-4.86	6.56	5.40	5.75	5.29
	1997	2000	2010	1997	2000	2010
	(chained 2002 dollars of gross investment per hour worked)					
Total	**5.06**	**5.56**	**4.88**	**5.68**	**6.16**	**7.24**
Building	0.67	0.64	0.52	0.92	0.76	0.68
Engineering	0.47	1.68	1.30	1.46	1.56	1.90
Machinery and Equipment	3.83	3.24	2.98	3.32	3.84	4.72
ICT	0.63	0.85	1.36	0.78	1.14	2.19
Computers	0.12	0.19	0.54	0.14	0.33	1.02
Telecommunication Equipment	0.21	0.39	0.33	0.26	0.36	0.42
Software	0.30	0.26	0.49	0.38	0.45	0.75

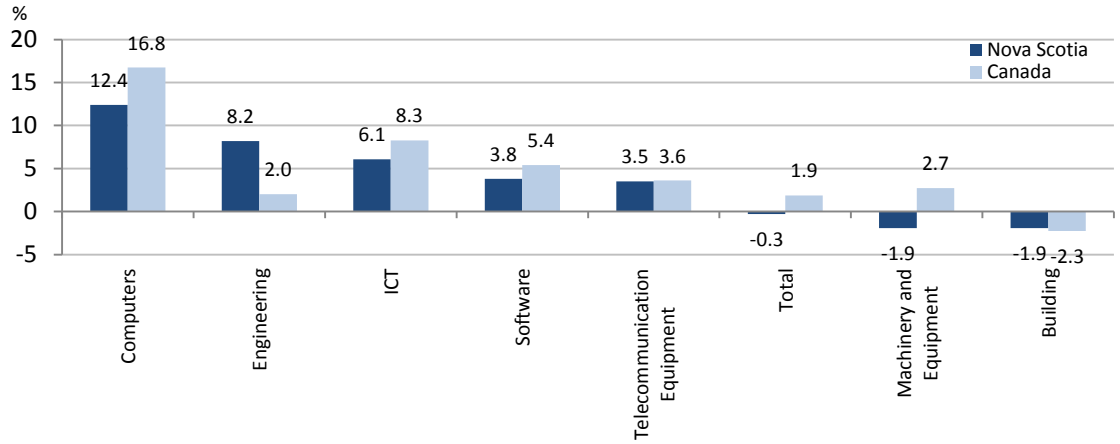
Note: Due to data availability issues, estimates for ICT investment intensity in Nova Scotia refer to the total economy instead of the business sector.
Source: CSLS Nova Scotia Productivity Database.

Chart 31: Real Gross Investment per Hour Worked in Nova Scotia and Canada, 1997-2010



Source: CSLS Nova Scotia Productivity Database.

Chart 32: Investment Intensity Growth in Nova Scotia and Canada, 1997-2010 (Compound Annual Growth Rates)



Source: CSLS Nova Scotia Productivity Database.

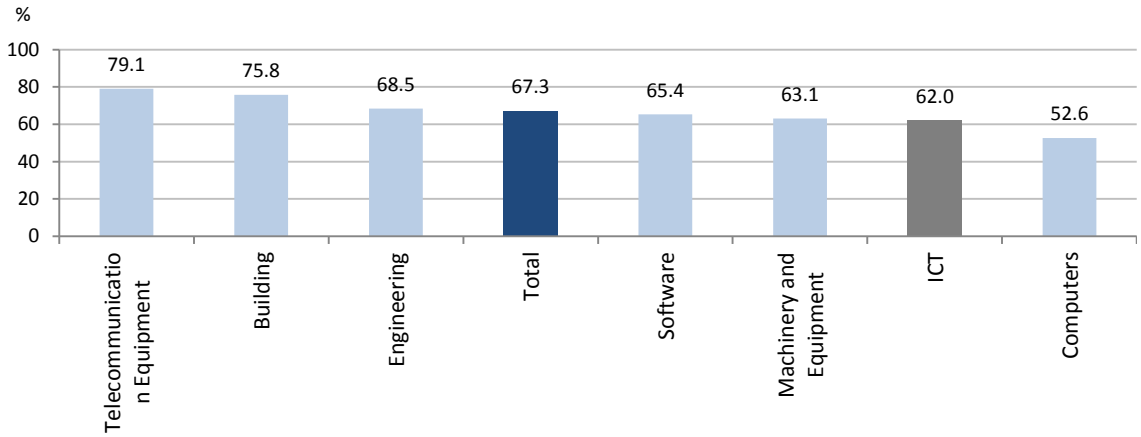
Since the national investment intensity level actually grew during the period (from $5.68 per hour in 1997 to $7.24 per hour in 2010), the gap between Nova Scotia and Canada as a whole increased substantially, from 11.0 percentage points to 22.7 percentage points (Table 21, Chart 33). It is interesting to note that Nova Scotia's investment intensity performance would have been even worse during the overall period if not for the robust engineering-related investments during the 1997-2000 period, which caused engineering investment intensity to increase 53.1 per cent per year.

Table 21: Nova Scotia's Real Gross Investment per Hour Worked as a Share of Canada's, 1997, 2000, and 2010 (Canada=100.0)

	1997	2000	2010
	(province's investment intensity level as a per cent of Canada's)		
Total	**89.0**	**90.3**	**67.3**
Building	*72.6*	*84.5*	*75.8*
Engineering	31.9	107.8	68.5
Machinery and Equipment	115.2	84.4	63.1
ICT	80.9	74.4	62.0
Computers	86.2	58.3	52.6
Telecommunication Equipment	80.0	110.3	79.1
Software	79.6	58.0	65.4

Note: Due to data availability issues, estimates for ICT investment intensity in Nova Scotia refer to the total economy instead of the business sector.
Source: CSLS Nova Scotia Productivity Database.

Chart 33: Nova Scotia's Real Gross Investment per Hour Worked as a Share of Canada's, 2010 (Canada=100.0)

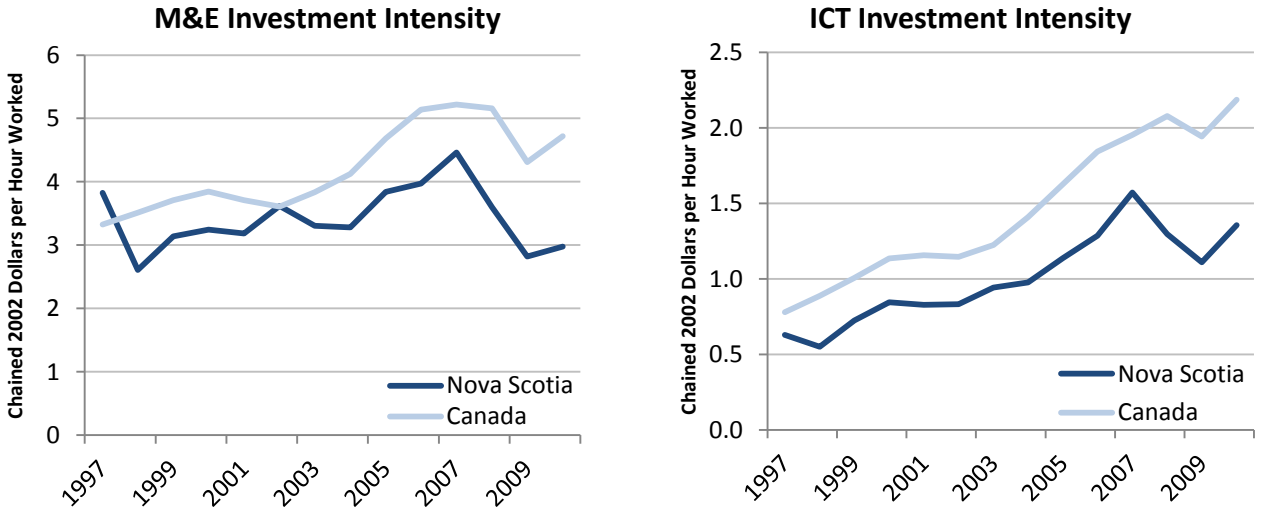


Note: Due to data availability issues, estimates for ICT investment intensity in Nova Scotia refer to the total economy instead of the business sector.
Source: CSLS Nova Scotia Productivity Database.

Although total fixed non-residential investment intensity is definitely an important indicator for understanding productivity growth, not all capital assets have the same impact on productivity. In particular, a number of cross-country studies have found investment in M&E to have a strong positive relationship with economic growth and productivity growth (see, for instance, De Long and Summers, 1991). M&E investment intensity declined 1.91 per cent in Nova Scotia during the 1997-2010 period, with the intensity level decreasing from $3.83 per hour (chained 2002 dollars) in 1997 to $2.98 per hour (chained 2002 dollars) in 2010 (Table 20, Chart 34). At the national level, however, M&E investment intensity grew 2.74 per cent per year during the same period, from$3.32 per hour (chained 2002 dollars) to $4.72 per hour (chained 2002 dollars).

M&E investment includes, among other asset categories, investment in information and communication technologies (ICTs). A large empirical literature (see Jorgenson, 2001, Jorgenson *et al.*, 2005, and Sharpe, 2006, for a detailed literature review) has identified the importance of ICT investment in driving productivity growth. In particular, ICTs are seen as the main force behind the labour productivity surge in the United States post-1995, working through increased MFP growth. Brynjolfsson and Hitt (2003), for instance, find that ICT use yields high returns and substantial productivity gains in the medium-run (three to seven years). These potential benefits should not, however, be taken for granted. There is strong evidence that ICT is a general purpose technology, i.e. a technology that fundamentally changes the production process of firms that make use of them (Basu *et al.*, 2003, and Basu and Fernald, 2008). For the gains of these technologies to be fully realized, firms often have to reorganize their activities, which can be both costly and time consuming.

Chart 34: M&E and ICT Investment per Hour Worked in Nova Scotia and Canada, 1997-2010



Source: CSLS Nova Scotia Productivity Database

ICT investment intensity in Nova Scotia increased 6.08 per cent per year from 1997 to 2010, less than the rate of increase seen at the national level, 8.27 per cent per year (Table 20, Chart 34). In fact, the province's investment intensity growth was lower than Canada's in all three ICT categories, with computers investment intensity increasing by 12.40 per cent per year (vs. 16.76 per cent in Canada), telecommunications equipment investment intensity by 3.52 per cent per year (vs. 3.61 per cent in Canada), and software investment intensity by 3.81 per cent per year (vs. 5.40 per cent per year in Canada).

As mentioned previously, due to confidentiality issues, Statistics Canada releases real investment data for only seven of the 20 two-digit NAICS sectors in Nova Scotia, and for some sectors the data span only a very limited time period. Since the available data would provide only a very partial picture of investment intensity by sector in the province, we will not discuss these numbers in the report. We make them available, however, in the Data Appendix.

ii. Capital Intensity

Shifting our attention to capital stock intensity (defined here as real net capital stock per hour worked), we can find similar trends to those seen in investment intensity. Nova Scotia's capital stock intensity increased 0.26 per cent per year during the 1997-2010 period, from $30.78 per hour (chained 2002 dollars) in 1997 to $31.82 per in 2010 (Table 22). During the same period, capital stock intensity in Canada as a whole grew 0.89 per cent per year, from $37.55 per hour (chained 2002 dollars) in 1997 to $42.11 per hour in 2010, which implies a growing gap between capital intensity levels in Nova Scotia and Canada (Table 23, Chart 37)

Table 22: Real Net Capital Stock per Hour Worked in Nova Scotia and Canada, Business Sector, 1997-2010

	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(compound annual growth rates, per cent)					
Total	**0.26**	**3.01**	**-0.55**	**0.89**	**0.02**	**1.15**
Building	-0.50	-1.16	-0.30	-1.19	-1.69	-1.04
Engineering	1.12	9.84	-1.36	1.34	-0.80	1.99
Machinery and Equipment	0.00	-0.20	0.06	1.97	2.19	1.90
ICT	4.42	4.30	4.45	6.95	8.58	6.47
Computers	14.89	24.77	12.08	18.34	34.52	13.87
Telecommunication Equipment	0.36	1.59	-0.01	1.91	2.30	1.80
Software	3.70	1.46	4.38	5.78	7.33	5.32
	1997	2000	2010	1997	2000	2010
	(chained 2002 dollars of capital stock per hour worked, levels)					
Total	**30.78**	**33.64**	**31.82**	**37.55**	**37.57**	**42.11**
Building	8.54	8.25	8.00	10.76	10.22	9.21
Engineering	10.00	13.25	11.56	13.95	13.62	16.58
Machinery and Equipment	12.22	12.15	12.22	12.87	13.74	16.59
ICT	1.70	1.93	2.98	1.96	2.51	4.70
Computers	0.17	0.32	1.01	0.20	0.49	1.78
Telecommunication Equipment	0.88	0.92	0.92	0.93	0.99	1.18
Software	0.65	0.68	1.05	0.84	1.03	1.73

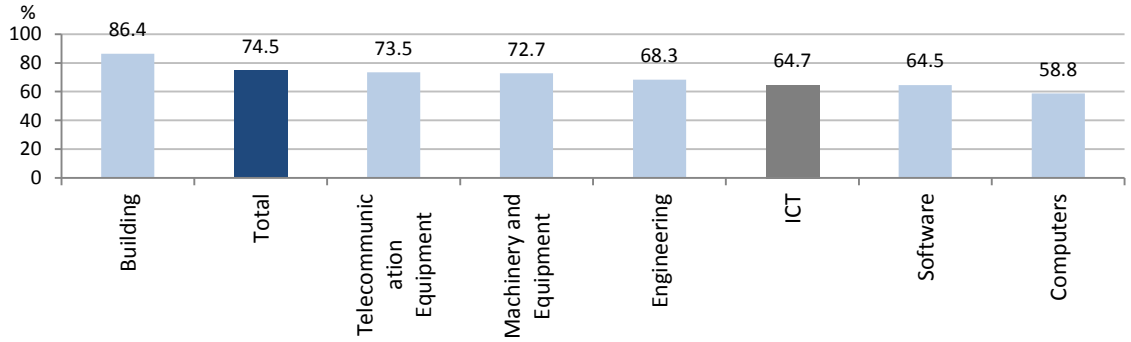
Note: Due to data availability issues, estimates for ICT investment intensity in Nova Scotia refer to the total economy instead of the business sector. Source: CSLS Nova Scotia Productivity Database.

Table 23: Nova Scotia's Real Net Capital per Hour Worked as a Share of Canada's, Business Sector, 1997, 2000, and 2010 (Canada=100.0)

	1997	2000	2010
	(province's investment intensity level as a per cent of Canada's)		
Total	**81.9**	**90.1**	**74.5**
Building	*79.4*	*81.2*	*86.4*
Engineering	71.6	97.9	68.3
Machinery and Equipment	94.9	89.0	72.7
ICT	86.6	77.3	64.7
Computers	83.5	67.1	58.8
Telecommunication Equipment	95.0	93.7	73.5
Software	78.1	66.5	64.5

Note: Due to data availability issues, estimates for ICT investment intensity in Nova Scotia refer to the total economy instead of the business sector. Source: CSLS Nova Scotia Productivity Database.

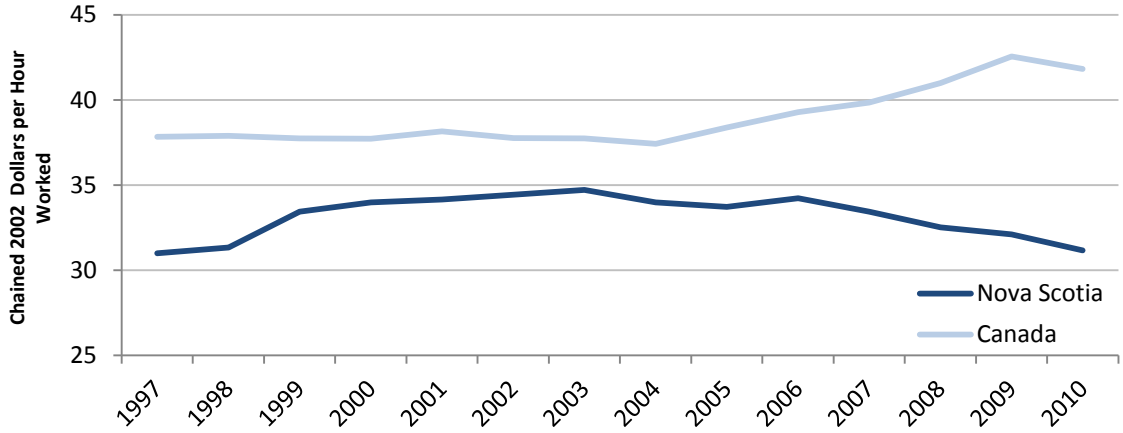
Chart 35: Nova Scotia's Real Net Capital Stock per Hour Worked as a Share of Canada's, 2010 (Canada=100.0)



Source: CSLS Nova Scotia Productivity Database.

It is interesting to note that overall capital stock intensity trends were very different in Nova Scotia and Canada (Chart 36). Canada's capital stock intensity was stagnant from 1997 to 2004, after which it started growing at a steady pace until 2009, due to the resource boom in Western Canada. In Nova Scotia, capital stock intensity rose in the late 1990s and then remained somewhat constant from 2000 to 2006, after which it started declining.

Chart 36: Real Net Capital Stock per Hour Worked in Nova Scotia and Canada, 1997-2010

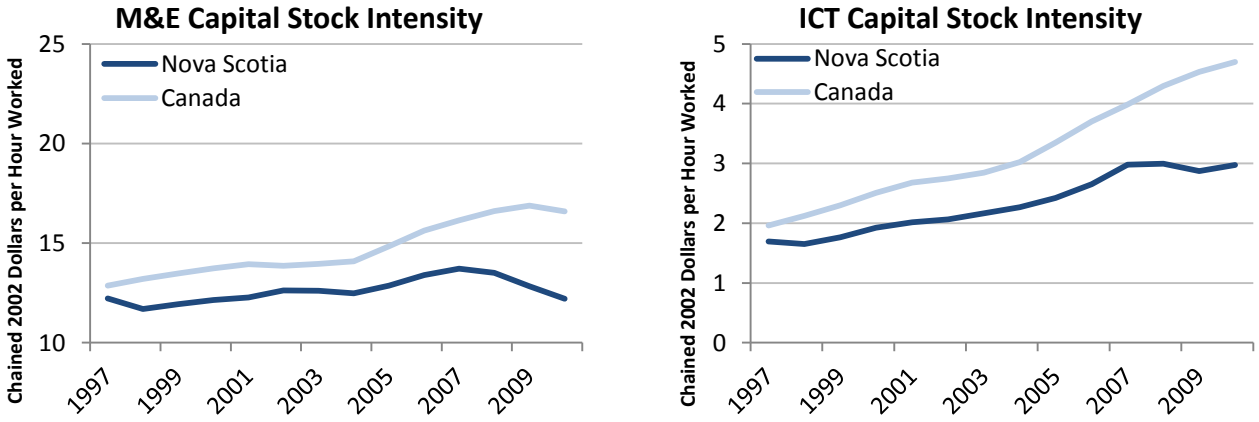


Source: CSLS Nova Scotia Productivity Database.

M&E capital stock intensity in Nova Scotia did not grow during the 1997-2010 period, remaining constant at $12.22 per hour. During this time, M&E capital intensity in Canada increased 1.97 per cent per year (Table 22). As Chart 37 shows, however, after a period of stagnation between 1997 and 2005, M&E capital stock intensity in the province increased for two years, and then in 2007 it started declining.

In the case of ICT capital stock intensity, Nova Scotia saw positive growth up until 2007, which gave way to a period of stagnation afterwards. During the overall period, ICT capital intensity in the province experienced relatively strong growth (4.22 per cent per year), albeit still lower than that of Canada as a whole (6.58 per cent per year).

Chart 37: M&E and ICT Capital Stock per Hour Worked in Nova Scotia and Canada, 1997-201



Source: CSLS Nova Scotia Productivity Database.

Given slower capital intensity growth at the business sector level, it is not surprising that seven two-digit NAICS sectors in Nova Scotia (out of the 12 for which data were available) experienced slower growth than the national average (Table 24). In particular, Nova Scotia's capital stock intensity growth from 1997 to 2010 was below average in agriculture, forestry, fishing and hunting (0.82 per cent vs. 2.75 per cent), manufacturing (-1.35 per cent per year vs. -0.20 per cent per year nation-wide), construction (0.92 per cent vs. 1.64 per cent), wholesale trade (2.66 per cent vs. 3.28 per cent), professional, scientific and technical services (5.26 per cent vs. 6.17 per cent), ASWMRS (2.99 per cent vs. 3.56 per cent). On the other hand, the province outperformed Canada as a whole in the following sectors: mining and oil and gas extraction (7.15 per cent vs. 3.17 per cent), retail trade (2.85 per cent vs. 2.50 per cent), transportation and warehousing (3.55 per cent vs. 1.58 per cent), information and cultural industries (0.17 per cent vs. -1.44 per cent), accommodation and food services (3.15 per cent vs. 0.74 per cent), and other private services (2.43 per cent vs. 1.05 per cent). Capital stock intensity data for Nova Scotia's utilities, FIRE, and arts, entertainment and recreation sectors could not be calculated, since capital stock data were not available (or, in the case of the FIRE sector, only partially available).

