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**An Analysis of Newfoundland and Labrador's
Productivity, 1997-2007: Mining, and Oil and Gas
Extraction Drives Strong Productivity Growth**

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An Analysis of Newfoundland and Labrador's Productivity, 1997-2007: Mining, and Oil and Gas Extraction Drives Strong Productivity Growth

Executive Summary

The report, based on the [CSLS Provincial Productivity Database](#), provides an overview of Newfoundland's productivity performance over the 1997-2007 period. The key findings are the following:

- Newfoundland experienced strong labour productivity growth in the market sector from 1997 to 2007, with an average annual growth rate of 4.8 per cent, almost three times the national average of 1.7 per cent. In terms of labour productivity growth, Newfoundland's performance ranks 1st among the provinces.
- Labour productivity growth in the province was driven mainly by multifactor productivity growth, which accounted for 85.9 per cent of the increase experienced over the 1997-2007 period. Capital intensity growth and labour quality growth played minor roles, accounting for 7.9 per cent and 5.5 per cent (respectively) of labour productivity growth
- Newfoundland's labour productivity level in 2007 was \$39.60 (1997 dollars) per hour, which represents 109.7 per cent of the Canadian level (which, in turn, implies a positive labour productivity differential of 9.7 percentage points), up from 81.2 per cent in 1997. The province had the highest labour productivity level among all the ten provinces in 2007.
- Despite ranking 1st in terms of labour productivity level in 2007, Newfoundland had negative labour productivity gaps relative to Canada in 12 of the 15 two-digit NAICS industries. In most cases, the below average multifactor productivity level was the main culprit.
- Capital productivity in Newfoundland's market sector grew at a rate of 4.2 per cent per year during the 1997-2007 period. This is in sharp contrast with the national average, which fell 0.6 per cent per year during the period in question. For this reason, the province's capital productivity growth in the market sector ranked 1st in Canada.
- Newfoundland's multifactor productivity in the market sector grew at an average rate of 4.1 per cent per year during the 1997-2007 period, ten times the national average of 0.4 per cent per year. The province ranked 1st in Canada.
- A key observation is that Newfoundland's productivity performance in the market sector was driven chiefly by the mining, and oil and gas extraction industry, which accounted for almost 60 per cent of the province's nominal GDP in 2007. Individually, most of the province's industries had sub-par productivity performances.

An Analysis of Newfoundland and Labrador's Productivity, 1997-2007: Mining, and Oil and Gas Extraction Drives Strong Productivity Growth

Productivity is the key factor that determines living standards in the long run. If the amount of output each worker produces does not increase, real wages and incomes cannot rise (Sharpe, 2010a). Since 2000, Canada's labour productivity growth has been abysmal, both from an historical and an international perspective (Sharpe and Thomson, 2010b).¹ Improving this poor performance must be a key objective of Canada's economic agenda. To develop policies with this goal in mind, it is important to understand the nature of labour productivity at both the national and provincial levels, including the sources of growth at the market sector and industry levels.

This report analyzes Newfoundland's² productivity performance over the 1997-2007 period. It is based on the CSLS Provincial Productivity Database. Level and growth rate estimates of labour, capital and multifactor productivity are discussed, with an emphasis on Newfoundland's market sector. Two-digit NAICS industry level estimates are also presented.³

This report is divided into ten sections. The first section provides a brief overview of basic concepts related to productivity, along with the methodology and the data sources used. Section two discusses Newfoundland's industry composition by nominal GDP and total hours worked. Sections three through nine detail Newfoundland's productivity performance, focusing on the following topics: labour productivity, capital productivity, multifactor productivity, capital intensity, labour quality, sources of labour productivity growth in the market sector, and sources of labour productivity gap by industry. Section ten concludes. An appendix provides details on the growth accounting framework used in the report.

I. Basic Concepts, Methodology and Data Sources

In this section, we first define the main concepts used in this report, as well as explain important topics related to productivity analysis – such as the difference between partial and total productivity measures, and the distinction between productivity growth rates and levels. This is followed by a brief discussion on methodology and data sources. Although the basics of the growth accounting framework used in the report are presented in this section, its details are only discussed in the Appendix.