Table 24: Real Net Capital Stock per Hour Worked in Nova Scotia and Canada, 1997-2010

	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(compound annual growth rates, per cent)					
Business sector industries	**0.26**	**3.01**	**-0.55**	**0.89**	**0.02**	**1.15**
Business sector, goods	..	..	..	*1.78*	*0.14*	*2.27*
Agriculture, forestry, fishing and hunting	0.82	0.62	0.88	2.75	4.06	2.36
Mining and oil and gas extraction	7.15	43.28	-1.80	3.17	7.07	2.03
Utilities	..	..	..	-0.45	-1.06	-0.27
Construction	0.92	3.28	0.22	1.64	4.38	0.83
Manufacturing	-1.35	-6.46	0.24	-0.20	-1.52	0.20
Non-durable manufacturing industries	..	..	..	..	..	..
Durable manufacturing industries	..	..	..	..	..	..
Business sector, services	..	..	..	*0.63*	*1.22*	*0.45*
Wholesale trade	2.66	11.47	0.16	3.28	2.29	3.58
Retail trade	2.85	-5.02	5.34	2.50	1.94	2.66
Transportation and warehousing	3.55	12.44	1.03	1.58	2.64	1.26
Information and cultural industries	0.17	3.28	-0.75	-1.44	-4.61	-0.47
FIRE	..	..	..	-0.39	1.97	-1.09
Professional, scientific and technical services	5.26	22.04	0.70	6.17	15.13	3.62
ASWMRS	2.99	-8.23	6.61	3.56	-4.99	6.27
Arts, entertainment and recreation	..	..	..	1.09	-1.50	1.88
Accommodation and food services	3.15	0.67	3.91	0.74	-3.39	2.01
Other private services	2.43	3.68	2.06	1.05	1.38	0.95
ICT Sector	**..**	**..**	**..**	**..**	**..**	**..**
	1997	2000	2010	1997	2000	2010
	(chained 2002 dollars of capital stock per hour worked)					
Business sector industries	**30.8**	**33.6**	**31.8**	**37.6**	**37.6**	**42.1**
Business sector, goods	..	..	..	*63.1*	*63.3*	*79.3*
Agriculture, forestry, fishing and hunting	29.6	30.1	32.9	33.3	37.5	47.3
Mining and oil and gas extraction	251.8	740.5	617.5	320.9	393.9	481.7
Utilities	..	..	..	953.1	923.1	898.8
Construction	5.6	6.2	6.4	6.6	7.5	8.2
Manufacturing	41.8	34.2	35.0	34.6	33.0	33.7
Non-durable manufacturing industries	..	..	..	..	..	..
Durable manufacturing industries	..	..	..	..	..	..
Business sector, services	..	..	..	23.8	24.7	25.8
Wholesale trade	12.3	17.1	17.3	9.6	10.3	14.7
Retail trade	9.0	7.7	13.0	9.8	10.4	13.6
Transportation and warehousing	34.6	49.2	54.5	58.5	63.2	71.7
Information and cultural industries	91.6	100.9	93.7	87.8	76.2	72.7
FIRE	..	..	..	80.8	85.6	76.8
Professional, scientific and technical services	2.9	5.4	5.7	3.6	5.5	7.9
ASWMRS	4.2	3.3	6.2	3.2	2.8	5.1
Arts, entertainment and recreation	..	..	..	21.0	20.1	24.1
Accommodation and food services	5.1	5.2	7.7	9.3	8.4	10.2
Other private services	2.2	2.5	3.0	3.6	3.7	4.1
ICT Sector	**..**	**..**	**..**	**..**	**..**	**..**

Source: CSLS Nova Scotia Productivity Database.

In 2010, Nova Scotia's capital intensity levels were above the national average in the following sectors: information and cultural industries (128.8 per cent), mining and oil and gas extraction (128.2 per cent of the Canadian level), ASWMRS (122.8 per cent), wholesale trade (118.3 per cent), and manufacturing (104.0 per cent) (Table 25). The province's capital intensity

levels were below the Canadian level in retail trade (95.7 per cent), construction (77.9 per cent), accommodation and food services (75.0 per cent of the Canadian level), transportation and warehousing (76.0 per cent), other private services (73.4 per cent), and agriculture, forestry, fishing and hunting (69.5 per cent).

Table 25: Nova Scotia's Real Net Capital per Hour Worked as a Share of Canada, Sectoral Breakdown, 1997, 2000, and 2010 (Canada=100.0)

	1997	2000	2010
	(province's capital intensity level as a per cent of Canada's		
Business sector industries	**82.0**	**89.5**	**75.6**
Business sector, goods	..	..	..
Agriculture, forestry, fishing and hunting	88.9	80.3	69.5
Mining and oil and gas extraction	78.4	188.0	128.2
Utilities	..	..	..
Construction	85.4	82.8	77.9
Manufacturing	121.0	103.7	104.0
Non-durable manufacturing industries	..	..	..
Durable manufacturing industries	..	..	..
Business sector, services	..	..	..
Wholesale trade	127.8	165.4	118.3
Retail trade	91.5	74.0	95.7
Transportation and warehousing	59.2	77.8	76.0
Information and cultural industries	104.3	132.4	128.8
FIRE	..	..	..
Professional, scientific and technical services	81.4	97.0	72.9
ASWMRS	132.0	118.9	122.8
Arts, entertainment and recreation	..	..	..
Accommodation and food services	55.1	62.3	75.0
Other private services	61.5	65.8	73.4
ICT Sector	**..**	**..**	**..**

Source: CSLS Nova Scotia Productivity Database.

B. Human Capital

Going back to Adam Smith, economists have long emphasized the importance of human capital in driving economic progress. More recently, Lucas (1988), Mankiw, Romer and Weil (1992), among others, have discussed the role of education in driving growth. In a comprehensive survey on the literature on education and productivity, Coulombe and Tremblay (2009) find compelling evidence that the higher the education level and the greater the experience of workers, the more output they can produce per hour of labour.

In the case of Canada, Sweetman (2002:158) writes:

> In particular, educational quality has a significant impact on labour market outcomes, and per capita economic growth. Further, the Canadian education system, with the evidence being mostly at the elementary and secondary levels, produces students with very high outcomes by international standards, which in turn has positive implications for future productivity growth.

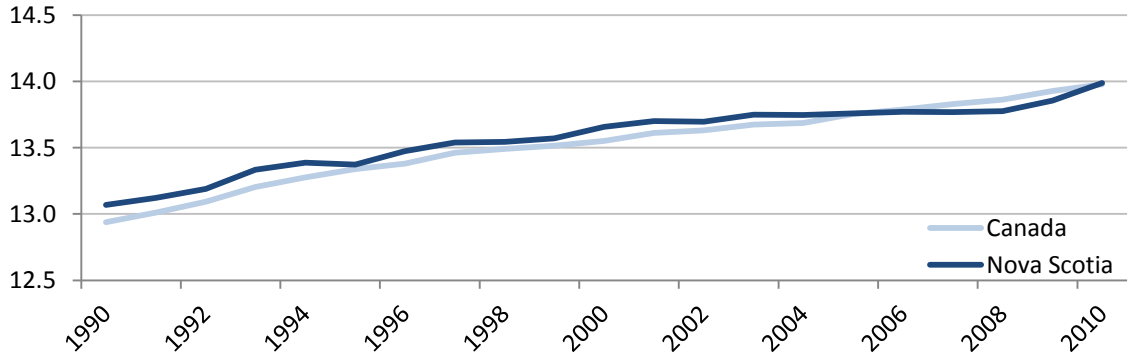
The objective of this section is to look at different components of human capital in Nova Scotia and assess their possible contribution to productivity growth in the province.

We start this section with a discussion on Statistics Canada's measure of labour composition. Next we look at trends in average years of schooling in Nova Scotia, comparing them to trends observed at the national level. This is followed by an analysis of other measures of human capital, including managerial skills, apprenticeship training, employer-supported training, adult literacy, early childhood education, and PISA scores.

i. Average Years of Schooling

In 2010, the employed population in Nova Scotia and in Canada as a whole had, on average, 14.0 years of schooling. Average years of schooling among Nova Scotia's employed population rose from 13.1 years in 1990 to 14.0 years in 2010 (Chart 38), growing at a compound annual rate of 0.34 per cent, which was slightly below the national average of 0.39 per cent per year. This has led to a small decline in the province's average years of schooling as a share of Canada's, from 101.0 per cent in 1990 to 100.1 per cent in 2010. Overall, formal educational attainment, as manifested by average years of schooling, does not seem to represent a problem to Nova Scotia from a productivity perspective.

Chart 38: Average Years of Schooling for Employed Population in Nova Scotia and Canada, Total Economy, 1990-2010

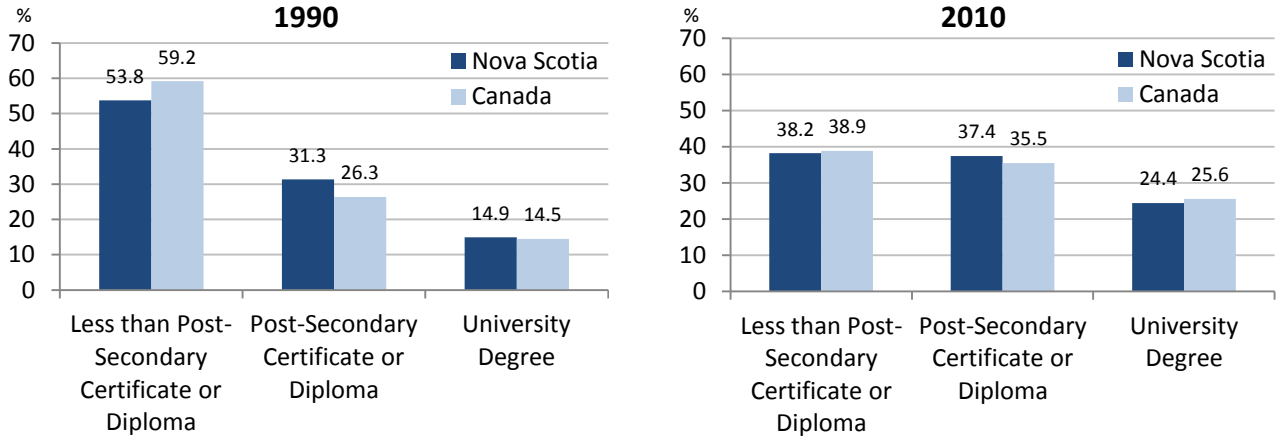


Source: CSLS calculations based on Statistics Canada data, Labour force survey estimates, by educational attainment, sex and age group, annually (CANSIM Table 282-0004).

Chart 39 breaks down Nova Scotia's and Canada's employed population by highest level of educational attainment. In 1990, the proportion of Nova Scotia's workers that had less than post-secondary education was substantially smaller than the Canadian average (53.8 per cent vs. 59.2 per cent, respectively). By 2010, this gap had been largely bridged (38.2 per cent vs. 38.9 percent). The drop in the proportion of workers with less than post-secondary education both in Nova Scotia and in Canada as a whole was accompanied by a marked increase in the proportion of workers with post-secondary degrees or diplomas (in Nova Scotia, this number went up from 31.3 per cent in 1990 to 37.4 per cent in 2010; in Canada the increase was from 26.3 per cent to 35.5 per cent), and even more so in the proportion of workers with university degrees (in Nova

Scotia, this proportion went from 14.9 per cent in 1990 to 24.4 per cent in 2010; in Canada it went from 14.5 per cent to 25.6 per cent).

Chart 39: Workers by Highest Level of Educational Attainment as a Share of Total Workers, Nova Scotia and Canada, 1990 and 2010



Source: CSLS calculations based on Statistics Canada data, Labour force survey estimates, by educational attainment, sex and age group, annually (CANSIM Table 282-0004).

Table 26: Average Years of Schooling, Nova Scotia and Canada, Sectoral Breakdown, 1990-2010

	Nova Scotia			Canada		
	1990	2010	CAGR	1990	2010	CAGR
	(average years of schooling)		(per cent)	(average years of schooling)		(per cent)
Total, All industries	**13.1**	**14.0**	**0.34**	**12.9**	**14.0**	**0.39**
Agriculture, forestry, fishing and hunting	11.5	12.4	0.37	11.5	12.7	0.49
Mining and oil and gas extraction	..	..	..	12.9	13.8	0.33
Utilities	..	..	..	13.6	14.5	0.34
Construction	12.6	13.3	0.28	12.2	13.3	0.41
Manufacturing	12.5	13.6	0.42	12.4	13.6	0.45
Wholesale trade	13.2	13.6	0.17	12.8	13.7	0.36
Retail trade	12.6	13.1	0.23	12.4	13.2	0.33
Transportation and warehousing	12.4	13.3	0.36	12.3	13.3	0.42
Information and cultural industries	13.5	14.1	0.22	13.6	14.4	0.27
FIRE	13.6	14.1	0.16	13.3	14.4	0.38
Professional, scientific and technical services	14.2	15.3	0.36	14.6	15.2	0.19
ASWMRS	11.2	13.5	0.92	12.3	13.4	0.43
Education Services	15.1	15.7	0.17	15.0	15.5	0.16
Health care and social assistance	13.9	14.6	0.27	13.7	14.6	0.32
Arts, entertainment and recreation	..	..	..	13.1	13.8	0.26
Accommodation and food services	12.2	12.7	0.23	11.9	12.9	0.39
Other services (except public admin)	12.8	13.8	0.37	12.7	13.8	0.42

Source: CSLS calculations based on Statistics Canada data (special run).

Table 26 presents estimates of the average years of educational attainment at the two-digit NAICS level for Nova Scotia and Canada in 1997 and 2010. Of the 14 industries for which data are available, Nova Scotia in 2010 had higher levels of educational attainment in three industries, the same level in five industries and lower levels in six industries. However, the

differences were minor and within the margin of statistical error. Given the similarity in educational attainment at the industry level between Nova Scotia and Canada, it is unlikely that educational attainment can account for gaps in labour productivity levels in these industries.

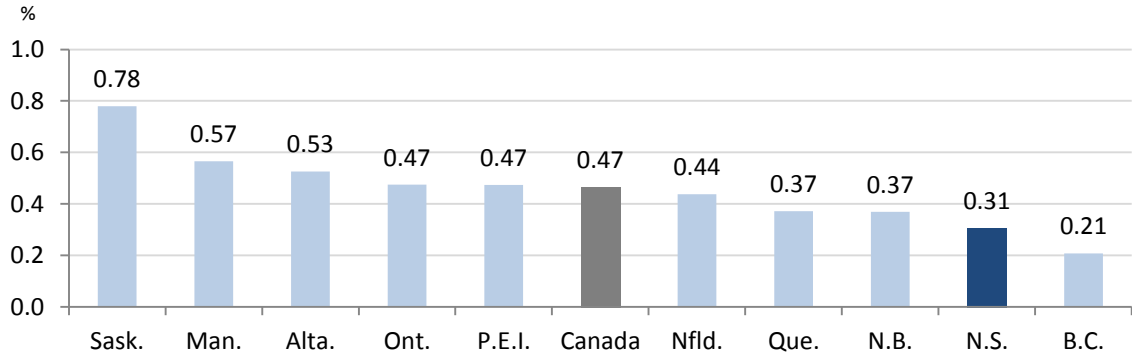
ii. Labour Composition

Changes in the human capital embodied in Nova Scotia's labour force are captured by Statistics Canada's measure of labour composition, which is the ratio of labour input to hours worked. The labour input, in turn, is the weighted sum of hours worked across different categories of workers, with the weights being equal to the relative labour compensation shares, i.e. categories of workers that receive a higher share of total labour compensation receive a higher weight. Thus, the labour services input can be decomposed into an hours component and a labour quality (or composition) component. The variables used to differentiate labour quality are education (four education levels), experience (proxied by seven age groups) and class of workers (paid employees versus self-employed workers). Overall, there are 56 different categories of workers.

According to the CSLS Provincial Productivity Database, labour composition in Nova Scotia's business sector increased at a compound annual rate of 0.31 per cent between 1997 and 2010, less than the growth rate observed in Canada as a whole, 0.47 per cent per year (Chart 40). Compared to the other provinces, Nova Scotia ranked 9th in terms of labour quality growth, only above British Columbia.

At the two-digit NAICS level, labour quality growth in Nova Scotia was higher than the national average in the following sectors: utilities (0.90 per cent per year vs. 0.14 per cent per year in Canada), wholesale trade (0.64 per cent vs. 0.30 per cent), ASWMRS (0.59 per cent vs. 0.01 per cent), and arts, entertainment and recreation (0.94 per cent vs. -0.04 per cent) (Table 27).

Chart 40: Labour Composition in Canada and the Provinces, 1997-2010



Source: CSLS Provincial Productivity Database.

Table 27: Labour Composition Growth in Nova Scotia and Canada, 1997-2007

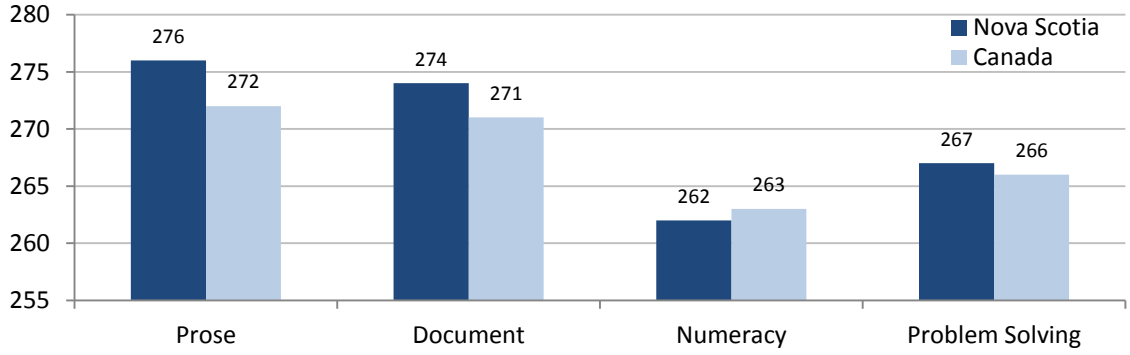
	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(per cent)					
Business sector industries	**0.31**	**0.37**	**0.29**	**0.47**	**0.53**	**0.45**
Agriculture, forestry, fishing and hunting	-0.03	1.16	-0.39	0.80	2.61	0.26
Mining and oil and gas extraction	0.27	0.01	0.35	0.29	0.39	0.25
Utilities	0.83	2.17	0.44	0.21	0.19	0.21
Construction	0.02	-0.21	0.09	0.08	-0.14	0.15
Manufacturing	0.11	-0.59	0.32	0.44	0.05	0.56
Wholesale trade	0.13	0.44	0.03	0.20	0.27	0.18
Retail trade	0.07	0.00	0.09	0.22	-0.01	0.29
Transportation and warehousing	0.28	1.16	0.02	0.35	0.21	0.39
Information and cultural industries	0.27	2.72	-0.46	0.31	0.72	0.18
FIRE	0.45	0.52	0.43	0.38	0.83	0.24
Professional, scientific and technical services	0.19	0.42	0.13	0.51	1.19	0.30
ASWMRS	0.37	1.31	0.09	0.04	-0.51	0.20
Arts, entertainment and recreation	0.59	2.79	-0.06	-0.02	0.88	-0.30
Accommodation and food services	0.22	0.08	0.26	0.22	0.21	0.23
Other private services	0.61	0.89	0.53	0.41	0.21	0.46

Source: CSLS Provincial Productivity Database.

iii. Adult Literacy

Another important indicator of human capital is adult literacy. In general, the ability of workers to understand written text and draw inferences from it has a direct bearing on the quality of the work being performed. The 2003 International Adult Literacy and Skills Survey (IALS) conducted by Statistics Canada measures competencies of persons 16 or older in four domains: prose literacy, document literacy, numeracy, and problem solving.[12] The mean scores in Nova Scotia were slightly above the national average in prose literacy (276 vs. 272), document literacy (274 vs. 271), and problem solving (267 vs. 266), but slightly below the national average in numeracy (262 vs. 263) (Chart 41). When compared to the other provinces, Nova Scotia ranked 4th in all categories. Alberta ranked 1st in all categories, followed closely by Saskatchewan and British Columbia.

Chart 41: Average IALS Scores, Canada and the Provinces, 2003

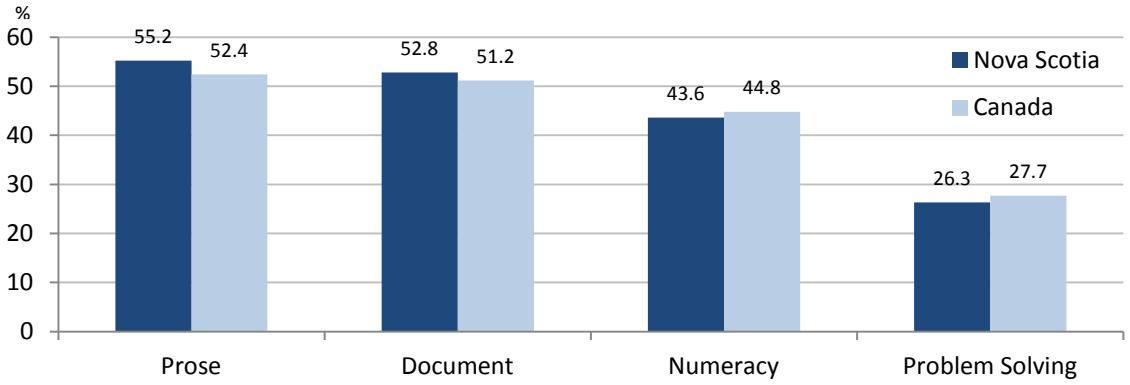


Source: CSLS Nova Scotia Productivity Database.

[12] An up-to-date international comparison of adult literacy estimates can be seen in Statistics Canada (2011).

The IALS defines five competency levels and considers Level 3 (scores between 276 and 325) to be the minimum desirable level of literacy. In Nova Scotia, 55.2 per cent of the population aged 16 and over met the desired threshold in prose literacy, 52.8 per cent in document literacy, 43.6 per cent in numeracy, and 26.3 per cent in problem solving (Chart 42).

Chart 42: Population Aged 16 and Over with IALS Literacy Scores of Level 3 or Above, Canada and the Provinces, 2003 (per cent)



Source: CSLS Nova Scotia Productivity Database.

iv. Managerial Skills

A key component of human capital is the managerial skills and training of the workforce. As Roger Martin, Dean of the Rotman School of Business at the University of Toronto has noted (ICP, 2009:4):

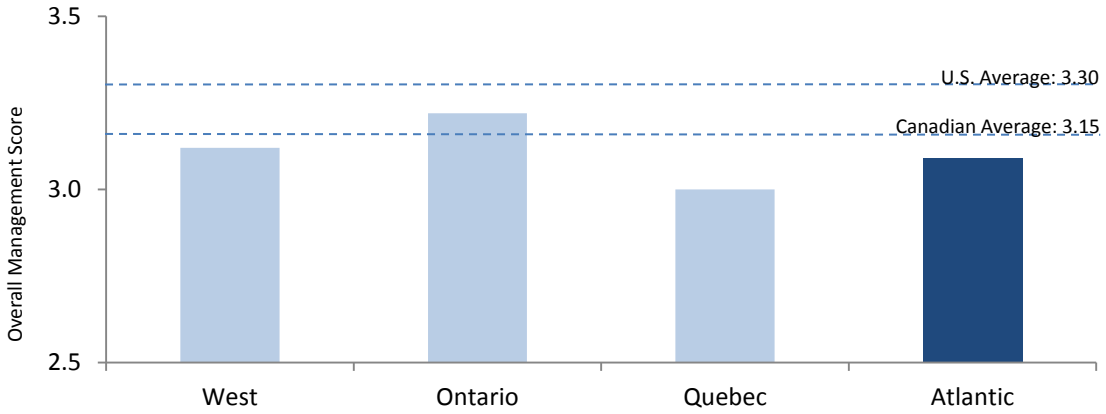
> Strong management is a critical element in the innovativeness of our economy and hence its productivity and prosperity. Strong management drives the demand to innovation through well developed businesses and ably executed strategies; it affects the ongoing supply of high quality innovation by setting research priorities and orchestrating technical resources; and it is key to the financing of innovation through the assembly of resources and the best allocation to promising investments.

One approach to quantifying the managerial skills is to examine the proportion of the labour force with formal educational qualifications in the business field, such as an MBA degree. A second approach is to assess the capacity of managers through surveys. This approach is likely more useful as it captures whether managerial skills are being effectively used, not just whether they exist on paper. Such surveys shed light on the extent to which advanced management techniques have been implemented, the level of knowledge of managerial techniques, the company-wide commitment to measuring and monitoring results, and the quality of people management. Research has shown that the quality of management correlates with firm and industry productivity.