¹ From 1981 to 2000, labour productivity in Canada's business sector grew at an average annual rate of 1.6 per cent. In the 2000-2009 period, labour productivity growth dropped sharply to a mere 0.7 per cent per year in Canada. This slowdown in labour productivity growth in Canada was not experienced in the United States, which grew at an average annual rate of 2.5 per cent during the same period (up from 2.0 per cent during the 1981-2000 period).

² For convenience, Newfoundland and Labrador will be referred to only as Newfoundland for the rest of this report.

³ This report builds on and extends earlier CSLS work on provincial productivity. The CSLS Provincial Productivity Database is available at http://www.csls.ca/data/mfp_new.asp. Previous CSLS articles on this topic include Sharpe and Arsenault (2009), Sharpe (2010) and Sharpe and Thomson (2010a, 2010b).

Basic Concepts

Productivity is, broadly speaking, a measure of how much output is produced per unit of input used. The output and input measures used will affect, however, the productivity estimates. In this sub-section, we define the input, output and productivity measures used throughout this paper:

- The **labour services input** is defined as total *quality adjusted* hours worked in a particular sector or in the market sector as a whole. It is the weighted sum of hours worked across different categories of workers, with the weights being equal to relative labour compensation shares.
- **Labour quality** (also known as **labour composition**) is defined residually as the difference between growth in labour services and growth in hours worked (*unadjusted* by quality). In Canada, 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.⁴
- The **capital services input** represents the flow of services provided by the capital stock. The difference between capital stock and capital services stems from the fact that not all forms 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 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 provide relatively more services per dollar of capital stock (i.e. short lived assets).
- **Capital intensity** is defined as capital services per hour worked.
- **Gross domestic product (GDP)** measures the value of all *final* goods and services produced in a defined geographic region during a certain time period, typically a year or a quarter.
- **Labour productivity** is defined as real GDP per hour worked.
- **Capital productivity** is real GDP per unit of capital services.
- **Multifactor Productivity (MFP)**⁵ growth is measured as the difference between real output growth and combined input growth. In other words, MFP reflects output growth that is not accounted for by input growth. The inputs that are taken into account to construct a combined input aggregate vary whether we are calculating MFP using a gross output basis or a value

⁴ For more information on how Statistics Canada calculates labour quality, see Gu *et al* (2002).

⁵ Also known as total factor productivity (TFP).

added basis. The gross output basis takes into consideration labour, capital, and intermediate inputs, while the value added basis takes into account only capital and labour (because intermediate consumption is already subtracted from value added). Thus, MFP captures the residual effects of several elements of the production process, such as improvements in technology and organizations, capacity utilization, increasing returns to scale, mismeasurement, etc. In this report, MFP growth is calculated on a value added basis.

When discussing productivity, there are two important dimensions to consider. The first is whether productivity is measured using a partial productivity approach or a multifactor productivity approach. The second is whether the focus is on growth rates, levels, or both.

There is a fundamental distinction between partial and multifactor productivity (MFP). Partial productivity measures refer to the relationship between output and a single input, such as labour or capital. Multifactor productivity, on the other hand, attempts to measure how efficiently all factors of production are used in the production process. This report provides estimates for two partial productivity measures – labour productivity (the most commonly used measure of productivity) and capital productivity –, as well as multifactor productivity.

Productivity can be expressed either in growth rates or in levels. The economics literature largely focuses on productivity growth rates, which reflect increases in *real* output per hour or per unit of capital. In this report we are also interested in making level comparisons between provinces. Ideally, productivity level comparisons are done in current dollars (i.e. using *nominal* GDP), as these estimates capture changes in relative prices. However, at the time the CSLS Provincial Productivity Database was constructed, nominal GDP figures at the industry level were available only up to 2005. As a consequence, the productivity levels were calculated using real GDP. One advantage of using real GDP instead of nominal GDP for the level comparisons is that the growth rates and changes in levels are consistent with each other. Regardless of whether nominal or real GDP figures are used for 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.

As mentioned above, this report makes provincial comparisons of both productivity levels and growth rates. These comparisons are done both at the **market sector level** and at the **two-digit NAICS industry level**.⁶ The North American Industry Classification System (NAICS) breaks down the economy into 20 sectors:

⁶ The words *industry* and *sector* are used interchangeably in this report.