The Institute for Competitiveness and Prosperity has conducted two surveys on the quality of management in Canada and compared the results with comparable data for other countries. The first survey was on 421 manufacturing operations across Canada (ICP, 2009) and the second on 409 retail outlets (ICP, 2010).

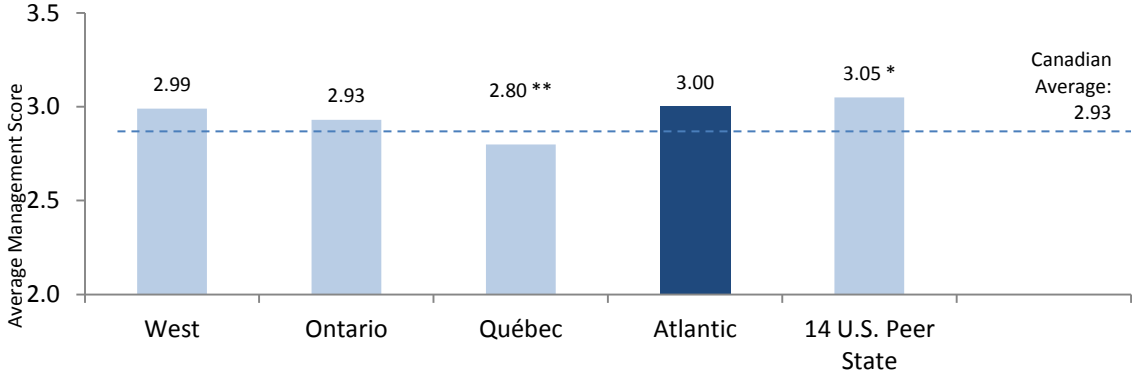
Canada ranked second behind the United States (tied with Germany and Sweden) out of 14 countries in the overall quality of its manufacturing management (ICP, 2009: Exhibit 7), Within Canada, Ontario ranked first in managerial quality, the West second, the Atlantic region third, and Quebec fourth (Chart 43). The quality of management in the retail sector in Canada matched that of the United States and exceeded that of the United Kingdom (ICP, 2010: Exhibit 5). Within Canada, Atlantic Canada ranked highest among the four regions in the quality of retail sector management although the differences are only statistically significant in Quebec (Chart 44).

Chart 43: Regional Differences in Overall Management Scores in Manufacturing



Source: ICP (2009), Exhibit 21.

Chart 44: Management Score of Canadian Regions and U.S. Peer States in Retail Trade



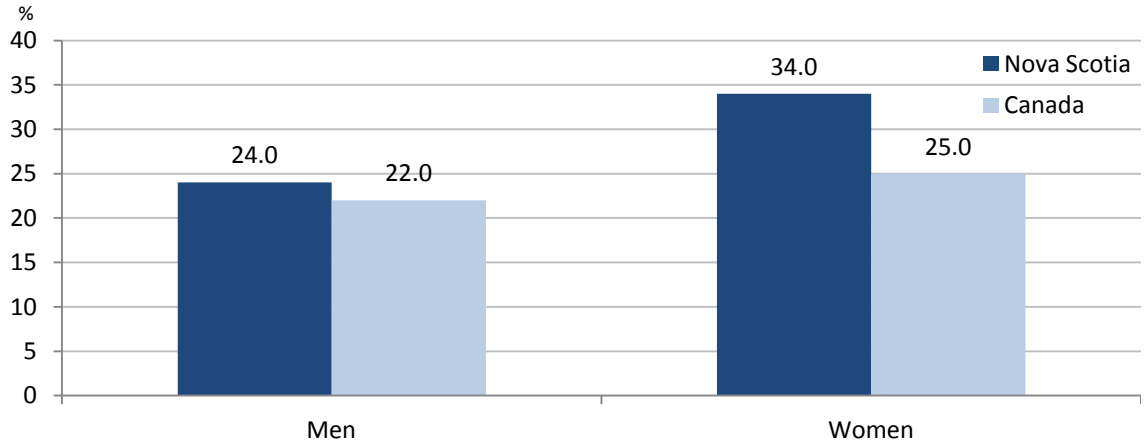
Note: *** denotes statistically different from Ontario at the 1 per cent level; ** at the 5 per cent level; * at the 10 per cent level. The U.S. peers' score is higher than the overall U.S. score of 2.99. Source: ICP (2010), Exhibit 17.

To summarize, the overall quality of management in Canada is strong, faring favourably with that of the rest of the world. Only the United States does better. Within Canada regional differences in the quality of management appear small, with the possible exception of Quebec. Poor management does not appear to be the cause of Canada's lagging productivity growth and not account for the gap between Nova Scotia's level of labour productivity and the national average (assuming the Atlantic figures accurately reflect the picture in Nova Scotia). This of course does not mean that better managerial capacity is not important for higher productivity levels. Indeed, any strategy to improve Nova Scotia's productivity performance should include measures to develop higher quality and more effective managers.

v. Employer-Supported Training

The quality of workers is also a function of how often firms are willing to invest in them and how much workers are willing to invest in themselves. According to Statistics Canada's Access and Support to Education and Training Survey (ASETS), Nova Scotia had above average participation rates in employer-supported training. In 2002, 24 per cent of employed men in the province reported receiving employer-supported training, slightly down from 25 per cent in 1993, but above the national average of 22 per cent. Regarding women, the difference is much more significant, with 34 per cent of employed women in Nova Scotia having received employer-supported training, up from 22 per cent in 1993 and well above the national average of 25 per cent.[13]

Chart 45: Employer-Supported Training, 2002 (per cent of total employees)



Source: CSLS Nova Scotia Productivity Database.

[13] Overall, participation rates in training without employer support were much lower than in the case of employer-supported training. In 2002, 10.0 per cent of employed men and women in Nova Scotia participated in training without employer support (the national averages were 9.0 per cent in the case of men and 11.0 per cent in the case of women).

vi. Apprenticeship Training

A competent and skilled labour force is essential for productivity growth. A key component of such a labour force is a well trained and qualified skilled trades workforce. Statistics Canada's Registered Apprenticeship Information System (RAIS) survey collects data on apprenticeship registration and completion broken down by age, gender, trade group, and province.

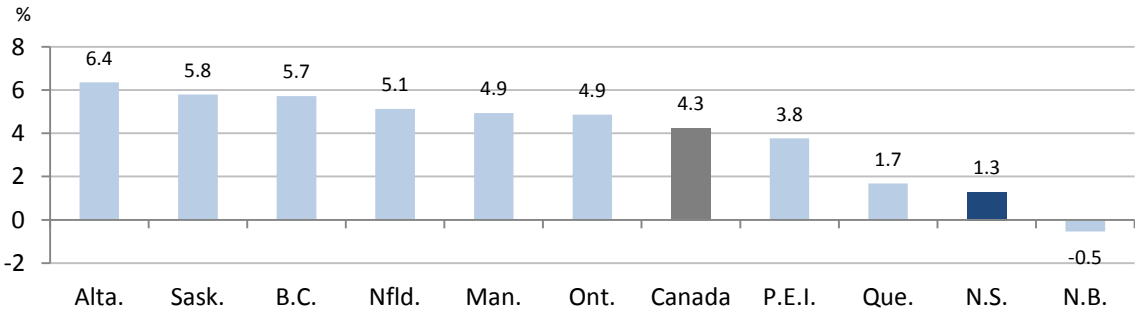
The number of apprenticeship registrations increased 1.30 per cent per year in Nova Scotia, from 4,950 in 1991 to 6,249 in 2009 (Table 28). At the national level, apprenticeship registrations grew at a significantly faster pace during the same period, 4.26 per cent per year. Compared to the other provinces, Nova Scotia ranked 9th in terms of apprenticeship registration growth, outperforming only New Brunswick (which saw a decline of 0.54 per cent per year in the number of apprenticeship registrations) (Chart 46). As a consequence of the below average growth rate, Nova Scotia's share in total apprenticeship registrations in Canada declined from 2.57 per cent in 1991 to 1.53 per cent in 2009, substantially below the province's share in total employment (2.51 per cent in 2009).

Table 28: Apprenticeship Registrations in Canada and the Provinces, 1991-2009

	1991-2009	1991-2000	2000-2009
	(compound annual growth rates, per cent)		
Canada	**4.26**	**0.35**	**8.33**
Newfoundland and Labrador	5.13	11.93	-1.25
Prince Edward Island	3.77	0.00	7.68
Nova Scotia	**1.30**	**-0.29**	**2.92**
New Brunswick	-0.54	-3.00	1.98
Quebec	1.68	-5.03	8.87
Ontario	4.86	0.72	9.17
Manitoba	4.93	2.87	7.04
Saskatchewan	5.79	5.93	5.65
Alberta	6.36	4.56	8.19
British Columbia	5.73	1.16	10.50
	1991	2000	2009
	(persons)		
Canada	**192,945**	**199,074**	**409,038**
Newfoundland and Labrador	2,829	7,803	6,966
Prince Edward Island	444	444	864
Nova Scotia	**4,950**	**4,824**	**6,249**
New Brunswick	5,694	4,329	5,163
Quebec	59,184	37,179	79,890
Ontario	62,511	66,675	146,859
Manitoba	4,140	5,343	9,852
Saskatchewan	4,149	6,969	11,427
Alberta	29,076	43,428	88,224
British Columbia	19,197	21,297	52,320

Source: CSLS calculations based on Statistics Canada data, Registered Apprenticeship Information System (CANSIM Table 477-0053).

Chart 46: Apprenticeship Registrations in Canada and the Provinces, 1991-2009 (compound annual growth rates, per cent)

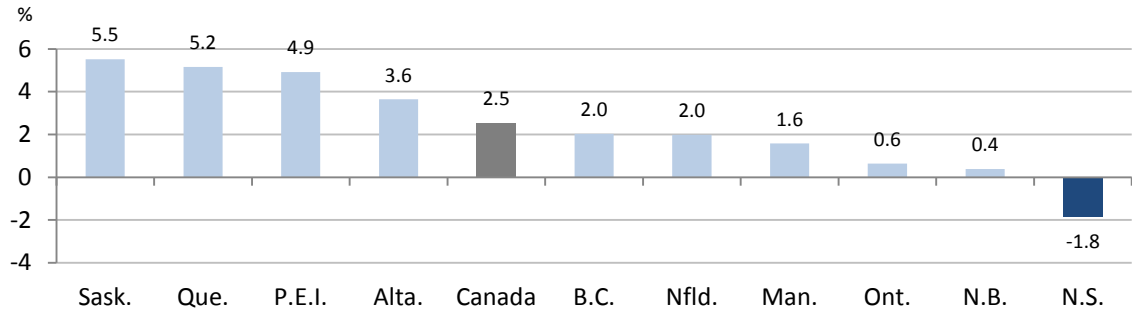


Source: CSLS calculations based on Statistics Canada data, Registered Apprenticeship Information System (CANSIM Table 477-0053).

The number of apprenticeship completions declined 1.81 per cent per year in Nova Scotia, from 705 people in 1991 to 507 people in 2009, in stark contrast to the trend observed at the national level, where the number of apprenticeship completions increased 2.52 per cent per year (Table 29). In fact, Nova Scotia ranked last in terms of apprenticeship completion growth when compared to the other provinces (Chart 47). Because of the below average growth rate, Nova Scotia's share in total apprenticeship completions in Canada declined from 3.57 per cent in 1991 to 1.64 per cent in 2009, well below the province's share in total employment (2.51 per cent in 2009).

In the 2000-2009 period, the province's performance was better than in the 1990s, with apprenticeship completions increasing 1.79 per cent per year. This growth rate, however, was still significantly below the national average of 5.93 per cent per year during the same period (and Nova Scotia continued to rank last). Overall, the weak growth of both apprenticeship registrations and completions in Nova Scotia may pose a challenge in the future, limiting overall productivity growth in the province, particularly in the context of the major expansion of the shipbuilding industry, which employs many tradespersons.

Chart 47: Apprenticeship Completions in Canada and the Provinces, 1991-2009 (compound annual growth rates, per cent)



Source: CSLS calculations based on Statistics Canada data, Registered Apprenticeship Information System (CANSIM Table 477-0054).

Table 29: Apprenticeship Completions in Canada and the Provinces, 1991-2009

	1991-2009	1991-2000	2000-2009
	(compound annual growth rates, per cent)		
Canada	**2.52**	**-0.77**	**5.93**
Newfoundland and Labrador	1.98	-2.04	6.17
Prince Edward Island	4.92	2.51	7.39
Nova Scotia	**-1.81**	**-5.30**	**1.79**
New Brunswick	0.39	-2.75	3.63
Quebec	5.16	-3.18	14.23
Ontario	0.64	-1.79	3.13
Manitoba	1.59	-3.51	6.96
Saskatchewan	5.52	6.32	4.73
Alberta	3.64	1.72	5.60
British Columbia	2.03	0.80	3.28
	1991	2000	2009
	(persons)		
Canada	**19,722**	**18,396**	**30,888**
Newfoundland and Labrador	354	294	504
Prince Edward Island	48	60	114
Nova Scotia	**705**	**432**	**507**
New Brunswick	540	420	579
Quebec	3,063	2,289	7,578
Ontario	7,275	6,186	8,166
Manitoba	741	537	984
Saskatchewan	432	750	1,137
Alberta	3,867	4,509	7,362
British Columbia	2,661	2,859	3,822

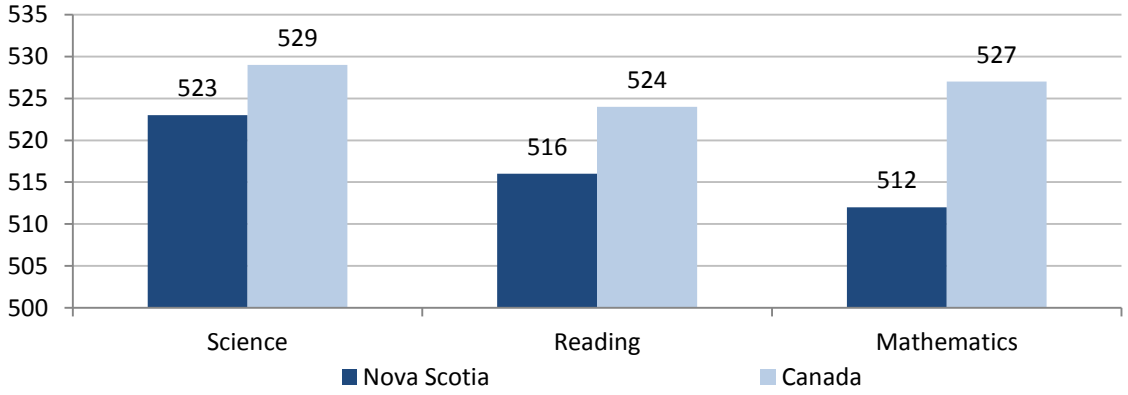
Source: CSLS calculations based on Statistics Canada data, Registered Apprenticeship Information System (CANSIM Table 477-0054).

vii. PISA

Educational outcomes affect productivity not only in the short-run, but in the long-run as well. After all, the high-school students of today will be the workers of tomorrow. In this sense, it is also important to keep track of the educational performance of the population that will be entering the labour force in the next 5 to10 years.

The Program for International Student Assessment (PISA), developed by the OECD, measures the performance of high school students in three key areas: science, reading, and mathematics. In 2009, Nova Scotia's average scores in science, reading, and mathematics were 523, 516, and 512, respectively (Chart 48). The province's scores were below the national averages in all three categories (529 in science, 524 in reading, and 527 in mathematics). Compared to the other provinces, Nova Scotia ranked 5th in all three categories. Although the province's performance within Canada is not impressive, it is important to note that Nova Scotia, like most Canadian provinces, outperforms the OECD average performance in all three areas (501 in science, 493 in reading, and 496 in mathematics).

Chart 48: Average Scores of Canadian 15-Year Old Students on the PISA Test by Subject Area, Canada and the Provinces, 2009



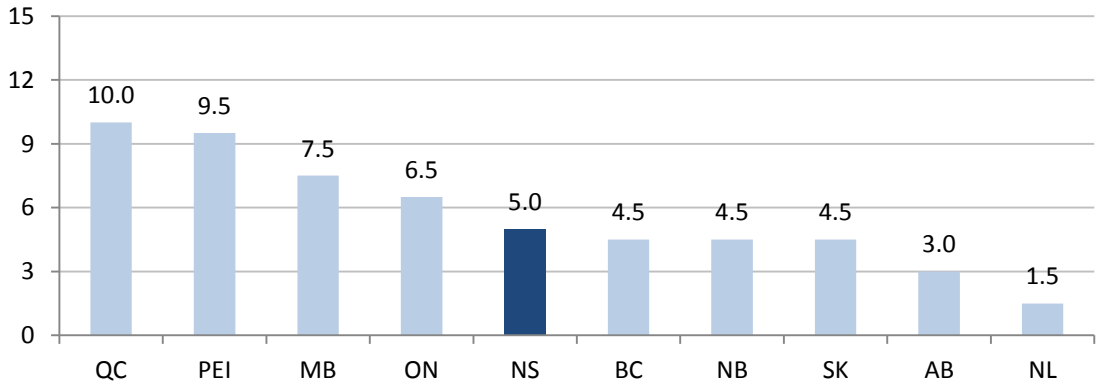
Source: CSLS Nova Scotia Productivity Database.

viii. Early Childhood Education

In addition to the quality of high school education, the quality of the future workforce also depends on the quality of early childhood education. The Early Childhood Education Index (ECEI) has been developed to assess the quality of early childhood education in the Canadian provinces. The index is based on 19 benchmarks organized under five categories: governance, funding access, learning environment, and accountability. Each category is assigned 3 points out of a total of 15 points.

In 2011, Nova Scotia ranked fifth among the 10 provinces in the ECEI with a score of 5 points (Chart 49). Details on how Nova Scotia fared on the 19 benchmarks are found in Appendix Table 7. This mediocre performance indicates that there are significant opportunities for Nova Scotia to improve the quality of early childhood education in the province to ensure that the future workforce meets its potential.

Chart 49: Early Childhood Education Index 2011: Total Score out of 15.0



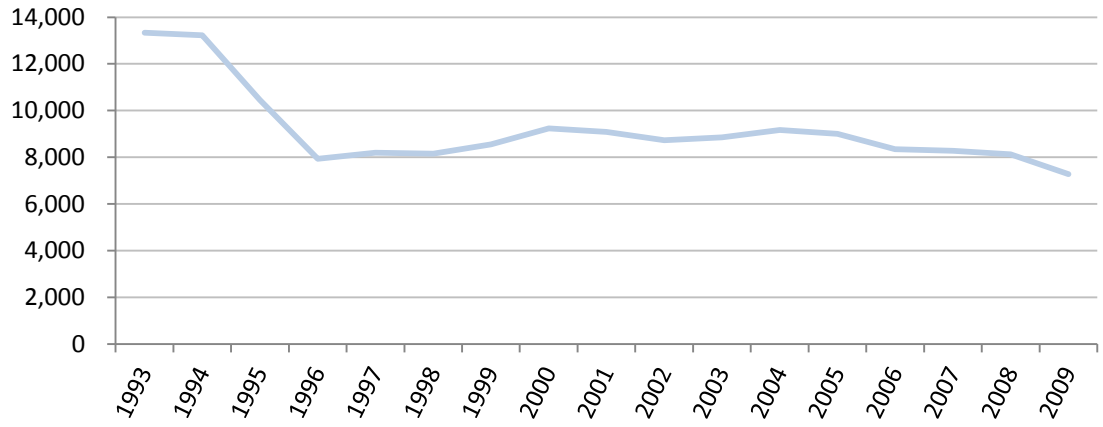
Source: Appendix Table 7.

ix. Workplace Injuries and Fatalities

The quality of life in a workplace can affect the productivity performance of the workers in that workplace. One aspect of workplace quality of life is the extent of workplace injuries and fatalities. In jurisdictions and enterprises where the incidence of workplace injuries and death is high and/or rising, worker morale commitment and morale might decline, and hence productivity will be negatively affected. Conversely, the effect may be the opposite in jurisdictions and enterprises where the incidence of injuries or death is low and/or falling. This section looks at trends in workplace injuries and deaths in Nova Scotia.

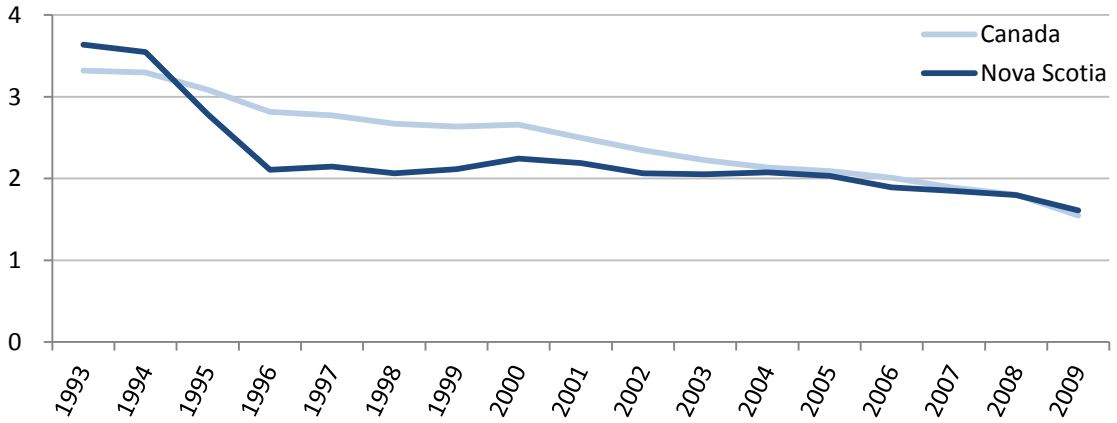
Chart 50 shows that 7,270 time-loss injuries were compensated by the Nova Scotia Workers Compensation Board in 2009. Chart 51 shows an incidence of workplace time-loss injuries of 1.6 per cent. This was comparable to the Canadian average of 1.5 per cent. In 1993, the first year for which data are available, there were 13,332 time-loss injuries in Nova Scotia, indicating a 45.5 per cent drop between that year and 2009. The incidence of time-loss injuries was 3.6 per cent in 2003 and had dropped 55.7 per cent by 2009. Similar declines took place at the national level. Nova Scotia workplaces, like Canadian workplaces in general, are becoming much less prone to injuries.

Chart 50: Number of Workplace Time-Loss Injuries in Nova Scotia, 1993-2009



Source: CSLS Nova Scotia Productivity Database.

Chart 51: Incidence of Workplace Time-Loss Injuries (per 100 Workers) in Nova Scotia and Canada, 1993-2009

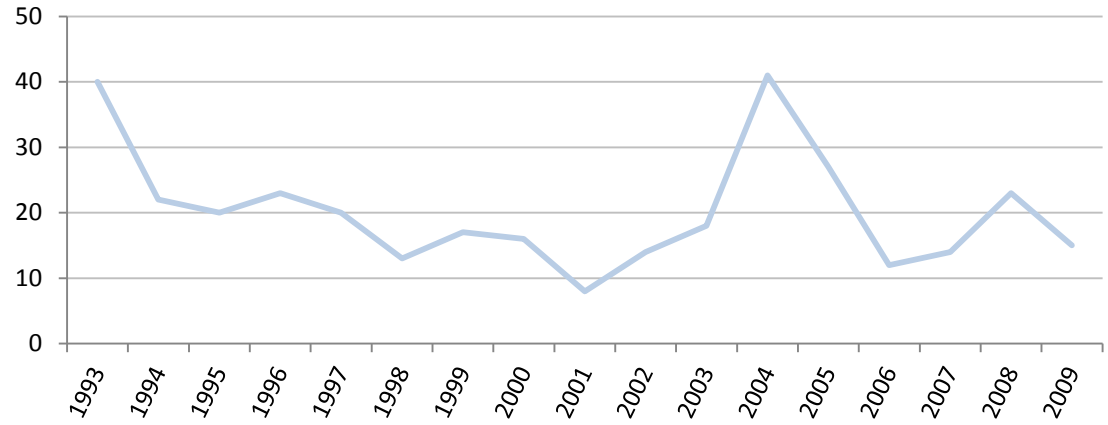


Source: CSLS Nova Scotia Productivity Database.

The downward trend in workplace time losses is also taking place for workplace fatalities, including both deaths from accidents and occupational diseases, at least for Nova Scotia. In 2009, there were 15 workplace fatalities in Nova Scotia, down from 40 in 1993, the first year for which data are available (Chart 52). The incidence of workplace fatalities in the province plummeted from 10.9 per 100,000 workers in 1993 to 3.3 in 2009 (Chart 53). It is interesting to note however that at the national level the incidence of workplace fatalities has not significantly fallen, at 5.9 per 100,000 in 1993 versus 5.6 in 2009.

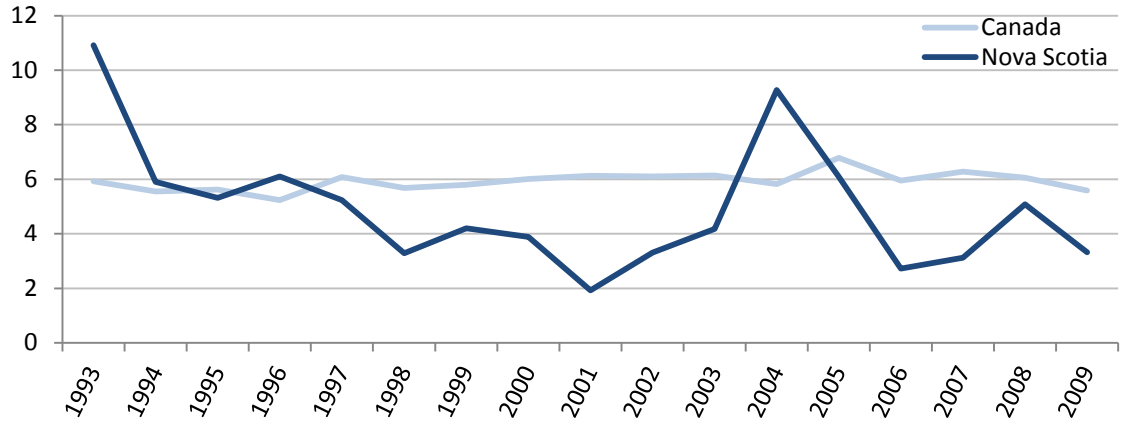
Nova Scotia's falling incidence of workplace injuries and fatalities certainly represents a positive development for workers in the province. However, the productivity implications are likely minor. Compared to the main drivers of productivity growth – human capital, investment and innovation – fewer injuries and fatalities have limited effects on output and productivity.

Chart 52: Number of Workplace Fatalities in Nova Scotia, 1993-2009



Source: CSLS Nova Scotia Productivity Database.

Chart 53: Incidence of Workplace Fatalities per 100,000 Workers in Nova Scotia and Canada, 1993-2009



Source: CSLS Nova Scotia Productivity Database.

x. Labour Shortages

The existence of labour shortages is often seen as evidence that supply of labour is inadequate to meet demand and may indicate that policies related to the skills development of the work force have been inadequate. This section briefly discusses the concept of labour shortages, the evidence of such shortages in Nova Scotia, and the implications of shortages for productivity growth.

The concept of labour shortages has different meaning for economists and businesspersons. While economists recognize that skilled labour shortages can exist, they argue that in competitive labour markets, market forces will bring labour supply and demand back into balance, at least in the medium to long run. In response to an inability to find an adequate supply of workers at current wages, employers will raise wages, attracting more workers from various sources (e.g. other firms, sectors, provinces, or countries). Economists recognize that if employers are unable to raise wages and still remain competitive, they may go out of business. But this is seen as the part of the continuous process by which labour is reallocated in an economy to its most productive use. While this creative destruction process is not without social costs, it is positive from the point of view of aggregate productivity growth. Not surprisingly considering the implications for their own survival, businesspersons are much less sanguine about the role of market forces in resolving labour shortages and see labour shortages as a much more critical issue than economists do.

The best measure of labour shortages is unfilled job vacancies. Unfortunately, Statistics Canada does not at this time produce estimates of job vacancies so information on the existence of labour shortages in this country is very limited. Since labour shortages are resolved though

wage increases, above average increases in labour compensation in a region, industry, or occupation can be taken as evidence of a labour market imbalance. Very low rates of unemployment (less than 5 per cent) coincide with the existence of labour shortages.

This report finds no evidence that at this time generalized labour shortages exist in Nova Scotia. The unemployment rate in the province in 2011 was above 8 per cent. Average weekly wages in Nova Scotia in October 2011 were up only 0.4 per cent on a year-over-year basis, with no industry exhibiting significant upward wage pressure. This rate of increase was below the national average of 1.4 per cent and the lowest of any province (in contrast, in Newfoundland and Labrador, where labour shortages in certain sectors appear an issue, wages were up 7.7 per cent). The 2010 Nova Scotia *Labour Market Review* also reported no evidence on labour shortages in the province at this time.

A small number of companies in Nova Scotia may be experiencing difficulty recruiting personnel for specialized positions at current wage rates. But these openings can generally be filled by training currently employed workers for the position, raising compensation to attract better qualified local applicants, or broadening the job search beyond the province.

There is little impact of true labour shortages, such as have existed in the Fort McMurray area of Alberta, on aggregate productivity. The impact of such shortages is to reduce both output growth and employment growth from what it would have been had workers been found for the positions. There is no effect on labour productivity outside compositional effects, which are likely minor. From a long term perspective, labour shortages associated with tight labour markets actually have a positive effect on labour productivity. These shortages lead to higher wages, which results in greater substitution of capital for labour and hence higher levels of labour productivity.

C. Innovation

We have already established that increases in productivity can be the result of increases in the amount of physical and human capital. Similarly, technological progress can be either embodied in physical capital or disembodied in the form of, for example, organizational change. Productivity can also be significantly raised if appropriate management practices are exploited, if firms learn how to better exploit existing technologies or if new and enhanced processes are developed.

The question then becomes how firms, governments and individuals can develop higher levels of physical capital and how knowledge can be created and diffused, thus improving the quality of human capital and creating intangible value in the form of better management practices and production processes. The innovative process is complex and necessitates a

suitable incentive structure, the appropriate a priori knowledge and considerable investment in knowledge creation and knowledge diffusion. It is this former element, expenditures on research and development (R&D), on which we focus our attention here.

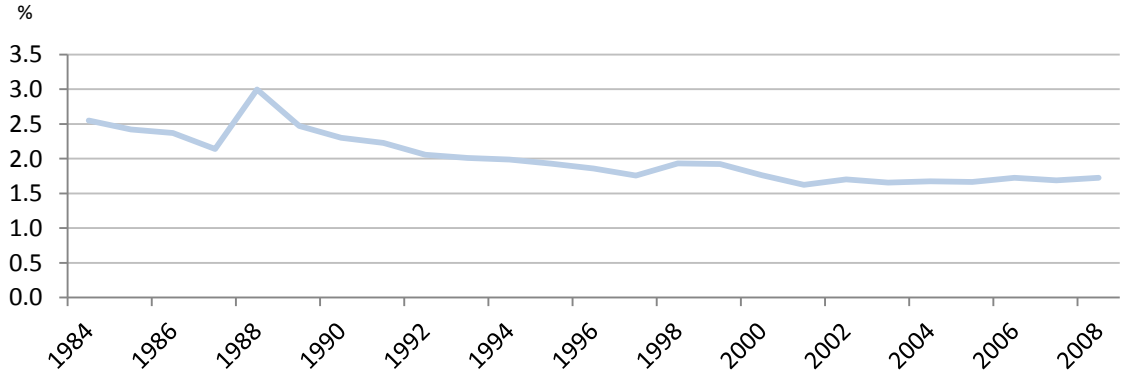
In 2008, nominal R&D expenditures in Nova Scotia reached $514 million, up from $160 million in 1984, growing at a compound annual rate of 4.99 per cent (Table 30). R&D expenditures at the national level increased at an even faster pace, 6.72 per cent per year, from $6,273 million in 1984 to $29,894 million in 2008. The growth rate differential between Nova Scotia and Canada as a whole caused Nova Scotia's R&D share in national R&D to decline 0.83 percentage points from 2.55 per cent in 1984 to 1.72 per cent in 2008 (Chart 54). Compared to the other provinces, Nova Scotia ranked 9th in terms of R&D expenditures growth during the 1984-2008 period, outperforming only Manitoba, where R&D expenditures increased 4.35 per cent per year.

Table 30: Nominal R&D Expenditures Growth in Canada and the Provinces, 1984-2008

	1984-2008	1984-1989	1989-2000	2000-2008
	(compound annual growth rates, per cent)			
Canada	**6.72**	**8.69**	**7.25**	**4.79**
Newfoundland and Labrador	6.67	10.91	3.07	9.15
Prince Edward Island	8.04	9.86	7.92	7.09
Nova Scotia	**4.99**	**7.99**	**4.01**	**4.51**
New Brunswick	7.84	26.86	-0.17	8.34
Quebec	8.02	13.46	8.49	4.12
Ontario	7.43	14.43	7.12	3.69
Manitoba	4.35	4.15	4.20	4.69
Saskatchewan	5.85	6.96	6.45	4.34
Alberta	7.47	6.07	6.12	10.24
British Columbia	8.68	12.01	8.27	7.21

Source: CSLS calculations based on Statistics Canada data, Research and Development in Canadian Industry (CANSIM Table 358-001).

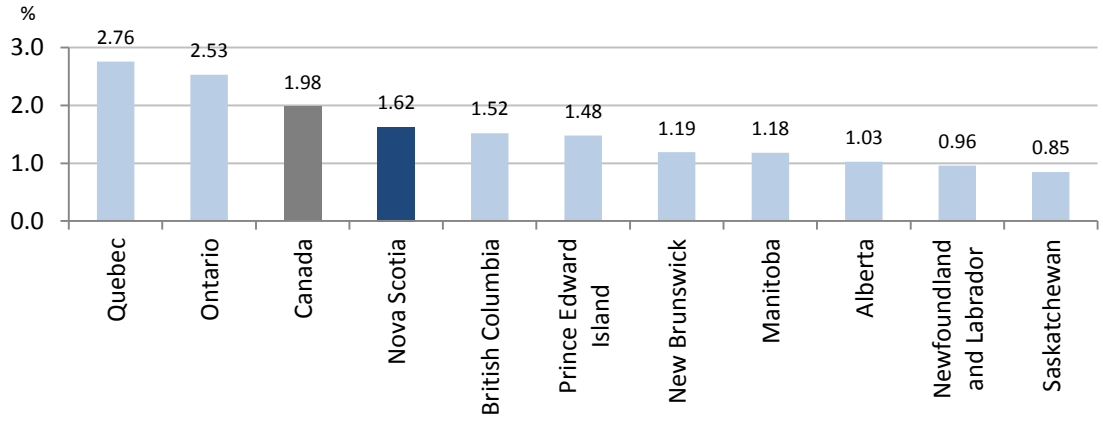
Chart 54: Total R&D Expenditures in Nova Scotia as a Share of Canada



Source: CSLS calculations based on Statistics Canada data, Research and Development in Canadian Industry (CANSIM Table 358-001).

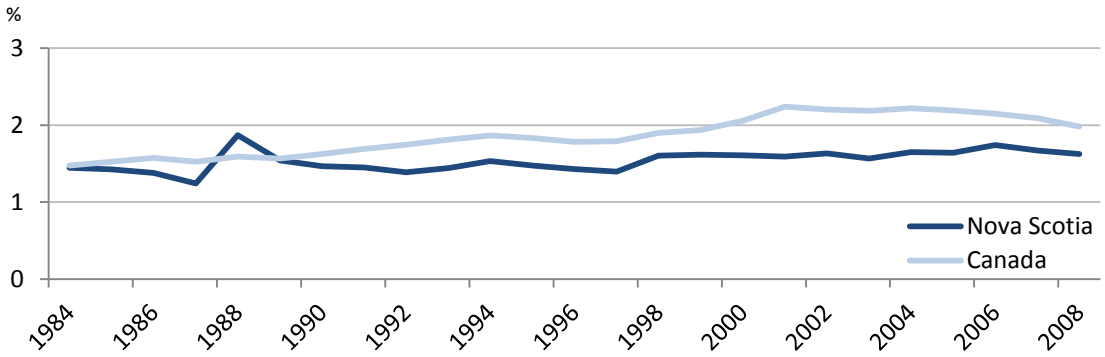
One of the most commonly used measures of R&D effort is R&D intensity, defined as the ratio of R&D expenditures to nominal GDP. In 2008, R&D intensity in Canada was 1.98 per cent, while in Nova Scotia it was only 1.62 per cent (Chart 55). It is interesting to note, however, that in 1984 R&D intensity in Nova Scotia was practically the same as the national average (1.45 per cent vs. 1.47 per cent, respectively) (Chart 56). The upward trend in R&D intensity experienced at the national level was largely driven by Ontario and Quebec.

Chart 55: R&D Intensity in Canada and the Provinces, 2008



Source: CSLS calculations based on Statistics Canada data, 1) Input-Output Structure of the Canadian Economy in Current Prices (CANSIM Tables 379-0024 and 379-0025); 2) Research and Development in Canadian Industry (CANSIM Table 358-001).

Chart 56: R&D Intensity in Nova Scotia and Canada, 1984-2008



Source: CSLS calculations based on Statistics Canada data, 1) Input-Output Structure of the Canadian Economy in Current Prices (CANSIM Tables 379-0024 and 379-0025); 2) Research and Development in Canadian Industry (CANSIM Table 358-001).

R&D can be performed by the business sector (BERD), the higher education sector (HERD), or the government. Although the focus of this report is on Nova Scotia's business sector, it is also important to take into account R&D performed by the higher education sector and by the government sector because of spill-over effects. In other words, the province's

business sector can benefit from R&D even when it is not conducted by business sector establishments.

Table 31: R&D Expenditures, Nova Scotia and Canada, 1984-2008

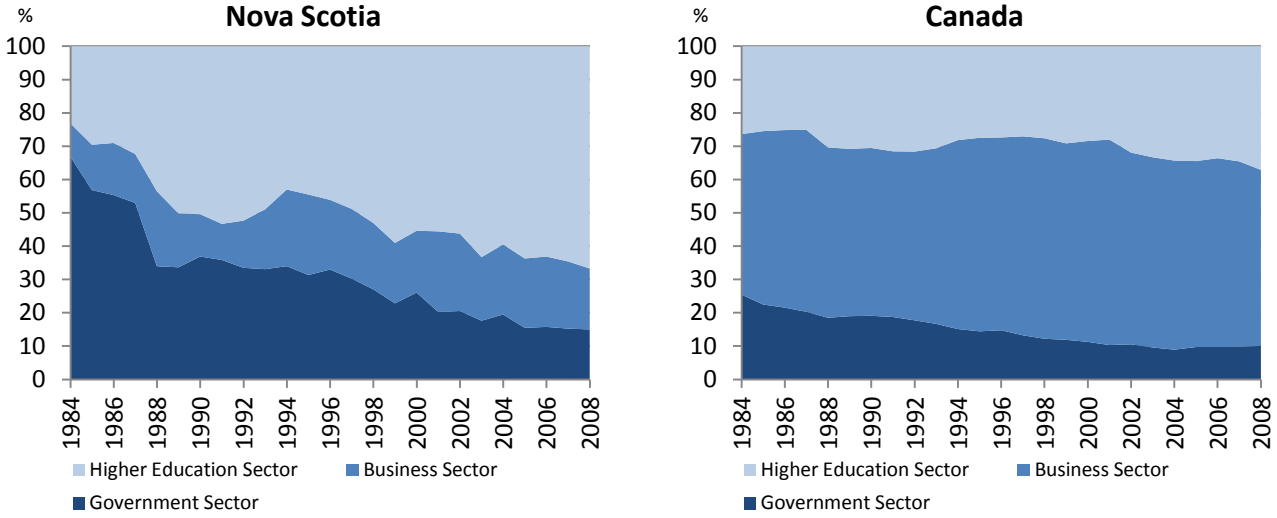
	Nova Scotia				Canada			
	1984-2008	1984-1989	1989-2000	2000-2008	1984-2008	1984-1989	1989-2000	2000-2008
	(compound annual growth rates, per cent)							
Total R&D Expenditures	**4.98**	**7.99**	**3.98**	**4.52**	**6.72**	**8.69**	**7.25**	**4.79**
Government Sector	-1.36	-5.89	1.59	-2.46	2.67	2.50	2.27	3.33
Business Sector	7.66	18.89	5.29	4.32	7.13	9.60	9.05	3.07
Higher Education Sector	9.72	26.11	4.91	6.98	8.25	12.11	6.48	8.33
	1984	1989	2000	2008	1984	1989	2000	2008
	(millions, current dollars)							
Total R&D Expenditures	**160**	**235**	**361**	**514**	**6,273**	**9,517**	**20,556**	**29,894**
Government Sector	107	79	94	77	1,595	1,805	2,310	3,001
Business Sector	16	38	67	94	3,022	4,779	12,395	15,792
Higher Education Sector	37	118	200	343	1,656	2,933	5,851	11,101
	1984	1989	2000	2008	1984	1989	2000	2008
	(as a share of total R&D expenditures)							
Total R&D Expenditures	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Government Sector	66.9	33.6	26.0	15.0	25.4	19.0	11.2	10.0
Business Sector	10.0	16.2	18.6	18.3	48.2	50.2	60.3	52.8
Higher Education Sector	23.1	50.2	55.4	66.7	26.4	30.8	28.5	37.1
	1984	1989	2000	2008	1984	1989	2000	2008
	(as a share of total economy nominal GDP)							
Total R&D Expenditures	1.45	1.87	1.61	1.62	1.47	1.57	2.06	1.98
Government Sector	0.97	0.64	0.42	0.24	0.38	0.30	0.23	0.20
Business Sector	0.14	0.42	0.30	0.30	0.71	0.79	1.24	1.05
Higher Education Sector	0.33	0.82	0.89	1.08	0.39	0.48	0.59	0.74

Source: CSLS calculations based on Statistics Canada data, 1) Input-Output Structure of the Canadian Economy in Current Prices (CANSIM Tables 379-0024 and 379-0025); 2) Research and Development in Canadian Industry (CANSIM Table 358-001).

Nova Scotia's BERD increased 7.66 per cent per year during the 1984-2008 period (vs. an increase of 7.13 per cent per year in the nation-wide BERD), from $16 million in 1984 to $94 million in 2008 (Table 31). The province's HERD grew 9.27 per cent per year during the same period (vs. 8.25 per cent per year in Canada), from $37 million in 1984 to $343 million in 2008. Finally, R&D expenditures performed by the government sector in Nova Scotia declined 1.36 per cent per year (vs. an increase of 2.67 per cent per year in Canada), from $107 million in 1984 to $77 million in 2008.

In 2008, the Canadian business sector as a whole played a much larger role in performing R&D than Nova Scotia's business sector (Chart 57). More specifically, the business sector in Canada performed 52.8 per cent of total nominal R&D expenditures during the period, while in Nova Scotia it performed only 18.3 per cent. Nova Scotia's main R&D performer was the higher education sector, which accounted for 66.7 per cent of total nominal R&D expenditures (vs. 37.1 per cent nation-wide). The prominent role of Nova Scotia's higher education sector in performing R&D dates back to the late 1980s-early 1990s, with the declining importance of the government sector as an R&D performer in the province (15.0 per cent in 2008, down from 66.9 per cent in 1984, but still above the national average of 10.0 per cent).

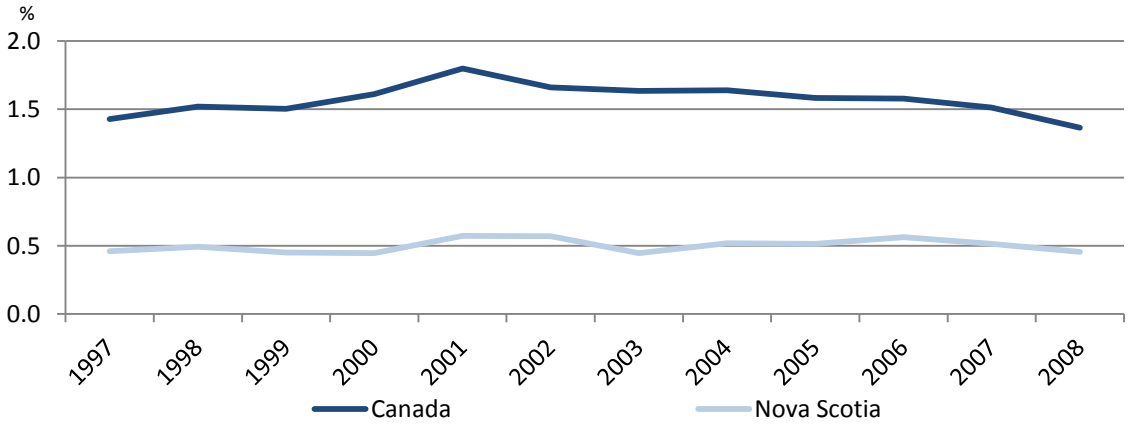
Chart 57: R&D Expenditures by Performer, Nova Scotia and Canada, 1984-2008 (as a per cent of total)



Source: CSLS calculations based on Statistics Canada data, Labour force survey estimates, by educational attainment, sex and age group, annually (CANSIM Table 282-0004).

Looking specifically at BERD intensity (defined here as BERD as a share of nominal GDP in the business sector), we can see that Nova Scotia's performance has been well below Canada's during the 1997-2008 period (Chart 58). BERD intensity in Nova Scotia was 0.45 per cent in 2008, less than a third of Canada's BERD intensity, 1.37 per cent.