Exhibit A: The North American Industry Classification System (NAICS) at the Two-Digit Level

Sector Number	Description
11	Agriculture, Forestry, Fishing and Hunting
21	Mining, and Oil and Gas Extraction
22	Utilities
23	Construction
31-33	Manufacturing
42	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
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

The market sector is comprised by 17 of the 20 sectors, all of which have been highlighted in Exhibit A. The only three sectors that are not included in the market sector are: education services, health care and social assistance, and public administration. For practical purposes, we have grouped the finance and insurance, real estate, rental and leasing, and management of companies and enterprises sectors into only one sector, which will be referred to as the finance, insurance, real estate, rental and leasing (FIRE) sector. Since this change is only a slight departure from the standard NAICS breakdown, we will still refer to these 15 sectors as NAICS sectors.

The provincial comparisons are done by ranking the productivity growth rates and levels of different provinces from 1 (highest) to 10 (lowest). Each province has two market sector ranks: an **equally-weighted rank** and an **industry composition weighted rank**. The industry composition weighted market sector rank, which will be referred throughout this report simply as the market sector rank, takes into account the province's market sector output, labour input and capital input, which are basically a sum of the outputs and inputs of the 15 two-digit NAICS industries in the province. Thus, it gives more weight to the sectors that comprise a more significant part of the province's economy. The equally-weighted market sector rank, as the name implies, attributes equal weights to all industries. Comparing the two ranks allows for important characteristics of the province's productivity performance to be identified. For instance, a province with a high market sector rank and a low equally-weighted market sector rank in labour productivity growth will most likely have strong labour productivity growth in its largest industries, but low productivity growth in most of the fifteen two-digit NAICS industries.

Lastly, we also perform **growth accounting** exercises in order to measure how different factors contributed to labour productivity growth. Contributions to labour productivity growth were broken

down into three factors: 1) capital intensity⁷; 2) labour quality; and 3) multifactor productivity.⁸ Formally, this decomposition is a consequence of the growth accounting framework adopted in this report. However, it is also quite intuitive:

- Workers that have access to more capital (i.e. higher capital intensity) tend to have, *ceteris paribus*, higher labour productivity. Imagine, for example, two teams with two workers each. In the first team, one worker has a shovel and the other has a snow blower. In the second team, both workers have snow blowers. The second team uses capital more intensively than the first, and thus is able to clear much more snow in the same period of time.
- Improvements in labour quality tend to increase the amount of output a worker can produce in a given time period. Thus, an experienced coal miner will normally be able to extract more coal than a novice miner during a given timeframe.
- Technological progress can substantially increase output per worker. A logger with a chainsaw, for instance, is much more productive than one with an axe. This is an example of productivity growth driven by MFP. It should be noted, however, that technological progress is only one of the several possible factors to drive MFP growth.

Methodology and Data Sources

Statistics Canada has detailed the methodologies and data sources used in the preparation of its estimates of multifactor productivity (MFP) at the national level in Baldwin *et al.* (2007). The provincial estimates used in this report have been prepared by Statistics Canada for the Centre for the Study of Living Standards (CSLS) and largely follow the methodologies used for the national estimates. There are, however, certain differences between the national and provincial estimates which are discussed in detail in Sharpe and Arsenault (2009). CSLS supplemented Statistics Canada data by calculating multifactor productivity level estimates for the provinces relative to the Canadian average.⁹

The growth accounting framework used in this report is the same as the one used in Sharpe and Thomson (2010a). It assumes a Cobb-Douglas production function such that:

$$Y = AK^{\alpha}L^{1-\alpha}$$

where Y is real output, K stands for capital services, L for labour input (quality adjusted hours), A for multifactor productivity and α is the share of output that takes the form of capital compensation. For more information, refer to the Appendix.

⁷ Note, once again, that capital intensity has been defined here as capital services per hour worked, *not* capital stock per hour worked.

⁸ To understand the reasons behind this decomposition, refer to the Appendix.

⁹ For more details, see Appendix.