Chart 58: BERD Intensity in Nova Scotia and Canada, 1997-2008



Source: CSLS calculations based on Statistics Canada data, 1) Input-Output Structure of the Canadian Economy in Current Prices (CANSIM Tables 379-0024 and 379-0025); 2) Research and Development in Canadian Industry (CANSIM Table 358-001).

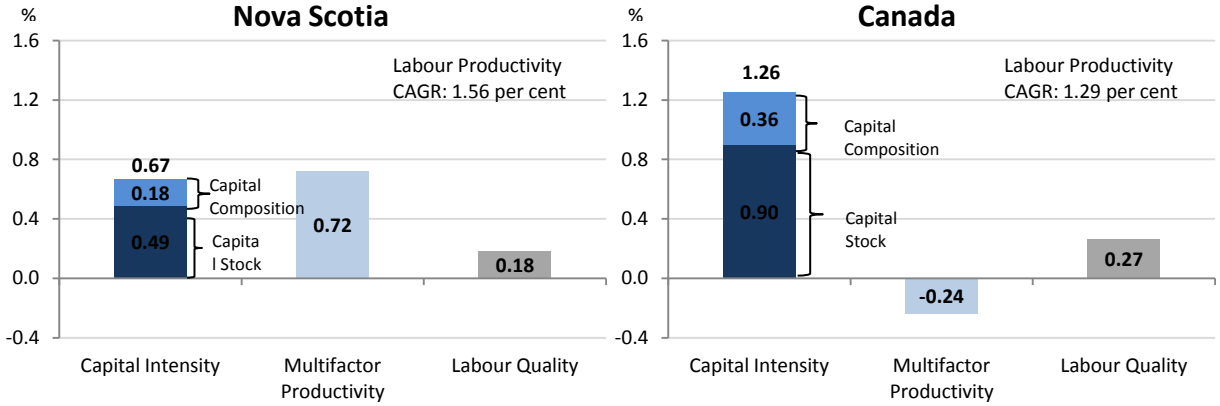
D. Sources of Labour Productivity Growth in Nova Scotia

The last three subsections have highlighted the evolution of important productivity drivers in Nova Scotia during the 1997-2010 period, using Canada as a benchmark. The province lagged behind Canada in terms of both capital intensity and innovation (as measured by R&D expenditures), while education outcomes were, in general, on par with the national average. Despite these facts, Nova Scotia observed above average labour productivity growth during the period (1.56 per cent vs. 1.29 per cent). What accounts for this productivity rate differential?

Labour productivity growth in the province outpaced Canada's due to strong multifactor productivity growth (MFP). MFP growth reflects output growth that is not accounted for by combined input growth. It can be explained by a number of very different factors, such as improvements in technology and organization, capacity utilization, increasing returns to scale, etc. It also embeds errors due to the mismeasurement of inputs. In a value-added context, MFP is calculated as the ratio between GDP and combined labour or capital input.

MFP growth accounted for 0.72 percentage points of the overall 1.56 annual labour productivity growth observed in Nova Scotia during the 1997-2010 period (Chart 59). The contribution of capital intensity to labour productivity growth was much smaller: capital composition growth was responsible for 0.18 percentage points of labour productivity growth, and capital stock growth accounted for 0.49 percentage points. Finally, a small increase in labour quality was responsible for 0.18 percentage points of the labour productivity growth experienced in the province.

Chart 59: Percentage Point Contribution to Labour Productivity Growth by the Source of Labour Productivity Growth in Nova Scotia and in Canada, Market Sector, 1997- 2010



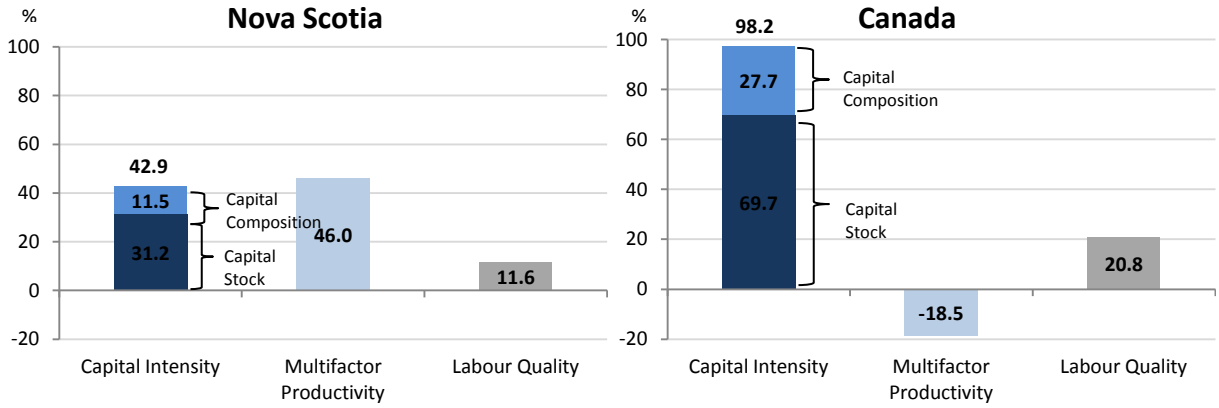
Source: CSLS Provincial Productivity Database.

It is interesting to note that the drivers of labour productivity growth in Nova Scotia and in Canada were quite different. Multifactor productivity actually declined in Canada, while in Nova Scotia it explained 46.0 per cent of the province's labour productivity growth (Chart 60).

Labour quality growth explains 20.8 per cent of labour productivity growth in Canada, but only 11.6 per cent in Nova Scotia. Capital intensity growth, in turn, was responsible for only 42.9 per cent of the growth in labour productivity for Nova Scotia and 98.2 per cent for Canada.

Unfortunately, it is hard to pinpoint exactly why MFP growth in Nova Scotia was higher than in Canada during the 1997-2010 period. By definition, MFP growth is a residual. It encapsulates the influence of a variety of factors. In this sense, it can be thought of as a "black box". Disentangling the influence of each potential factor to productivity growth is by no means trivial. One possible explanation is that Nova Scotia is experiencing "catch-up" growth, with the province's labour productivity converging to the national average.

Chart 60: Per Cent Contribution to Labour Productivity Growth by the Source of Labour Productivity Growth in Nova Scotia and in Canada, Market Sector, 1997 to 2010



Note: Numbers may not sum up to 100 due to rounding. Source: CSLS Provincial Productivity Database.

E. Industrial Structure and Intersectoral Shifts

The aggregate labour productivity level is (approximately) the weighted average of sectoral labour productivity levels, with the weights being equal to each sector's labour input share. Using the framework developed by Sharpe and Thomson (2010b),[14] we can decompose the contributions of different sectors to aggregate labour productivity growth in Nova Scotia (the framework is formally derived in Appendix 2). Furthermore, the contribution of each sector can be broken down in three components:

- The **within-sector effect**, as the name implies, captures the change in labour productivity that happens within a sector, driven by increased capital intensity, increased labour quality, technical change, economies of scale, etc.

[14] For an alternative decomposition methodology that works well with chained indexes, see Almon and Tang (2011).

- The **reallocation level effect** indicates whether changes in the share of hours have favoured sectors with above (or below) average labour productivity *levels*. This effect is positive when the labour input share is growing in industries that have above average labour productivity levels or when the labour input share is falling in industries with below average labour productivity levels. It is negative when labour is moving into industries with below average productivity levels or leaving industries with above average productivity levels.

- The **reallocation growth effect** measures whether labour is shifting towards sectors with above (or below) average labour productivity *growth*. This effect is positive if the growth rate of labour productivity is above average and the labour input share of the industry is increasing or if the growth rate is below average and the labour share is decreasing. It is negative if the growth rate of labour productivity is above average and the labour input share is decreasing or if the rate of growth is below average and the labour input share is rising.

According to CSLS calculations, Nova Scotia's retail trade sector was responsible for 20.3 per cent of the province's overall labour productivity growth during the 1997-2010 period. It was followed by other private services (14.3 per cent), manufacturing (14.1 per cent), and wholesale trade (13.8 per cent) (Table 32). On the other hand, sectors like professional, scientific and technical services, ASWMRS, and arts, entertainment and recreation actually hindered productivity growth in the province.

Table 33 decomposes the contribution of Nova Scotia's two-digit NAICS sectors to aggregate labour productivity into within-sector, reallocation level, and reallocation growth effects. The within-sector effect was, by far, the most important, accounting for 121.2 per cent of total labour productivity growth in the province's business sector. With the exception of information and cultural industries, the sectors that contributed the most to the within-sector effect were the same sectors highlighted above: retail trade, manufacturing, wholesale trade, and other private services. Aggregate labour productivity growth was hindered by a negative reallocation effect. A relatively strong, negative reallocation growth effect added to the slightly negative reallocation level effect, generating a net decrease of 15.6 per cent in Nova Scotia's total labour productivity. The sectors that had the strongest negative reallocation growth effects were: ASWMRS, mining and oil and gas extraction, and information and cultural industries.

Table 32: Sectoral Contribution to Labour Productivity (LP) Growth in Nova Scotia and Canada, Business Sector, 1997-2010

	Hours Share, 1997 A	Hours Share, 2010 B	Δ Hours Share C=B-A	LP Level, 1997 D	LP Level, 2010 E	Δ LP F=E-D	Absolute Sectoral Contribution to Overall LP Growth G	Per Cent Sectoral Contribution to Overall LP Growth H
A) Nova Scotia								
Business sector industries	*100.0*	*100.0*	*0.0*	*23.73*	*29.03*	*5.30*	*5.30*	*100.0*
Agriculture, forestry, fishing and hunting	5.8	4.6	-1.3	17.95	28.90	10.95	0.61	11.4
Mining and oil and gas extraction	1.4	0.9	-0.5	57.15	87.49	30.34	0.12	2.3
Utilities	0.7	0.6	-0.1	153.07	174.99	21.92	0.05	0.9
Construction	10.2	12.7	2.5	20.21	23.37	3.17	0.17	3.2
Manufacturing	13.9	11.6	-2.4	29.20	35.69	6.49	0.71	13.4
Wholesale trade	6.2	5.5	-0.8	27.24	40.39	13.15	0.69	13.0
Retail trade	18.0	17.7	-0.4	12.70	18.43	5.74	1.01	19.1
Transportation and warehousing	6.6	5.6	-1.0	23.67	29.13	5.46	0.34	6.4
Information and cultural industries	2.5	2.1	-0.4	41.94	72.51	30.57	0.56	10.5
FIRE	6.0	7.2	1.2	59.96	64.85	4.89	0.68	12.9
Professional, scientific and technical services	4.7	5.9	1.2	24.71	24.95	0.24	-0.04	-0.7
ASWMRS	2.8	6.4	3.6	16.35	16.44	0.09	-0.43	-8.0
Arts, entertainment and recreation	1.3	1.4	0.1	21.47	15.07	-6.40	-0.09	-1.8
Accommodation and food services	8.4	7.8	-0.5	11.66	13.14	1.48	0.20	3.8
Other private services	11.4	10.0	-1.3	15.24	20.93	5.68	0.72	13.6
B) Canada								
Business sector industries	*100.0*	*100.0*	*0.0*	*32.47*	*38.37*	*5.90*	*5.90*	*100.0*
Agriculture, forestry, fishing and hunting	5.5	3.1	-2.4	20.04	37.26	17.22	0.99	16.8
Mining and oil and gas extraction	1.7	1.9	0.2	141.69	118.67	-23.02	-0.21	-3.5
Utilities	0.8	0.8	0.0	163.15	152.09	-11.07	-0.08	-1.4
Construction	8.8	11.0	2.2	25.32	28.11	2.79	0.02	0.3
Manufacturing	18.4	13.1	-5.3	40.35	50.71	10.35	1.29	21.8
Wholesale trade	7.4	6.7	-0.7	28.53	43.44	14.91	1.09	18.5
Retail trade	12.9	13.2	0.3	16.91	24.02	7.12	0.90	15.2
Transportation and warehousing	6.3	6.2	-0.1	31.75	36.15	4.41	0.29	4.9
Information and cultural industries	2.4	2.9	0.5	50.31	62.47	12.16	0.42	7.2
FIRE	7.4	8.1	0.7	63.60	76.11	12.50	1.24	20.9
Professional, scientific and technical services	6.1	8.1	1.9	26.79	30.80	4.01	0.10	1.7
ASWMRS	4.0	5.9	1.9	21.53	21.52	-0.01	-0.33	-5.6
Arts, entertainment and recreation	1.5	1.9	0.4	21.34	20.11	-1.23	-0.09	-1.6
Accommodation and food services	7.4	7.2	-0.2	14.18	15.39	1.21	0.14	2.4
Other private services	9.4	9.9	0.4	21.08	23.17	2.09	0.13	2.3

Source: CSLS calculations based on Statistics Canada data.

Table 33: Sectoral Contributions to Labour Productivity Growth Decomposed into Within-Sector, Reallocation Level, and Reallocation Growth Effects, Nova Scotia, 1997-2010

	Within-Sector Effect	Reallocation Level Effect	Reallocation Growth Effect	Total
	(absolute change in labour productivity between 1997-2010)			
Business sector industries	6.42	-0.11	-0.72	5.30
Agriculture, forestry, fishing and hunting	0.64	0.07	-0.07	0.64
Mining and oil and gas extraction	0.42	-0.17	-0.12	0.13
Utilities	0.14	-0.09	-0.01	0.05
Construction	0.32	-0.09	-0.05	0.18
Manufacturing	0.91	-0.13	-0.03	0.75
Wholesale trade	0.82	-0.03	-0.06	0.73
Retail trade	1.03	0.04	0.00	1.07
Transportation and warehousing	0.36	0.00	0.00	0.36
Information and cultural industries	0.78	-0.08	-0.11	0.59
FIRE	0.29	0.43	0.00	0.72
Professional, scientific and technical services	0.01	0.01	-0.06	-0.04
ASWMRS	0.00	-0.27	-0.19	-0.45
Arts, entertainment and recreation	-0.08	0.00	-0.01	-0.10
Accommodation and food services	0.12	0.07	0.02	0.21
Other private services	0.65	0.11	-0.01	0.76
	(as a share of total labour productivity change)			
Business sector industries	121.2	-2.1	-13.5	100.0
Agriculture, forestry, fishing and hunting	12.1	1.4	-1.3	12.1
Mining and oil and gas extraction	7.8	-3.1	-2.3	2.4
Utilities	2.7	-1.6	-0.2	0.9
Construction	6.1	-1.7	-1.0	3.4
Manufacturing	17.1	-2.4	-0.5	14.1
Wholesale trade	15.5	-0.5	-1.2	13.8
Retail trade	19.5	0.8	0.0	20.3
Transportation and warehousing	6.8	0.0	0.0	6.8
Information and cultural industries	14.7	-1.5	-2.0	11.2
FIRE	5.5	8.1	-0.1	13.5
Professional, scientific and technical services	0.2	0.2	-1.2	-0.7
ASWMRS	0.0	-5.0	-3.6	-8.5
Arts, entertainment and recreation	-1.5	-0.1	-0.3	-1.9
Accommodation and food services	2.3	1.3	0.4	4.0
Other private services	12.2	2.2	-0.1	14.3

Source: CSLS calculations based on Statistics Canada data.

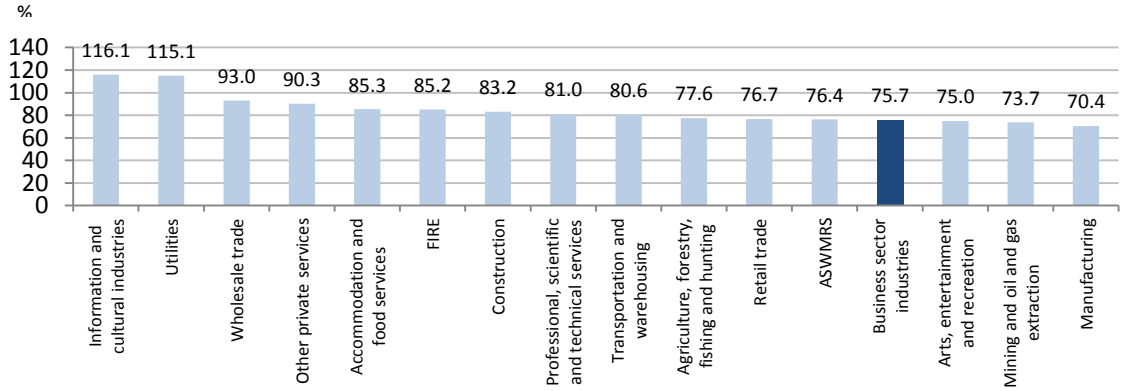
One of the most striking facts about Nova Scotia's labour productivity performance is that almost all two-digit NAICS sectors in the province had levels below the national averages (Table 34, Chart 61). In 2010, the only two exceptions were information and cultural industries and utilities, where labour productivity levels represented 116.1 per cent and 115.1 per cent of the national averages, respectively. The province's labour productivity levels in wholesale trade, and other private services were also relatively close to Canada's, representing (respectively), 93.0 per cent of the national level and 90.3 per cent.

Table 34: Nova Scotia's Real Labour Productivity Levels by Industry as a Share of Canada's, Business Sector Industries, 1997, 2000, and 2010 (Canada=100.0)

	1997	2000	2010
	(province's real labour productivity level as a per cent of Canada's)		
Business sector industries	**73.1**	**73.5**	**75.7**
Business sector, goods	*67.9*	*67.6*	*67.2*
Agriculture, forestry, fishing and hunting	89.6	83.0	77.6
Mining and oil and gas extraction	40.3	96.9	73.7
Utilities	93.8	75.4	115.1
Construction	79.8	81.7	83.2
Manufacturing	72.4	62.3	70.4
Non-durable manufacturing industries	71.1	66.7	69.3
Durable manufacturing industries	68.2	56.5	73.9
Business sector, services	*78.6*	*79.1*	*80.9*
Wholesale trade	95.5	97.1	93.0
Retail trade	75.1	72.6	76.7
Transportation and warehousing	74.6	82.2	80.6
Information and cultural industries	83.4	103.0	116.1
FIRE	94.3	95.2	85.2
Professional, scientific and technical services	92.3	85.8	81.0
ASWMRS	76.0	82.0	76.4
Arts, entertainment and recreation	100.6	76.4	75.0
Accommodation and food services	82.2	82.3	85.3
Other private services	72.3	77.7	90.3
ICT Sector	**..**	**..**	**..**

Source: CSLS Nova Scotia Productivity Database.

Chart 61: Labour Productivity Levels in Nova Scotia as a Share of Canada's, Business Sector Industries, 2010 (Canada=100.0)



Source: CSLS Nova Scotia Productivity Database.

The labour productivity gap between Nova Scotia and Canada can be decomposed into two main components: differences in levels and differences in sectoral composition (in terms of shares of hours worked). Our previous discussion makes it clear that the low labour productivity levels play a dominant role in explaining the gap. Table 35 reinforces this view, showing that differences between Nova Scotia's and Canada's sectoral composition accounted for $2.75 of the $8.96 average gap observed during the 1997-2010 period, equivalent to 30.0 per cent of the gap.

The remaining difference of $6.21 (70.0 per cent) is explained by lower labour productivity levels in Nova Scotia.

Table 35: Labour Productivity Level Gap Decomposition, Nova Scotia, 1997-2010

	Labour Productivity Levels				Gap Decomposition	
		Nova Scotia				
	Canada	Using Actual Hours Worked Shares	Using Canada's Hours Worked Shares	Labour Productivity Gap	Sectoral Composition	Level
	A	B	C	D=B-A	E=B-C	F=C-A
	(chained 2002 dollars per hour worked)					
1997	32.47	23.73	25.75	-8.74	-2.03	-6.72
1998	33.11	23.91	26.14	-9.20	-2.23	-6.98
1999	34.25	25.28	27.72	-8.97	-2.44	-6.53
2000	35.55	26.14	28.81	-9.41	-2.67	-6.74
2001	35.87	27.24	29.73	-8.63	-2.49	-6.13
2002	36.42	28.25	31.02	-8.17	-2.78	-5.40
2003	36.60	28.50	31.18	-8.10	-2.68	-5.42
2004	36.74	28.39	31.44	-8.35	-3.05	-5.29
2005	37.58	28.29	31.21	-9.30	-2.92	-6.38
2006	38.04	28.49	31.90	-9.55	-3.42	-6.14
2007	38.02	28.14	31.37	-9.89	-3.24	-6.65
2008	37.84	28.82	31.58	-9.02	-2.76	-6.26
2009	37.71	28.92	31.81	-8.79	-2.90	-5.89
2010	38.37	29.03	31.90	-9.34	-2.87	-6.47
AVERAGE	36.33	27.37	30.11	-8.96	-2.75	-6.21
	(as a share of Canada's labour productivity level, per cent)					
1997	100.00	73.08	79.32	-26.92	-6.24	-20.68
1998	100.00	72.21	78.93	-27.79	-6.72	-21.07
1999	100.00	73.81	80.94	-26.19	-7.13	-19.06
2000	100.00	73.52	81.04	-26.48	-7.52	-18.96
2001	100.00	75.95	82.90	-24.05	-6.95	-17.10
2002	100.00	77.56	85.19	-22.44	-7.62	-14.81
2003	100.00	77.86	85.18	-22.14	-7.32	-14.82
2004	100.00	77.28	85.59	-22.72	-8.31	-14.41
2005	100.00	75.26	83.03	-24.74	-7.77	-16.97
2006	100.00	74.89	83.87	-25.11	-8.98	-16.13
2007	100.00	74.00	82.51	-26.00	-8.51	-17.49
2008	100.00	76.17	83.46	-23.83	-7.29	-16.54
2009	100.00	76.70	84.37	-23.30	-7.68	-15.63
2010	100.00	75.66	83.14	-24.34	-7.48	-16.86
AVERAGE	100.00	75.28	82.82	-24.72	-7.54	-17.18

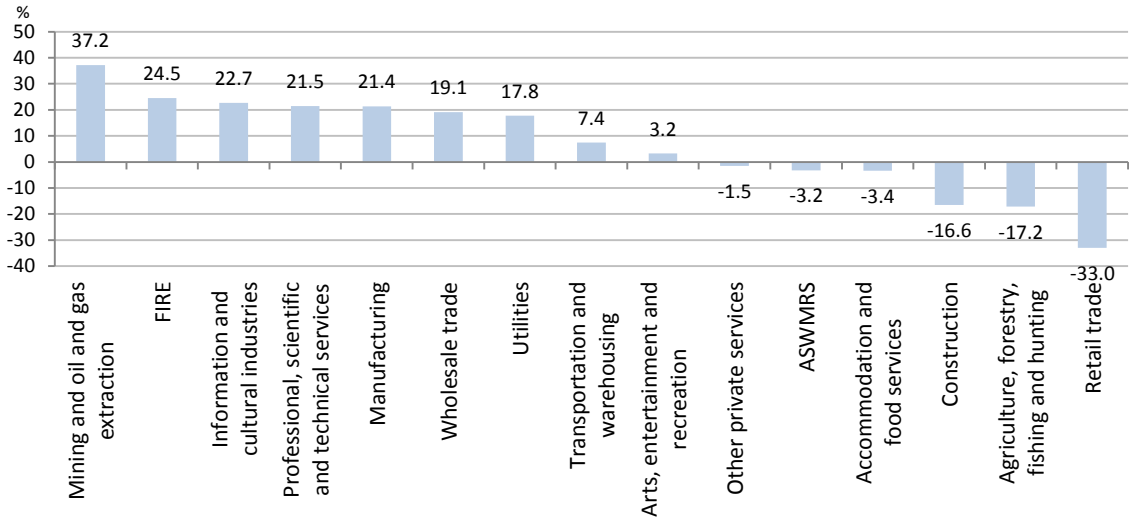
Source: CSLS calculations based on Statistics Canada data.

Chart 62 shows how each of the two-digit NAICS sectors contributed to the "sectoral composition gap" in Nova Scotia and Canada in 2010. Sectors in Nova Scotia that contributed towards a greater gap (i.e. lower labour productivity level in Nova Scotia relative to Canada) did so through two channels: 1) either they had below average labour productivity levels and their hours share was not high enough to counter the effect of the low productivity level; 2) or the sector had average (or even above average) labour productivity level and was under-represented in the economy (to a degree that counteracted the effect of the high level). The sector that contributed the most to the gap was mining and oil and gas extraction (37.2 per cent of the gap), followed by FIRE (24.5 per cent) and information and cultural industries (22.7 per cent). Other sectors that contributed to a greater gap were professional, scientific and technical services (21.5 per cent of the gap); manufacturing (21.4 per cent); wholesale trade (19.1 per cent); utilities (17.8

per cent); transportation and warehousing (7.4 per cent); and arts, entertainment and recreation (3.2 per cent).

Some sectors, however, had a negative contribution to the gap, reducing the difference between Nova Scotia's labour productivity level and Canada's. This happened through one of two channels: 1) the sector had above average labour productivity level and an hours share that was not low enough to counter the effect of the high productivity level; 2) the sector had below average labour productivity level, but a high enough hours share that could counteract the effect of the low productivity level. The sectors included in these two categories were: retail trade (-33.0 per cent of the gap); agriculture, forestry, fishing and hunting (-17.2 per cent of the gap); construction (-16.6 per cent of the gap); accommodation and food services (-3.4 per cent); ASWMRS (-3.2 per cent); and other private services (-1.5 per cent).

Chart 62: Contribution of Two-Digit NAICS Sectors to Sectoral Composition Gap, 2010 (per cent)

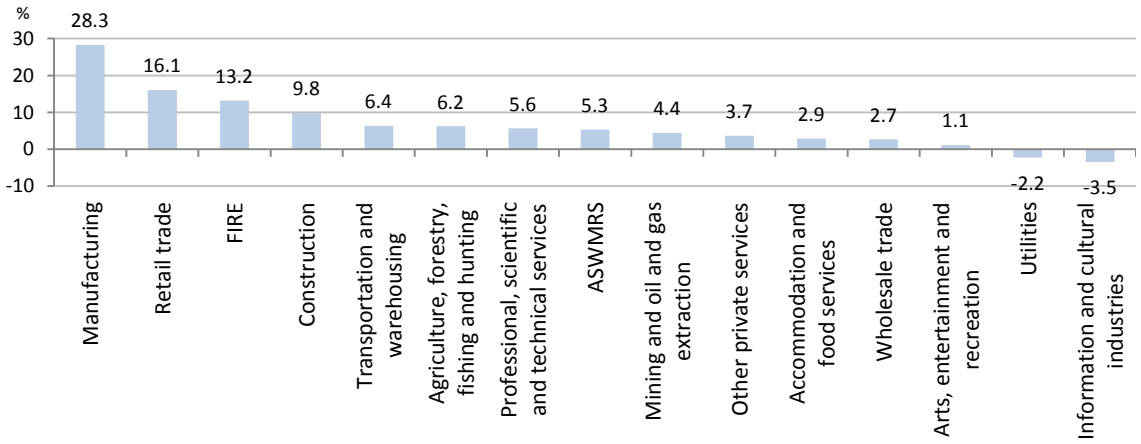


Source: CSLS calculations based on Statistics Canada data.

We can also measure the contribution of Nova Scotia's two-digit NAICS sectors to the "within-sector gap", i.e. the part of the overall labour productivity level gap caused by lower productivity levels of industries in Nova Scotia. Chart 63 shows that the sector that contributed the most to the within-sector gap was manufacturing, accounting for 28.3 per cent of the gap. This was followed by retail trade (16.1 per cent of the within-sector gap); FIRE (13.2 per cent); and construction (9.8 per cent). Other sectors that contributed to a larger within sector gap were: transportation and warehousing; agriculture, forestry, fishing and hunting; professional, scientific and technical services; ASWMRS; mining and oil and gas extraction; other private services; accommodation and foods services; wholesale trade; and arts, entertainment and recreation. In fact, the only two sectors that contributed to reducing the size of the within-sector gap were

utilities (-2.2 per cent of the within-sector gap) and information and cultural industries (-3.5 per cent of the gap).

Chart 63: Contribution of Two-Digit NAICS Sectors to the Within-Sector Gap, 2010 (per cent)



Source: CSLS calculations based on Statistics Canada data.

The above decompositions raise several relevant questions, which are currently hard to answer appropriately due to lack of data. The main problem here is that differences in labour productivity levels can be caused by a variety of factors, including:

- Differences in the price *levels* of inputs and output. The GDP estimates used to calculate labour productivity levels are not adjusted by purchasing power parity (PPP). Thus, provinces such as Nova Scotia, where the price level of inputs and output is lower than the national average, will have lower GDP contributions for the same activity, and hence lower labour productivity levels.

- Differences in the mix of commodities produced. As an example, although the relative size of Nova Scotia's and Canada's manufacturing sectors in terms of hours worked was approximately the same in 2010 (11.6 per cent of the business sector in Nova Scotia vs. 13.0 per cent in Canada), non-durable manufacturing industries played a larger role in the province than in Canada. These industries have, on average, lower labour productivity levels than durable manufacturing industries. Furthermore, the non-durable (and durable) manufacturing industries in which Nova Scotia focused were not the same as the ones in which Canada as a whole focused.

- Actual productivity differences, with establishments in Nova Scotia producing less output per labour input than similar establishments in other provinces. There

is some evidence that this might indeed be a relevant factor in the province, caused in particular by its below average capital intensity levels, which, according to our previous study (Ross, 2011), explained approximately 70.0 per cent of the labour productivity gap. Differences in multifactor productivity and labour quality levels explained the remainder of the gap (23.5 and 5.5 per cent, respectively).

VI. Public Policy and Productivity in Nova Scotia

This section explores the relationship between public policy and productivity in the Nova Scotia context. It first examines the impact of public policy on the productivity performance of Nova Scotia. It then discusses the implications of the findings of the report for public policy in the province.

A. The Impact of Public Policy on Productivity

As noted earlier, sound public policy sets the scene for solid business sector productivity performance. Bad public policy dampens productivity growth, or even leads to declines in productivity. Good public policy is a necessary, but not sufficient, condition for strong productivity growth. Two questions can be raised. First, can public policy in Nova Scotia explain the slightly faster labour productivity growth in Nova Scotia relative to Canada in the 1997-2010 period? Second, and more importantly, can the large gap in the business sector labour productivity level between Nova Scotia and the national average (around 25 percentage points in 2010) be explained by public policy?

Before proceeding to address these questions two points need to be made. First, there is a growing consensus that public policy is less responsible for Canada's poor productivity performance than previously thought (Drummond, 2011 and Sharpe, 2009). Public policy has become increasingly market-oriented in Canada in recent years so there is less chance that it is constraining productivity growth. Rather it is the business sector that must assume responsibility for poor business sector productivity growth given its mediocre investment in R&D and in machinery and equipment. Second, the federal government has more public policy levers that affect the influence economic behavior and hence productivity than provincial governments, which focus more on social issues. These federal policies apply uniformly throughout the country (although their impact may differ because of structural differences in industry composition), making it difficult to explain interprovincial productivity differences through federal policies.

To answer the two questions posed at the beginning of this section would require an evaluation of the productivity impacts of all economic-related policies and programs of the Nova Scotia government. Although a highly desirable initiative, it is well beyond the scope of this project. In terms of the first question, it is unlikely that provincial public policy accounts for Nova Scotia's slightly superior labour productivity growth relative to the national average. Indeed, the productivity growth rate difference is small (0.27 points) and may be within the margin of measurement error.

In terms of the second question, given the large Nova Scotia-Canada gap in labour productivity levels the public policy stance of the Nova Scotia government may be more relevant. The provincial government controls the education sector so it could have a negative impact on productivity through inappropriate policies in this area. But as was seen earlier, Nova Scotia performs at the national level for most human capital indicators, except apprenticeship. One area where provincial public policy could have potentially contributed to poor productivity gap is an emphasis on job creation over productivity advance. The unemployment rate has historically been above the national average in Nova Scotia, particularly outside Halifax. Economic policy may have understandably focused more on job creation than on productivity advance. With the advent of tighter labour markets as the baby boom cohort leaves the labour force, this emphasis may switch. In any case, it is beyond the scope of this report to quantify the relative importance given to jobs and productivity in the public policy decisions of the Nova Scotia government.

B. Implications of the Findings for Public Policy

In 2003 the OECD published the results of the OECD growth project, an ambitious initiative to quantify the determinants of economic growth. Based on an econometric analysis of the drivers of economic growth in OECD countries in the 1980s and 1990s, the study developed a number of rules of thumb to quantify the impact of a change in a driver of economic growth (Nicholson, 2003). These relationships are found in Appendix Table 8. The relationships particularly relevant in the Nova Scotia context are highlighted below.

- a 1 percentage point increase in private non-residential investment as a share of GDP will raise GDP per capita by 1.3 per cent.

- a 0.1 percentage point increase in business R&D as a share of GDP boosts GDP per capita by over 1.2 per cent.

- a 1 year increase in average years of education increases GDP per capita from 4 to 7 per cent.

The key finding of this report is that the Nova Scotia-Canada labour productivity gap is accounted for by weak investment in machinery and equipment and business R&D and that human capital played a small role. The OECD rules of thumb, which in principle were developed for growth rates but can also be applied to levels, provide an indication of the quantitative importance of these factors.[15]

[15] It is important to keep in mind that the OECD rules of thumb reflect the effect of investment, R&D, and education in an aggregate of OECD countries. The magnitude of these effects is likely to change from country to country, and even within the same country, due to a variety of reasons (e.g. institutional differences). The OECD rules of thumb

In 2008, business sector non-residential investment represented 13.6 per cent on nominal GDP in Nova Scotia, compared to 17.9 per cent in Canada. Given that a 1.3 percentage point difference in non-residential investment has a 1.3 per cent impact on GDP per capita, this 4.3 percentage point gap implies a difference in GDP per capita of 6.6 percentage points.

In 2010, business sector R&D as a share of business sector GDP was 0.45 per cent, compared to 1.37 per cent for Canada. Given that a 0.1 percentage point difference in BERD intensity has a 1.2 per cent impact on GDP per capita, this 0.92 point difference implies a difference in GDP per capita of 12.0 percentage points.

As average years of educational attainment were identical in Nova Scotia and Canada at 14.0 years in 2010, no difference in GDP per capita between the two jurisdictions can be attributed to this factor.

The difference in GDP per capita between Nova Scotia and Canada is largely due to the labour productivity gap. These rules of thumb suggest that lower level of spending on investment and on R&D by business account for most of the labour productivity gap and that the BERD intensity gap is twice as important as the investment gap. Human capital bears much less responsibility for the gap.

The policy implications follow from the key findings of the study. If Nova Scotia wants to close the business sector labour productivity gap with Canada, it must close the business investment and R&D gaps. Public policy must encourage business to invest more in capital goods, particularly machinery and equipment and in R&D. While human capital is as important to productivity growth as physical capital and innovation, Nova Scotia does relatively well on indicators in this field (with the important exception of apprenticeship). In this sense, education should not be as high a priority as the other two areas.

Of course, it is not an easy task for government to incent business to increase spending on capital investment and R&D. There are no magic levers. Indeed, there are already many policies and programs in place run by the federal and provincial governments for this purpose. It is beyond the scope of this report to assess the effectiveness of these programs and policies on business investment and R&D in Nova Scotia and to put forward specific recommendations for changes.[16]

---

can still be useful, however, in providing a general idea of the importance of each of these variables in the context of Nova Scotia's economy.

[16] The recent Jenkins report (Government of Canada, 2011) has put forward a number of recommendations to improve the effectiveness of public support program for business R&D in Canada, particularly the federal R&D tax credit program.

A recent article by Kevin Lynch, former Clerk of the Privy Council, and Munir Sheikh, former Chief Statistician of Canada (Lynch and Sheikh, 2011) suggests some general principles for fostering productivity growth through innovation and the limitations of the role of government in this process. They write:

> We need a stronger culture of innovation in our business community, with greater managerial focus on continual innovation and productivity and less risk aversion to change. There are clear limits to the effectiveness of policy support by government unless corporate management teams understand and value innovation as a key business strategy for competitiveness and growth.

Lynch and Sheikh identify five general areas where public policy has the potential to influence the drivers of business innovation: the development of a more competitive framework for the business environment; more effective government support for business innovation; better support for the financing of business investment; better support mechanisms for businesses to access new technologies; and education systems, especially for managers, geared to the needs of a globally oriented, knowledge-based economy. A recent report on productivity in Canada by the consultancy Deloitte (2011) identified similar areas for action.

VII. Conclusion

This report has provided a detailed and comprehensive analysis of labour and capital productivity trends and drivers in Nova Scotia. Despite labour productivity growth somewhat above the national average over the 1997-2000 period, Nova Scotia's level of business sector output per hour in 2010 was only 75.7 per cent that of Canada. The report concludes that weak investment, particularly machinery and equipment investment and low levels of business R&D are the two factors most responsible for the province's productivity gap. To reduce this productivity shortfall, businesses in Nova Scotia must reduce these investment and R&D gaps with the rest of the country. The challenge for the Nova Scotia government departments[17] and for the Nova Scotia offices of the federal government departments and agencies such as the Atlantic Canada Opportunities Agency is to identify and develop policies and programs in these areas. It is encouraging that this challenge has been recognized by both levels of government and that they are working together to address the situation, as seen for example by the very successful Nova Scotia Productivity Conference held November 30, 2011 in Halifax.

[17] Other provincial governments have also identified productivity as a major priority area and are taking steps to address the issue. For example, on May 12, 2011, the Ontario Ministry of Economic Development and Trade held a high-level symposium on pathways to productivity (MEDT, 2011). The Government of Alberta has established Productivity Alberta as an independent body to improve the productivity performance of businesses in the province. This organization sponsored a conference on productivity at the University of Alberta on October 14, 2011 (Ascah, 2011).

Bibliography

Almon, Michael-John and Tang, Jianmin (2011) "Industrial structural change and the post-2000 output and productivity growth slowdown: a Canada-U.S. comparison," *International Productivity Monitor*, No. 22, Fall, pp. 44-81.

Ascah, Robert (2011) "Imagining Alberta - A Symposium on Alberta's Economic Future: A Summary, October 14, 2011, University of Alberta.

Basu, Susanto., John G. Fernald, Nicholas Oulton., and Sylaja Srinivasan (2003) "The case of the missing productivity growth: or, does information technology explain why productivity accelerated in the United States but not the United Kingdom?" NBER Working Paper 10010.

Basu, Susanto and John G. Fernald (2008) "Information and communication technology as a general purpose technology: evidence from U.S. data," Federal Reserve Bank of San Francisco, *Economic Review*, pp. 1-15.

Brynjolfsson, Erik, and Lorin Hitt (2003) "Computing productivity: firm-level evidence," *Review of Economics and Statistics*, Vol. 85, No. 4, pp. 793-808. A working paper version of this paper can be found here.

Coulombe, Serge and Jean-Francois Tremblay (2009) "Education, Productivity and Economic Growth: A Selective Review of the Literature," *International Productivity Monitor*, Spring, pp. 3-24.

de Avillez, Ricardo and Christopher Ross (2011) "A synthesis of the CSLS provincial productivity reports, 1997-2007," CSLS Research Report 2011-03 (Ottawa: Centre for the Study of Living Standards).

Deloitte (2011) *The future of productivity: An eight-step game plan for Canada*.

De Long, Bradford and Lawrence H. Summers (1991) "Equipment investment and economic growth," *Quarterly Journal of Economics*, Vol. 106, No. 2, pp. 445-502.

Diewert, Erwin (2008) "The measurement of nonmarket sector outputs and inputs using cost weights," Discussion Paper 08-03, Department of Economics, University of British Columbia.

Drummond, Don (2011) "Confessions of a serial productivity researcher," *International Productivity Monitor*, No. 22, Fall, pp. 3-10.

Government of Canada (2011) Innovation Canada: A Call to Action.

Government of Nova Scotia (2011) 2010 Nova Scotia Labour Market Review.

Institute for Competitiveness and Prosperity (2009) "Management matters," Working Paper 12, March.

Institute for Competitiveness and Prosperity (2010) "Management matters in retail," Working Paper 13, April.

Jorgenson, Dale W. (2001) "Information technology and the U.S. economy," *American Economic Review*, Vol. 91, No. 1, pp. 1-32.

Jorgenson, Dale W., Mun S. Ho, and Kevin J. Stiroh. (2005) "Growth of U.S. industries and investments in information technology and higher education," in *Measuring capital in the new economy*, C. Corrado, J. Haltiwanger, D. Sichel (eds.) (Chicago, IL: University of Chicago Press).

Jorgenson, Dale and Kevin J. Stiroh (2000) "Raising the speed limit: U.S. economic growth in the information age," *Brookings Papers on Economic Activity*, Vol. 31 (2000-1), pp. 125-236.

Lucas, Robert (1988) "On the mechanics of economic development," *Journal of Monetary Economics*, Vol. 22, pp. 3-42.

Lynch, Kevin and Munir Sheikh (2011) "Innovation Dividend = Stronger Productivity Growth," *Policy Options*, September, pp 22-30.

Mankiw, Gregory N., David Romer, and David N. Weil (1992) "A contribution to the empirics of economic growth," *The Quarterly Journal of Economics*, Vol. 107, Issue 2, pp. 407-437.

McCain, Margaret Norris, Fraser Mustard and Kerry McCuaig (2011) Early Years Study 3: Making Decisions, Taking Action (Toronto: Margaret and Wallace McCain Foundation).

Ministry of Economic Development and Trade, Government of Ontario (2011) "Pathways to Productivity Economic Symposium: Summary Report of the May 12, 2011 Conference.

OECD (2001) *Measuring productivity – Measurement of aggregate and industry-level productivity growth* (Paris: OECD).

Nicholson, Peter (2003) "The Growth Story: Canada's Long-run Economic Performance and Prospects," *International Productivity Monitor*, Fall, pp. 3-23.

Nicholson, Peter (2009) "Innovation and Business Strategy: Why Canada Falls Short," *International Productivity Monitor*, Spring, pp. 31-50.

Ross, Christopher (2011) "An analysis of Nova Scotia's productivity performance, 1997-2007: strong growth, low levels," CSLS Research Report 2011-03c (Ottawa: Centre for the Study of Living Standards).

Sharpe, Andrew (2006) "The relationship between ICT investment and productivity in the Canadian economy: a review of the evidence," CSLS Research Report 2006-05 (Ottawa: Centre for the Study of Living Standards).

Sharpe, Andrew (2009) "The paradox of market-oriented public policy and poor productivity growth in Canada," in Festschrift in Honour of David Dodge's Contributions to Canadian Public Policy, Ottawa: Bank of Canada.

Sharpe, Andrew and Jean-François Arsenault (2008) "Productivity drivers in British Columbia: strategic areas for improvement," CSLS Research Report 2008-09 (Ottawa: Centre for the Study of Living Standards).

Sharpe, Andrew and Ricardo de Avillez (2010) "Canada-U.S. ICT investment in 2009: the ICT investment per worker gap widens," CSLS Research Report 2010-08 (Ottawa: Centre for the Study of Living Standards).

Sharpe, Andrew and Eric Thomson (2010a) "New estimates of labour, capital and multifactor productivity growth and levels for Canadian provinces at the three-digit NAICS level, 1997-2007," CSLS Research Report 2010-06 (Ottawa: Centre for the Study of Living Standards).

Sharpe, Andrew and Eric Thomson (2010b) "Insights into Canada's abysmal post-2000 productivity performance from decompositions of labour productivity growth by industry and province," *International Productivity Monitor*, No. 20, Fall, pp. 48-67.

Statistics Canada (2007) *North American Industry Classification System (NAICS) – Canada*, Cat. No. 12-501-XIE (Ottawa: Statistics Canada).

Statistics Canada (2008) *Guide to the income and expenditure accounts*, Cat. No. 13-017-X, (Ottawa: Statistics Canada).

Statistics Canada (2011) *Literacy for life: further results from the Adult Literacy and Life Skills Survey*, Cat No. 89-604-X (Ottawa: Statistics Canada).

Sweetman, Arthur (2002) "Working smarter: education and productivity," in R*eview of Economic Performance and Social Progress – Towards a Social Understanding of Productivity*, Vol. 2, A. Sharpe, F. St-Hillaire, K. Banting (eds.) (Montreal: Institute for Research and Public Policy and Ottawa: Centre for the Study of Living Standards).

Therrien, Pierre and Petr Hanel (2011) "Innovation and Productivity: Summary Results for Canadian Manufacturing Establishments," *International Productivity Monitor*, Number 22, Fall, pp. 11-28.

Trueblood, Michael and Vernon Ruttan (1992) "A comparison of multifactor productivity calculations of the U.S. agricultural sector," Staff Paper P92-29, Department of Agriculture and Applied Economics, University of Minnesota.

Tuomi, Ikka (2004) "Economic productivity in the knowledge society: a critical review of productivity theory and the impacts of ICT," *First Monday*, Vol. 9, No. 7.

van Ark, Bart (2002) "Understanding productivity differentials among OECD countries: a survey," in *The Review of Economic Performance and Social Progress – Towards a Social Understanding of Productivity*, Vol. 2, A. Sharpe, F. St-Hillaire, K. Banting (eds.) (Ottawa: Institute for Research and Public Policy and The Centre for the Study of Living Standards).

Whelan, Karl (2002) "A guide to U.S. chain aggregated NIPA data," *Review of Income and Wealth*, Vol.48, No. 2.

Yu, Kam. (2004) "Measurement of government output", forthcoming in *Essays on price and productivity measurement*, Vol. 3, W.E. Diewert, B. Balk, D. Fixler, K. Fox, and A.O. Nakamura (eds.) (Victoria: Trafford Publishing).