II. Industry Composition by Nominal GDP and Total Hours Worked

In order to understand Newfoundland's overall productivity performance, it is essential to understand how each of the 15 two-digit NAICS industries contributed to the province's market sector in terms of nominal GDP and actual hours worked. Table 1 details these contribution shares for 1997 and 2007. In Newfoundland, the industries that had the largest GDP shares in 2007 were the mining, and oil and gas extraction (59.7 per cent of the province's nominal GDP in the market sector), retail trade (5.1 per cent), and manufacturing (5.0 per cent). In terms of total hours worked, the three industries that had the highest contributions in 2007 were retail trade (19.3 per cent of total hours worked), manufacturing (11.8 per cent), and construction (8.4 per cent).

Comparing Newfoundland's industry composition in 1997 and 2007, we can see how, in a single decade, mining, and oil and gas extraction acquired a pivotal role in the province's economy. In 1997, the mining, oil and gas extraction industry was responsible for only 8.2 per cent of the province's nominal GDP. By 2007, this industry's nominal GDP share had jumped to 59.7, which reflects an increase of 628.0 per cent.¹⁰ Note also that, during this short time span, the share of total hours worked in mining, and oil and gas extraction did not increase nearly as much as the industry's nominal GDP contribution, going from 3.6 to 5.3 per cent (a 47.2 per cent increase).

Table 1: Industry Share of Nominal GDP and Total Hours Worked in Newfoundland and Labrador

	1997				2007			
	GDP		Hours Worked		GDP		Hours Worked	
	Canada	Newfoundland and Labrador	Canada	Newfoundland and Labrador	Canada	Newfoundland and Labrador	Canada	Newfoundland and Labrador
Market Sector	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Agriculture, Forestry, Fishing and Hunting	3.2	5.1	5.4	5.9	2.1	1.8	3.4	3.0
Mining, and Oil and Gas Extraction	5.5	8.2	1.7	3.6	11.1	59.7	2.0	5.3
Utilities	4.2	7.5	0.9	1.7	3.0	2.9	0.8	1.7
Construction	7.0	9.9	7.9	9.0	9.0	4.4	10.1	8.4
Manufacturing	23.2	11.1	18.3	10.1	16.8	5.0	14.8	11.8
Wholesale Trade	7.1	6.4	7.4	6.0	7.1	2.8	6.9	5.0
Retail Trade	6.9	9.8	13.1	21.4	7.4	5.1	12.9	19.3
Transportation and Warehousing	6.2	7.2	6.3	7.6	5.6	2.8	6.6	7.8
Information and Cultural Industries	4.3	5.6	2.5	2.8	4.3	2.2	2.7	3.0
FIRE*	15.0	13.1	7.5	5.9	14.6	4.6	7.8	4.7
Professional, Scientific and Technical Services	4.9	3.8	6.3	4.2	6.2	2.4	7.9	5.8
ASWMR**	2.5	1.5	4.0	2.3	3.3	1.1	5.7	4.3
Arts, Entertainment and Recreation	0.9	0.7	1.5	0.7	0.9	0.2	1.9	1.1
Accommodation and Food Services	3.2	3.6	7.8	8.8	2.8	1.6	7.0	8.2
Other Services (Except Public Administration)	5.7	6.6	9.4	9.9	5.8	3.4	9.5	10.6

Source: Shares calculated by the CSLS, based on Statistics Canada data (Cansim Table 383-0011).