Appendix 1: Labour Productivity and Living Standards

In part I, we noted that there is a link between labour productivity and living standards. In this subsection, we explain the nature of this link. According to van Ark (2002:69), labour productivity affects social progress through two fronts:

> The first and more obvious reason is that, together with a greater use of labour, productivity positively contributes to per capita income, which is a reasonable proxy for living standards in a country. The second reason is that labour productivity growth often reflects the accumulation of intangible capital, which itself contributes to social progress, as workers become equipped with more human capital, more knowledge and access to networks, and which may ultimately even lead to the creation of more social capital.

Our main focus here is the first reason highlighted by van Ark, the relationship between GDP per capita and labour productivity.[18] Using a simple growth accounting framework, GDP per capita can be decomposed into a number of determinants:

Exhibit 5: Decomposition of GDP per Capita into Labour Productivity and Labour Supply Components

$$\frac{GDP}{Population} = \frac{GDP}{Hours\ Worked} \times \frac{Hours\ Worked}{Employment} \times \frac{Employment}{Labour\ Force} \times \frac{Labour\ Force}{Working\ Age\ Population} \times \frac{Working\ Age\ Population}{Total\ Population}$$

GDP per Capita	Labour Productivity (LP)	Hours Worked per Person Employed (HWPE)	1-Unemployment Rate (1-UR)	Labour Force Participation Rate (LFPR)	Working Age Population Share (WAPS)

Note: The definition of working age population used here encompasses persons fifteen years and older.
Source: Adapted from The Conference Board of Canada, 2009.

According to Exhibit 5, GDP per capita is driven by labour productivity (LP) and labour supply, which affects GDP per capita through four different terms (HWPE, UR, LFPR, and WAPS).[19] Exhibit 5 shows the factors that contribute to the *levels* of GDP per capita. To see how each of these factors contribute to the *growth rate* of GDP per capita, we take the log of both sides and differentiate with respect to time, which leads to:

$$\Delta GDP\ per\ Capita = \Delta LP + \Delta HWPE + \Delta(1 - UR) + \Delta LFPR + \Delta WAPS$$

[18] For a detailed discussion on how labour productivity affects the accumulation of intangible capital, refer to van Ark (2002).
[19] The reader should bear in mind that this is one of many possible GDP per capita decompositions. In the end, GDP per capita is determined by a number of different factors that are not highlighted here, such as terms of trade.

where Δ denotes percentage point changes.

Note that four out of the five factors shown above have an upper bound, i.e. there is a clear limit as to how much hours worked per person employed, per cent employed in the labour force, labour force participation rate, and working age population share can rise. Labour productivity, on the other hand, can grow indefinitely, driven on the long-run by innovation and technological change, and therefore plays a vital role in increasing GDP per capita.

We estimated the contribution of the different factors to GDP per capita in Nova Scotia over the 1997-2010 period.[20] In 2010, Nova Scotia had a GDP per capita of $31,710 (chained 2002 dollars), up from $23,998 (chained 2002 dollars) in 1997, which entails an average growth rate of 2.14 per cent per year.[21] As Table 36 and Chart 64 show, labour productivity growth accounted for 1.28 percentage points of GDP per capita growth over the entire period, 59.8 per cent of total growth. Of the four labour supply terms, hours worked per person employed was the only one that had a negative contribution (-0.34 percentage points), while the unemployment rate, the labour force participation rate, and the demographic participation rate all had positive contributions (0.24, 0.55, and 0.41 percentage points, respectively). In the 2000-2010 period, labor productivity in Nova Scotia increased by 0.98 per cent, representing 61.6 per cent of GDP per capita growth, while the labour supply variables had a net contribution of 38.4 per cent.

Table 36: Sources of GDP per Capita Growth in Nova Scotia, 1997-2010

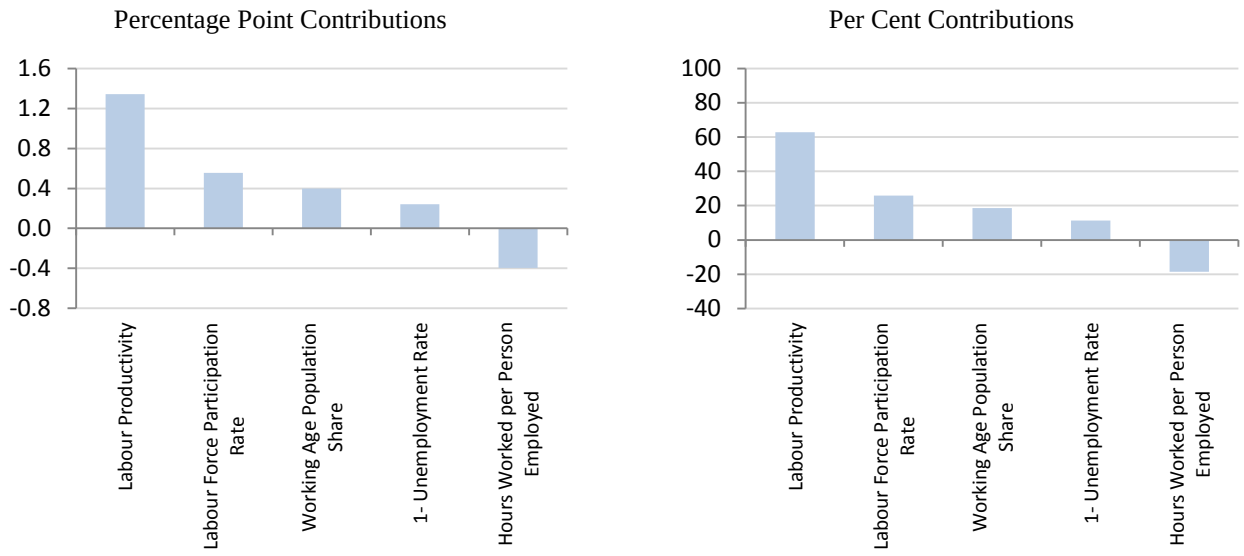
	1997-2010	1997-2000	2000-2010
	(percentage point contribution)		
GDP per Capita	2.14	3.96	1.60
Labour Productivity	1.34	2.14	1.10
Hours Worked per Person Employed	-0.40	-0.61	-0.33
1- Unemployment Rate	0.24	1.14	-0.03
Labour Force Participation Rate	0.55	0.83	0.47
Working Age Population Share	0.40	0.45	0.38
	(per cent contribution)		
GDP per Capita	100.0	100.0	100.0
Labour Productivity	62.7	54.2	69.0
Hours Worked per Person Employed	-18.5	-15.4	-20.9
1- Unemployment Rate	11.3	28.8	-1.7
Labour Force Participation Rate	25.9	21.0	29.6
Working Age Population Share	18.6	11.4	24.0

Source: CSLS calculations based on Statistics Canada data.

[20] The numbers in this section refer to total economy, not business sector, and hence are slightly different from the numbers used in the rest of the report, which refer to the business sector (either at the provincial level or at the national level). The main reason for this is that it is very hard to talk about a "business sector labour force", and using business sector employment numbers to calculate participation rates would lead to an understatement of the labour force participation rate term. A second difference is that GDP estimates in this section refer to GDP at market prices estimates, instead of GDP at basic prices.

[21] In order to be consistent with Exhibit 5, continuous time growth rates were calculated (as opposed to growth rates that are compounded in discrete time periods).

Chart 64: Sources of GDP per Capita Growth in Nova Scotia, 1997-2010



Source: CSLS calculations based on Statistics Canada data.

In 2010 GDP per capita in Canada was $38,826 (chained 2002 dollars), 22.5 per cent higher than in Nova Scotia. Exhibit 5 can also be used to decompose the sources of the GDP per capita gap between the province and Canada as a whole. Taking the log of the ratio between GDP per capita in Nova Scotia and Canada gives us the sources of the GDP per capita gap:

$$ln\left(\frac{GDP\ per\ Capita_{NS}}{GDP\ per\ Capita_{CAD}}\right) = ln\left(\frac{LP_{NS}}{LP_{CAD}}\right) + ln\left(\frac{HWPE_{NS}}{HWPE_{CAD}}\right) + ln\left(\frac{(1-UR)_{NS}}{(1-UR)_{CAD}}\right) + ln\left(\frac{LFPR_{NS}}{LFPR_{CAD}}\right) + ln\left(\frac{WAPS_{NS}}{WAPS_{CAD}}\right)$$

Table 37 and Chart 65 show the results of the above decomposition for 2010. Lower labour productivity levels in Nova Scotia accounted for $6,390.35 (chained 2002 dollars) of the $7,125.74 gap, or 89.7 per cent of the gap. Two other factors that contributed to a larger gap were the higher unemployment rate in Nova Scotia (6.9 per cent of the gap) and the lower participation rate in the province (20.9 per cent of the gap). Two labour supply factors contributed to reducing the gap – namely, higher hours worked per persons employed and higher working age population share in Nova Scotia (with contributions equal to -10.3 per cent and -7.2 per cent of the gap, respectively).

Table 37: Sources of the Nova Scotia-Canada GDP per Capita Gap, 2010

A) Data

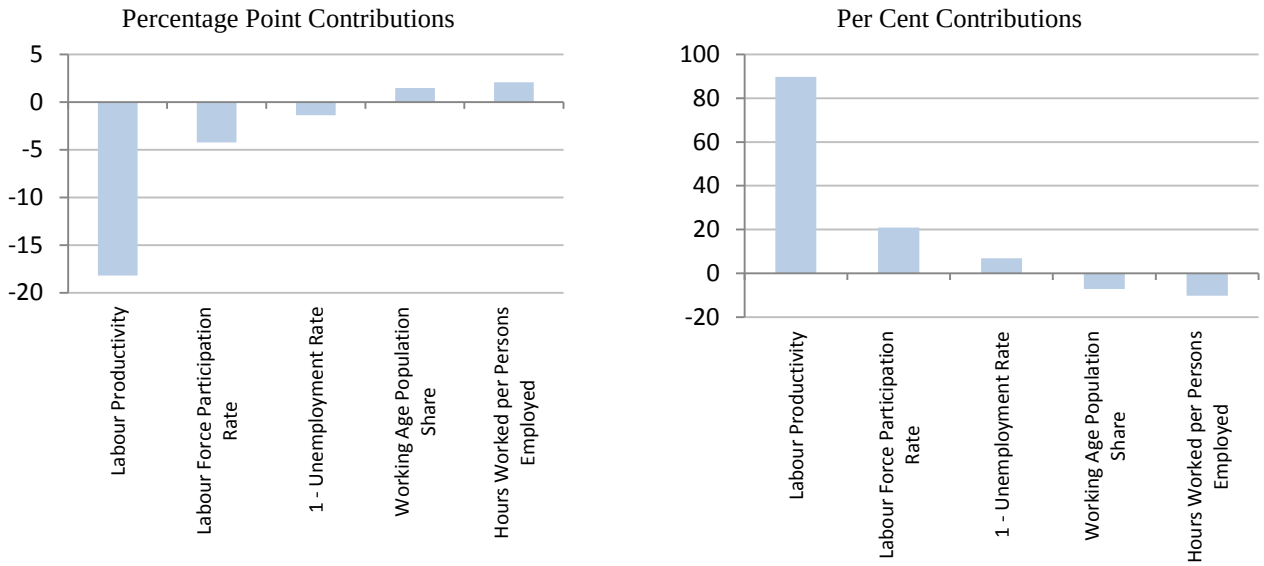
	GDP per Capita	Labour Productivity	Hours Worked per Persons Employed	1 - Unemployment Rate	Labour Force Participation Rate	Working Age Population Share
Nova Scotia	31,700.55	37.44	1,768.04	90.7	64.2	82.2
Canada	38,826.29	44.90	1,731.60	92.0	67.0	81.0

B) Gap Decomposition

	GDP per Capita	Labour Productivity	Hours Worked per Persons Employed	1 - Unemployment Rate	Labour Force Participation Rate	Working Age Population Share
Gap (chained 2002 dollars)	-7,125.74	-6,390.35	731.96	-488.95	-1,491.07	512.68
Gap (percentage points)	-20.3	-18.2	2.1	-1.4	-4.2	1.5
Gap (per cent)	100.0	89.7	-10.3	6.9	20.9	-7.2

Source: CSLS calculations based on Statistics Canada data.

Chart 65: Sources of the Nova Scotia-Canada GDP per Capita Gap, 2010



Source: CSLS calculations based on Statistics Canada data.

Appendix 2: Decomposing Labour Productivity Growth by Sector[22]

To begin we note that at any given point in time

$$P \equiv \frac{Q}{H} = \frac{\sum Q_i}{H} = \frac{\sum H_i P_i}{H} = \sum P_i \, h_i \qquad (1)$$

where

$P = Aggregate\ labour\ productivity\ level$
$P_i = Labour\ productivity\ level\ in\ sector\ i$
$H = Aggregate\ hours\ worked$
$H_i = Hours\ worked\ in\ sector\ i$
$h_i = Share\ of\ hours\ worked\ in\ sector\ i$
$Q = Aggregate\ real\ output$
$Q_i = Real\ output\ of\ sector\ i$

Equation (1) says that aggregate labour productivity *P* is equal to the weighted average of labour productivity in each of the sectors that make up the economy. The weight for each sector is its share of the total number of hours worked in the economy.

Because we are interested in how shifts in hours worked across sectors affect aggregate labour productivity growth, we must move beyond a single point in time. Equation (2) expresses the absolute change in aggregate labour productivity from period 0 to period 1, $\Delta P = P^1 - P^0$ where superscripts denote the period.

$$\Delta P = \sum h_i^0 \Delta P_i + \sum P_i^0 \Delta h_i + \sum \Delta h_i \Delta P_i \qquad (2)$$

In equation (2) h_i^0 and P_i^0 are respectively the share of total hours worked in sector *i* and the level of labour productivity in sector *i* in period 0, expressed in dollars.

In order to obtain economically meaningful sectoral contributions to aggregate productivity growth, we adjust the second term of equation (2) by subtracting the average level of labour productivity $\bar{P}^0$ from the level of labour productivity in each sector in period 0, P_i^0. In the third term, we subtract the average change in labour productivity $\Delta\bar{P}$ $\Delta\bar{P}$ from the change in labour productivity in each sector, ΔP_i ΔP_i. The first adjustment ensures that an increase in the hours share in a sector with a below-average labour productivity level makes a negative contribution to aggregate labour productivity growth. The second adjustment also ensures that an increase in the hours share in a sector with below-average absolute growth in labour productivity

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

makes a negative contribution to aggregate labour productivity growth. The result of these adjustments is equation (3):

$$\Delta P = \sum h_i^0 \Delta P_i + \sum (P_i^0 - \bar{P}^0)\Delta h_i + \sum \Delta h_i (\Delta P_i - \Delta \bar{P}) \qquad (3)$$

We are able to subtract $\bar{P}^0$ from equation (2) because the terms $\Delta \bar{P} \Delta h_i$ and $\bar{P}^0 \Delta h_i$ each sum to zero across all sectors, since $\bar{P}^0$ and $\Delta \bar{P}$ are constant and all changes in hours share Δh_i sum to zero across sectors.

The three terms in equation (3) represent respectively the within-sector, reallocation level and reallocation growth effects. The within-sector effect captures the change in labour productivity within a sector. The reallocation level effect indicates whether changes in hours share have favoured sectors with above- or below-average labour productivity levels. The reallocation growth effect is the sum of the product of the absolute change in the share of hours worked and the absolute change in the labour productivity level for each of the *i* sectors. It measures whether an economy is subject to a phenomenon akin to Baumol's cost disease, *i.e.* the tendency of labour to move towards sectors with relatively small absolute increases in labour productivity. A negative reallocation growth effect at the aggregate level means that labour is moving to sectors with relatively smaller absolute labour productivity increases.

There are some limitations to this analysis. First, the analysis assumes that differences in technological, institutional, and market structures across sectors lead to differences in average levels of labour productivity, even if marginal products are the same. It also assumes that when a sector loses or gains labour, the changes in output per hour are equal to the sector's average output per hour worked. Second, these results are sensitive to the level of disaggregation. For instance, we use 12 sectors at the two-digit level. If within a sector, resources shift from one subsector to another, and these subsectors have different levels of labour productivity, then the measured impact of the reallocation effect on aggregate labour productivity growth would be different.

Data Appendix

Appendix Table 1: Real Investment (Fixed, Non-Res) Growth by Two-Digit NAICS Sectors and Special Industry Aggregations, Nova Scotia and Canada, 1997-2010

	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(compound annual growth rates, per cent)					
Business sector industries	**0.65**	**5.68**	**-0.81**	**3.10**	**5.42**	**2.41**
Business sector, goods	..	..	..	*2.27*	*2.39*	*2.23*
Agriculture, forestry, fishing and hunting	-2.13	4.58	-4.05	-0.28	-2.58	0.42
Mining and oil and gas extraction	..	64.66	..	2.77	2.87	2.74
Utilities	..	..	..	8.67	5.31	9.70
Construction	4.69	7.94	3.73	5.92	7.86	5.34
Manufacturing	..	-24.67	..	-2.46	1.30	-3.55
Non-durable manufacturing industries	..	..	..	..	..	..
Durable manufacturing industries	..	..	..	..	..	..
Business sector, services	..	..	..	*4.03*	*8.54*	*2.71*
Wholesale trade	..	..	..	3.23	-1.44	4.67
Retail trade	5.66	-2.18	8.13	3.52	4.01	3.37
Transportation and warehousing	..	..	..	4.67	8.87	3.44
Information and cultural industries	..	17.21	..	3.35	8.73	1.78
FIRE	..	...	..	3.32	11.14	1.08
Professional, scientific and technical services	..	..	..	8.48	25.78	3.77
ASWMRS	..	..	..	7.89	-6.46	12.61
Arts, entertainment and recreation	..	..	..	5.61	7.05	5.18
Accommodation and food services	..	..	..	5.54	-3.77	8.50
Other private services	..	..	..	3.03	-1.94	4.57
ICT Sector	**..**	**..**	**..**	**..**	**..**	**..**

Source: CSLS Nova Scotia Productivity Database.

Appendix Table 2: Real Investment (Fixed, Non-Res) per Hour Worked by Two-Digit NAICS Sectors and Special Industry Aggregations, Nova Scotia and Canada, 1997-2010

	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(compound annual growth rate, per cent)					
Business sector industries	**-0.28**	**3.19**	**-1.30**	**1.88**	**2.70**	**1.64**
Business sector, goods	..	..	..	*2.32*	*1.53*	*2.56*
Agriculture, forestry, fishing and hunting	-1.20	4.43	-2.83	2.93	1.05	3.50
Mining and oil and gas extraction	..	85.01	..	0.56	5.30	-0.82
Utilities	..	..	..	7.27	6.08	7.63
Construction	1.99	6.65	0.63	2.90	7.08	1.68
Manufacturing	..	-27.47	..	-1.05	-1.16	-1.02
Non-durable manufacturing industries	..	..	..	..	..	..
Durable manufacturing industries	..	..	..	..	..	..
Business sector, services	..	..	..	*2.19*	*4.76*	*1.43*
Wholesale trade	..	..	..	2.80	-3.45	4.76
Retail trade	4.84	-4.85	7.94	2.11	2.44	2.01
Transportation and warehousing	..	..	..	3.55	5.55	2.96
Information and cultural industries	..	17.55	..	0.63	-0.18	0.87
FIRE	..	..	..	1.38	8.15	-0.56
Professional, scientific and technical services	..	..	..	4.97	16.85	1.64
ASWMRS	..	..	..	3.44	-13.07	8.98
Arts, entertainment and recreation	..	..	..	2.63	1.63	2.94
Accommodation and food services	..	..	..	4.53	-6.73	8.16
Other private services	..	..	..	1.45	-4.44	3.29
ICT Sector	**..**	**..**	**..**	**..**	**..**	**..**
	1997	2000	2010	1997	2000	2010
	(chained 2002 dollars of investment per hour worked)					
Business sector industries	5.1	5.6	4.9	5.7	6.2	7.2
Business sector, goods	..	..	..	8.8	9.3	11.9
Agriculture, forestry, fishing and hunting	3.2	3.6	2.7	5.0	5.2	7.3
Mining and oil and gas extraction	22.1	140.0	..	70.7	82.6	76.0
Utilities	..	..	..	42.5	50.7	105.8
Construction	1.4	1.7	1.8	1.7	2.1	2.5
Manufacturing	13.4	5.1	..	6.1	5.9	5.3
Non-durable manufacturing industries	..	..	..	..	..	..
Durable manufacturing industries	..	..	..	..	..	..
Business sector, services	..	..	..	4.0	4.6	5.3
Wholesale trade	..	..	..	2.5	2.2	3.6
Retail trade	1.2	1.0	2.2	1.8	1.9	2.3
Transportation and warehousing	..	..	..	7.8	9.2	12.3
Information and cultural industries	15.0	24.4	..	17.8	17.7	19.3
FIRE	..	..	..	12.9	16.3	15.4
Professional, scientific and technical services	..	..	..	1.5	2.4	2.8
ASWMRS	..	..	..	1.0	0.7	1.6
Arts, entertainment and recreation	..	..	..	2.7	2.9	3.8
Accommodation and food services	..	..	..	0.9	0.7	1.6
Other private services	..	..	..	0.7	0.6	0.9
ICT Sector	..	..	..	..	..	..

Source: CSLS Nova Scotia Productivity Database.

Appendix Table 3: Real M&E Investment Growth by Two-Digit NAICS Sectors and Special Industry Aggregations, Nova Scotia and Canada, 1997-2010

	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(compound annual growth rates, per cent)					
Business sector industries	**-0.99**	**-3.09**	**-0.35**	**3.96**	**7.75**	**2.85**
Business sector, goods	..	..	..	*2.74*	*2.40*	*2.84*
Agriculture, forestry, fishing and hunting	-1.42	3.55	-2.86	0.36	-3.95	1.69
Mining and oil and gas extraction	..	18.04	..	9.24	8.55	9.45
Utilities	..	..	..	9.01	5.33	10.14
Construction	4.82	8.60	3.71	6.26	8.69	5.54
Manufacturing	..	-24.92	..	-1.71	0.92	-2.49
Non-durable manufacturing industries	..	..	..	..	..	..
Durable manufacturing industries	..	..	..	..	..	..
Business sector, services	..	..	..	*4.84*	*11.61*	*2.89*
Wholesale trade	..	..	..	4.18	-1.44	5.92
Retail trade	3.70	-7.05	7.16	5.11	3.67	5.54
Transportation and warehousing	..	..	..	3.49	3.17	3.58
Information and cultural industries	..	17.21	..	4.00	10.12	2.23
FIRE	..	..	..	4.55	18.99	0.57
Professional, scientific and technical services	..	..	..	9.27	26.31	4.62
ASWMRS	..	..	..	9.84	-2.66	13.89
Arts, entertainment and recreation	..	..	..	12.89	21.33	10.47
Accommodation and food services	..	..	..	7.58	6.92	7.78
Other private services	..	..	..	5.23	-2.26	7.59
ICT Sector	**..**	**..**	**..**	**..**	**..**	**..**

Source: CSLS Nova Scotia Productivity Database.

Appendix Table 4: Real M&E Investment per Hour Worked by Two-Digit NAICS Sectors and Special Industry Aggregations, Nova Scotia and Canada, 1997-2010

	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(per cent)					
Business sector industries	**-1.91**	**-5.37**	**-0.85**	**2.74**	**4.97**	**2.08**
Business sector, goods	..	..	..	*2.80*	*1.55*	*3.17*
Agriculture, forestry, fishing and hunting	-0.48	3.40	-1.62	3.59	-0.37	4.81
Mining and oil and gas extraction	..	32.62	..	..	..	7.21
Utilities	..	..	..	7.60	6.10	8.06
Construction	2.11	7.31	0.60	3.24	7.90	1.88
Manufacturing	..	-27.71	..	-0.30	-1.53	0.07
Non-durable manufacturing industries	..	..	..	..	..	..
Durable manufacturing industries	..	..	..	..	..	..
Business sector, services	..	..	..	*2.99*	*7.73*	*1.61*
Wholesale trade	..	..	..	3.75	-3.46	6.01
Retail trade	2.90	-9.59	6.98	3.68	2.11	4.15
Transportation and warehousing	..	..	..	2.38	0.02	3.10
Information and cultural industries	..	17.56	..	1.26	1.09	1.31
FIRE	..	..	..	2.60	15.79	-1.06
Professional, scientific and technical services	..	..	..	5.73	17.34	2.48
ASWMRS	..	..	..	5.31	-9.54	10.22
Arts, entertainment and recreation	..	..	..	9.70	15.19	8.11
Accommodation and food services	..	..	..	6.55	3.64	7.44
Other private services	..	..	..	3.62	-4.75	6.28
ICT Sector	**..**	**..**	**..**	**..**	**..**	**..**
	1997	2000	2010	1997	2000	2010
	(chained 2002 dollars of investment per hour worked)					
Business sector industries	3.83	3.24	2.98	3.32	3.84	4.72
Business sector, goods	..	..	..	4.41	4.62	6.31
Agriculture, forestry, fishing and hunting	1.69	1.87	1.59	3.48	3.44	5.50
Mining and oil and gas extraction	5.17	12.07	..	..	10.71	21.49
Utilities	..	..	..	16.40	19.59	42.52
Construction	1.26	1.56	1.66	1.51	1.90	2.29
Manufacturing	11.61	4.39	..	4.97	4.75	4.78
Non-durable manufacturing industries	..	..	..	..	..	..
Durable manufacturing industries	..	..	..	..	..	..
Business sector, services	..	..	..	2.75	3.44	4.04
Wholesale trade	..	..	..	2.00	1.80	3.22
Retail trade	0.94	0.70	1.37	1.06	1.12	1.69
Transportation and warehousing	..	..	..	5.31	5.31	7.21
Information and cultural industries	11.85	19.25	..	12.38	12.79	14.57
FIRE	..	..	..	9.19	14.26	12.82
Professional, scientific and technical services	..	..	..	1.25	2.01	2.57
ASWMRS	..	..	..	0.72	0.54	1.42
Arts, entertainment and recreation	..	..	..	0.87	1.33	2.90
Accommodation and food services	..	..	..	0.35	0.39	0.79
Other private services	..	..	..	0.48	0.42	0.76
ICT Sector	..	..	..	..	..	..

Source: CSLS Nova Scotia Productivity Database.

Appendix Table 5: Real M&E Capital Growth by Two-Digit NAICS Sectors and Special Industry Aggregations, Nova Scotia and Canada, 1997-2010

	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(compound annual growth rates, per cent)					
Business sector industries	**0.93**	**2.20**	**0.55**	**3.18**	**4.90**	**2.68**
Business sector, goods	..	..	..	*1.30*	*1.10*	*1.37*
Agriculture, forestry, fishing and hunting	-1.23	-0.87	-1.34	0.81	1.06	0.74
Mining and oil and gas extraction	-1.95	-0.43	-2.41	11.37	8.89	12.12
Utilities	..	..	..	-0.85	-2.79	-0.26
Construction	4.58	6.39	4.05	6.25	7.53	5.87
Manufacturing	-0.96	-2.44	-0.52	-0.95	1.36	-1.63
Non-durable manufacturing industries	..	..	..	..	..	..
Durable manufacturing industries	..	..	..	..	..	..
Business sector, services	..	..	..	*5.24*	*9.49*	*4.00*
Wholesale trade	2.36	8.00	0.73	5.23	5.59	5.13
Retail trade	3.57	-3.43	5.77	4.86	4.02	5.12
Transportation and warehousing	1.43	6.67	-0.09	3.70	6.44	2.89
Information and cultural industries	1.54	3.89	0.85	3.32	5.07	2.80
FIRE	..	..	..	6.30	15.26	3.75
Professional, scientific and technical services	7.88	18.26	4.94	10.25	25.44	6.06
ASWMRS	13.20	11.51	13.72	9.46	0.44	12.33
Arts, entertainment and recreation	..	..	..	7.79	4.96	8.65
Accommodation and food services	2.15	1.50	2.35	3.72	0.57	4.68
Other private services	11.28	24.64	7.56	6.25	5.08	6.60
ICT Sector	**..**	**..**	**..**	**..**	**..**	**..**

Source: CSLS Nova Scotia Productivity Database.

Appendix Table 6: Real M&E Capital per Hour Worked by Two-Digit NAICS Sectors and Special Industry Aggregations, Nova Scotia and Canada, 1997-2010

	Nova Scotia			Canada		
	1997-2010	1997-2000	2000-2010	1997-2010	1997-2000	2000-2010
	(compound annual growth rates, per cent)					
Business sector industries	**0.00**	**-0.20**	**0.06**	**1.97**	**2.19**	**1.90**
Business sector, goods	..	..	..	*1.36*	*0.25*	*1.69*
Agriculture, forestry, fishing and hunting	-0.30	-1.01	-0.08	4.06	4.84	3.83
Mining and oil and gas extraction	0.54	11.88	-2.63	8.97	11.47	8.23
Utilities	..	..	..	-2.13	-2.08	-2.14
Construction	1.88	5.12	0.93	3.23	6.75	2.20
Manufacturing	-0.47	-6.06	1.27	0.48	-1.10	0.96
Non-durable manufacturing industries	..	..	..	..	..	..
Durable manufacturing industries	..	..	..	..	..	..
Business sector, services	..	..	..	*3.39*	*5.69*	*2.71*
Wholesale trade	2.45	7.38	1.02	4.80	3.43	5.22
Retail trade	2.77	-6.07	5.58	3.43	2.45	3.73
Transportation and warehousing	1.77	5.89	0.57	2.60	3.19	2.42
Information and cultural industries	2.03	4.19	1.40	0.60	-3.54	1.87
FIRE	..	..	..	4.31	12.17	2.07
Professional, scientific and technical services	4.98	18.95	1.12	6.68	16.53	3.88
ASWMRS	5.18	-1.56	7.29	4.95	-6.66	8.71
Arts, entertainment and recreation	..	..	..	4.75	-0.36	6.33
Accommodation and food services	1.73	-2.05	2.90	2.73	-2.52	4.35
Other private services	11.32	21.35	8.48	4.62	2.41	5.30
ICT Sector	**..**	**..**	**..**	**..**	**..**	**..**
	1997	2000	2010	1997	2000	2010
	(chained 2002 dollars of capital stock per hour worked)					
Business sector industries	**12.22**	**12.15**	**12.22**	**12.87**	**13.74**	**16.59**
Business sector, goods	..	..	..	*21.87*	*22.04*	*26.07*
Agriculture, forestry, fishing and hunting	10.35	10.04	9.96	10.26	11.82	17.22
Mining and oil and gas extraction	37.60	52.65	40.34	31.00	42.94	94.66
Utilities	..	..	..	255.61	239.97	193.21
Construction	3.71	4.31	4.73	4.15	5.04	6.27
Manufacturing	26.12	21.66	24.57	22.33	21.61	23.76
Non-durable manufacturing industries	..	..	..	..	..	..
Durable manufacturing industries	..	..	..	..	..	..
Business sector, services	..	..	..	8.13	9.60	12.53
Wholesale trade	7.24	8.97	9.93	4.76	5.26	8.75
Retail trade	3.63	3.01	5.17	3.36	3.62	5.22
Transportation and warehousing	19.63	23.30	24.66	19.50	21.43	27.21
Information and cultural industries	43.90	49.66	57.04	39.92	35.83	43.14
FIRE	..	..	..	23.92	33.76	41.42
Professional, scientific and technical services	2.36	3.98	4.45	2.55	4.04	5.91
ASWMRS	1.91	1.82	3.68	1.82	1.48	3.41
Arts, entertainment and recreation	..	..	..	4.06	4.02	7.42
Accommodation and food services	1.57	1.47	1.96	1.80	1.67	2.56
Other private services	0.26	0.46	1.05	1.10	1.18	1.98
ICT Sector	**..**	**..**	**..**	**..**	**..**	**..**

Source: CSLS Nova Scotia Productivity Database.

Appendix Table 7: Early Childhood Education Index, 2011

BENCHMARKS	Value	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC
Integrated Governance											
ECE under common department/ ministry	0.5		0.5		0.5		0.5		0.5		
Common ECE supervisory unit	0.5						0.5				
Common ECE policy framework	1		1			1		1			
Common local authority for ECE management and administration	1										
Funding											
At least two-thirds of child care funding goes to program operations*	1		1	1		1		1		1	
Mandated salary and fee scale	1		1			1		1			
At least 3% of budget devoted to early childhood education	1					1					
Access											
Full day kindergarten offered	1		1	1	1	1	1*				1
50% of 2-4-year-olds regularly attend an ECE program	1					1	1				
Funding is conditional on including children with special needs	1		1**					1			
Learning Environment											
Early childhood curriculum/framework	0.5		0.5		0.5	0.5	0.5	0.5	0.5	0.5	0.5
Alignment of early childhood framework with kindergarten	0.5		0.5		0.5	0.5	0.5				0.5
Programs for 2-4-year-olds require at least two-thirds of staff to have ECE qualifications	0.5			0.5		0.5	0.5	0.5			
Kindergarten educators require ECE qualifications	0.5		0.5				0.5				
Salaries for Early childhood educators are at least two-thirds of teacher salaries	0.5					0.5					
ECE professional certification and/or professional development required	0.5	0.5	0.5	0.5			0.5	0.5	0.5	0.5	0.5
Accountability											
Annual progress reports are current and posted (2008 or later)	1		1	1	1	1***		1	1	1	1
Program standards for ECE programs (including kindergarten)	1										
EDI or population measure for preschool leaning collected and reported	1	1	1	1	1	1	1	1	1	1	1
Total	**15**	**1.5**	**9.5**	**5**	**4.5**	**10**	**6.5**	**7.5**	**4.5**	**3**	**4.5**

* Includes special needs funding.

** In Early Years Centres only.

*** Quebec was not a signatory to the federal/provincial/territorial early childhood development agreements where the parties agreed to regular standardized reporting. Quebec has its own mechanisms for public reporting.

Source: http://earlyyearsstudy.ca/en/report/chapter-6-where-are-we-how-far-do-we-have-go/chapter-6-figures/

Appendix Table 8: Quantifying Some Key Growth Drivers*

Impact on level of GDP per capita in steady state

Driving Factor	Definition	Change	Impact	Typical Change over 80s and 90s in OECD
Human Capital	Average years of education	+ 1 Year	4% - 7%	+ 1.5 years in G-7
Physical Capital	Private non-res. Invest. as % GDP	+ 1 pct. pt.	1.3%	Variable
R&D	Business R&D % GDP	+ 0.1 pct. pt.	> 1.2%	About 0.1 pct. pt.
Trade Exposure	Ave of Exp/Imp % GDP	+ 10 pct. pt.	4%	About 10 pct. pts
Tax Burden	Govt. Revenue % GDP	+ 1 pct. pt. (0.6%)	- (0.7%)	About 1.5 pct. pts
Inflation Level	Final Consumption Deflator	- 1 pct. pt.	0.4% - 0.5%	About 4 pct. pts.
Inflation Variability	Standard Deviation	- 1 pct. pt.	2%	About 2/3 pct. pts

* Based on regression analysis of 21 OECD countries over 1971-98.

Source: Nicholson (2003), p. 11.

Appendix Table 9: Employment in the ICT Sector, Nova Scotia, 1997-2010

	ICT Sector	*ICT Manufacturing*	Commercial and service industry machinery manufacturing	Computer and peripheral equipment manufacturing	Communications equipment manufacturing	Radio and television broadcasting and wireless communications equipment manufacturing	Semiconductor and other electronic component manufacturing	Navigation, measuring, medical and control instruments manufacturing	Other electrical equipment and component manufacturing
	A = B + J	*B = C + ... + I*	C	D	E	F	G	H	I
					(number of persons)				
1997	..	..	42	..	..	..	..	..	..
1998	..	..	61	..	..	..	..	..	..
1999	..	..	140	..	..	..	..	..	..
2000	..	..	201	..	..	..	..	..	..
2001	..	..	131	..	..	..	..	..	..
2002	..	..	177	..	..	..	..	..	..
2003	..	..	192	..	..	..	..	..	..
2004	..	..	..	..	..	..	..	..	..
2005	..	..	240	..	..	..	..	..	..
2006	..	..	284	..	..	..	..	..	..
2007	..	..	308	..	..	..	..	..	..
2008	..	..	325	..	..	..	..	..	..
2009	..	..	301	..	..	..	..	..	..
2010	..	..	296	..	..	..	..	..	..
Compound Annual Growth Rates, per cent									
1997-2010	..	..	16.21	..	..	..	..	..	..

	ICT Services	Computer and communications equipment and supplies wholesaler-distributors	Software publishers	Pay and specialty television	Telecommunication	Data processing, hosting, and related services	Other information services	Rental and leasing services and lessors of non-financial intangible assets (except copyrighted works)	Computer systems design and related services
	J = K + ... + R	K	L	M	N	O	P	Q	R
					(number of persons)				
1997	..	1021	..	..	..	..	..	..	856
1998	..	1025	..	..	..	..	..	..	1045
1999	..	1051	..	..	..	..	..	..	1323
2000	..	1013	..	..	..	..	..	..	1772
2001	..	916	..	..	..	..	..	..	2322
2002	..	849	..	..	..	144	..	..	3070
2003	..	750	..	..	..	..	..	..	3339
2004	..	653	..	..	..	..	..	..	2827
2005	..	616	..	..	..	..	..	..	3444
2006	..	615	..	..	..	..	..	..	3948
2007	..	568	..	..	..	..	..	..	3276
2008	..	624	..	..	..	187	..	..	2216
2009	..	597	..	..	4009	163	727	..	2304
2010	..	559	..	..	4092	..	732	..	2220
Compound Annual Growth Rates, per cent									
1997-2010	..	-4.53	..	..	..	..	..	..	7.61

Note: See description of the ICT sector in Appendix Table 12.

Source: Statistics Canada, Survey of Employment, Payrolls and Hours (SEPH), CANSIM Table 281-0024.

Appendix Table 10: Employment in the ICT Sector, Canada, 1997-2010

	ICT Sector	*ICT Manufacturing*	Commercial and service industry machinery manufacturing	Computer and peripheral equipment manufacturing	Communications equipment manufacturing	Radio and television broadcasting and wireless communications equipment manufacturing	Semiconductor and other electronic component manufacturing	Navigation, measuring, medical and control instruments manufacturing	Other electrical equipment and component manufacturing
	A = B + J	*B = C + … + I*	C	D	E	F	G	H	I
					(number of persons)				
1997	440,384	148,035	9,439	13,386	24,517	36,074	24,197	25,857	14,565
1998	466,734	154,093	9,758	13,706	25,628	36,897	26,583	27,111	14,410
1999	501,665	158,905	9,975	13,904	26,465	36,550	28,733	27,631	15,647
2000	540,706	166,928	10,369	14,669	27,800	36,764	30,678	28,149	18,499
2001	557,617	165,811	11,438	14,739	30,561	36,017	29,341	26,171	17,544
2002	535,914	154,493	12,839	11,381	26,869	36,359	28,285	23,699	15,061
2003	496,619	147,689	12,547	10,457	24,353	37,175	25,949	23,296	13,912
2004	516,740	145,283	11,452	9,393	24,498	37,564	25,786	22,418	14,172
2005	522,871	143,473	12,728	8,335	25,329	37,174	23,941	22,869	13,097
2006	536,634	144,114	12,913	8,329	27,142	38,519	19,648	24,116	13,447
2007	544,844	142,355	12,067	8,168	25,854	39,547	18,598	24,737	13,384
2008	552,331	144,691	12,699	8,362	28,291	40,005	18,459	23,694	13,181
2009	534,732	134,529	12,837	6,646	24,780	39,454	16,420	23,040	11,352
2010	531,550	132,524	13,832	6,204	23,304	40,955	14,652	23,039	10,538
Compound Annual Growth Rates, per cent									
1997-2010	1.46	-0.85	2.98	-5.74	-0.39	0.98	-3.79	-0.88	-2.46

	ICT Services	Computer and communications equipment and supplies wholesaler-distributors	Software publishers	Pay and specialty television	Telecommunication	Data processing, hosting, and related services	Other information services	Rental and leasing services and lessors of non-financial intangible assets (except copyrighted works)	Computer systems design and related services
	J = K + … + R	K	L	M	N	O	P	Q	R
					(number of persons)				
1997	292,349	47,169	12,021	934	119,674	7,033	22,496	..	83,022
1998	312,641	47,982	14,127	941	122,521	8,248	20,686	..	98,136
1999	342,760	51,286	17,066	902	124,379	10,233	21,040	..	117,854
2000	373,778	52,901	20,188	870	127,934	11,939	21,502	..	138,444
2001	391,806	55,379	24,161	1,404	124,652	12,460	23,056	..	150,694
2002	381,421	51,729	24,146	1,635	119,933	11,582	25,077	..	147,319
2003	348,930	52,834	22,599	1,883	117,134	10,770	..	..	143,710
2004	371,457	51,538	23,088	1,938	118,038	11,823	25,884	..	139,148
2005	379,398	50,603	26,026	1,885	118,285	12,443	26,247	..	143,909
2006	392,520	51,913	28,482	2,050	117,974	13,427	28,248	..	150,426
2007	402,489	54,719	30,800	2,622	116,997	14,224	30,293	..	152,834
2008	407,640	56,418	31,326	3,194	116,449	14,814	28,929	..	156,510
2009	400,203	54,289	29,990	2,760	116,608	13,509	27,589	..	155,458
2010	399,026	53,823	30,625	2,349	115,735	14,489	28,008	..	153,997
Compound Annual Growth Rates, per cent									
1997-2010	2.42	1.02	7.46	7.35	-0.26	5.72	1.70	..	4.87

Note: See description of the ICT sector in Appendix Table 12.

Source: Statistics Canada, Survey of Employment, Payrolls and Hours (SEPH), CANSIM Table 281-0024.

Appendix Table 11: Real GDP, Employment, and Labour Productivity in the ICT Sector, Nova Scotia and Canada, 1997-2010

Nova Scotia

	Real GDP (millions, chained 2002 dollars)	Employees (number of people)	Weekly Hours Worked (number of hours)	Total Hours Worked (millions)	Labour Productivity (chained 2002 dollars per hour worked)
	A	B	C	D=C*B	E=A/D
1997	510	..	35.1	..	..
1998	589	..	35.3	..	..
1999	658	..	35.2	..	..
2000	727	..	34.8	..	..
2001	832	..	35.0	..	..
2002	925	..	34.6	..	..
2003	952	..	34.3	..	..
2004	994	..	33.9	..	..
2005	1044	..	34.0	..	..
2006	1079	..	34.0	..	..
2007	1095	..	34.5	..	..
2008	1142	..	34.0	..	..
2009	1159	..	33.7	..	..
2010	1189	..	33.9	..	..
	Compound Annual Growth Rates, per cent				
1997-2010	6.73	..	-0.28	..	..
1997-2000	12.52	..	-0.30	..	..
2000-2010	5.05	..	-0.28	..	..

Canada

	Real GDP (millions, chained 2002 dollars)	Employees (number of people)	Weekly Hours Worked (number of hours)	Total Hours Worked (millions)	Labour Productivity (chained 2002 dollars per hour worked)
	F	G	H	I=G*H	J=F/I
1997	27,095	440,384	35.0	803	33.8
1998	31,299	466,734	35.0	849	36.9
1999	39,735	501,665	34.9	911	43.6
2000	45,755	540,706	34.9	980	46.7
2001	44,610	557,617	34.7	1,005	44.4
2002	44,948	535,914	34.2	954	47.1
2003	47,397	496,619	34.1	879	53.9
2004	50,493	516,740	34.4	925	54.6
2005	52,237	522,871	34.2	929	56.2
2006	54,937	536,634	34.1	952	57.7
2007	56,862	544,844	34.1	966	58.8
2008	57,831	552,331	33.9	974	59.4
2009	57,267	534,732	33.3	926	61.9
2010	58,332	531,550	33.3	921	63.4
	Compound Annual Growth Rates, per cent				
1997-2010	6.08	1.46	-0.39	1.06	4.96
1997-2000	19.08	7.08	-0.19	6.88	11.42
2000-2010	2.46	-0.17	-0.45	-0.62	3.10

Note: Weekly hours worked in the ICT sector assumed to be equal to the business sector average for both Nova Scotia and Canada.

Source: 1) Real GDP, employment and weekly hours worked from Statistics Canada (CANSIM Tables 379-0026, 281-0024, and 383-0021, respectively); 2) Total hours worked and labour productivity calculated by the CSLS based on Statistics Canada data.

Appendix Table 12: The ICT Sector

ICT manufacturing	3333	Commercial and service industry machinery manufacturing
	3341	Computer and peripheral equipment manufacturing
	33421	Telephone apparatus manufacturing
	33422	Radio and television broadcasting and wireless communications equipment manufacturing
	3344	Semiconductor and other electronic component manufacturing
	3345	Navigation, measuring, medical and control instruments manufacturing
	33592	Communication and energy wire and cable manufacturing
ICT services	41	(parts of) Wholesale trade
	5112	Software publishers
	5152	Pay and specialty television
	517	Telecommunications
	518	Data processing, hosting, and related services
	5190	*Other information services*
	5A0520	*Rental and leasing services and lessors of non-financial intangible assets (except copyrighted works)*
	5415	Computer systems design and related services

Note: 1) Employment in the ICT sector was calculated by the CSLS based on SEPH estimates from Statistics Canada;

2) Since employment data for telephone apparatus manufacturing (33421) and communication and energy wire and cable manufacturing were unavailable even at the national level, they were substituted for data on communications equipment manufacturing (3342) and other electrical equipment and component manufacturing (3359), respectively; 2);

3) Since employment data for rental and leasing services and lessors of non-financial intangible assets (except copyrighted works) was unavailable even at the national level, it was assumed to be zero for all years when calculating total employment in ICT services.