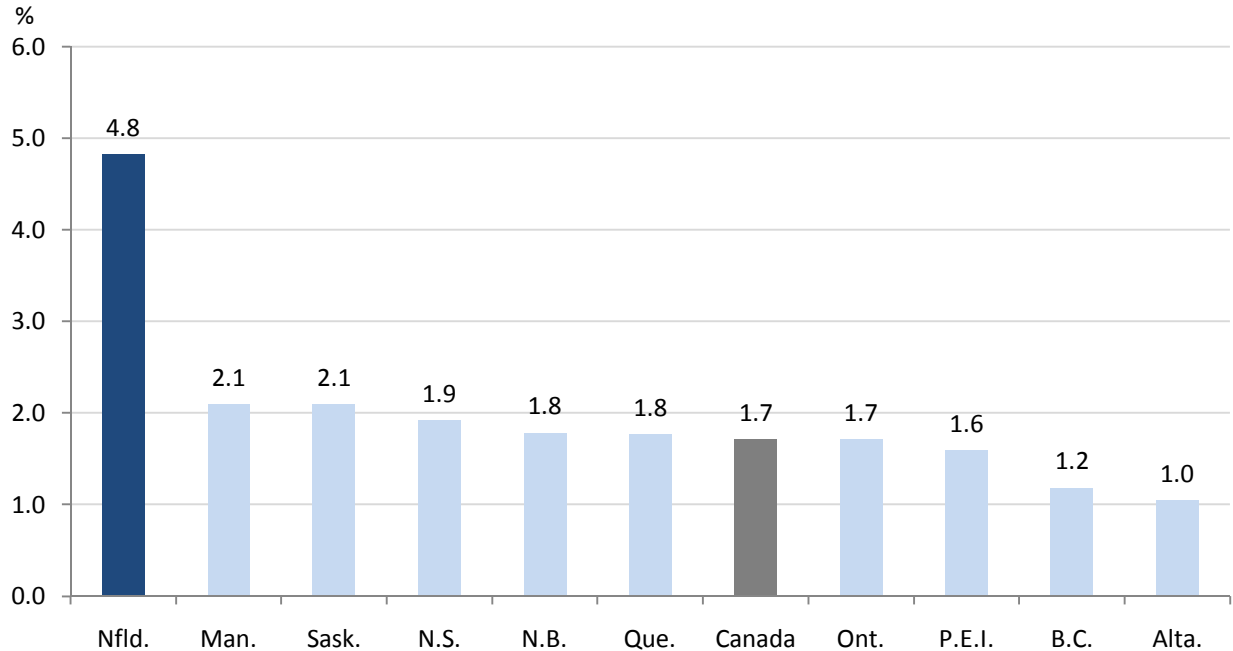
*Finance, insurance, real estate, rental and leasing **Administrative and support, waste management and remediation services

¹⁰ It is also interesting to note that Newfoundland had the largest GDP shares in mining, and oil and gas extraction among all the provinces, considerably higher than Alberta's (34.0 per cent of the province's nominal GDP in the market sector), and Saskatchewan's (31.7 per cent).

III. Labour Productivity

Labour productivity, defined as real GDP per hour worked,¹¹ grew at an average rate of 4.8 per cent per year in Newfoundland's market sector during the 1997-2007 period. This is almost three times the national average of 1.7 per cent per year. Newfoundland ranks 1st among the provinces in terms of labour productivity growth (Chart 1).

Chart 1: Labour Productivity Growth in Canada and the Provinces, Market Sector, 1997-2007
(Average Annual Growth Rates)



Source: CSLs Provincial Productivity Database, Appendix Tables, http://www.csls.ca/data/mfp_new.asp.

During the period in question, the industry that experienced the highest labour productivity growth rate in Newfoundland was the mining, and oil and gas extraction industry (15.3 per cent per year), followed by agriculture, forestry, fishing and hunting (8.9 per cent), and information and cultural industries (4.1 per cent) (Table 2). The industry that had the lowest labour productivity growth rate was arts, entertainment and recreation (-5.1 per cent per year), followed by administrative and support, waste management and remediation services, and construction (-2.2 per cent and -1.4 per cent, respectively).

In terms of labour productivity growth, Newfoundland had an astounding growth rate in its most important industry, i.e. mining, and oil and gas extraction, and abysmal growth rates in almost everything else, which explains why the province had both the highest market sector rank and the second lowest equally-weighted market sector rank. Simply put, eight of the 15 two-digit NAICS industries in Newfoundland ranked 8th or below, while only three industries ranked 3rd or above. The province had the lowest labour productivity growth rates in Canada in the following three industries: construction, manufacturing, and other services. At the same time, the province had the highest labour productivity growth in mining, and oil and gas extraction, and agriculture, forestry, fishing and hunting.

¹¹ Note that the total hours worked figures used to calculate labour productivity are unadjusted for labour quality.

Newfoundland's labour productivity level in 2007 was \$39.60 (1997 dollars) per hour, which represents 109.7 per cent of the Canadian level, up from 81.2 per cent in 1997. The province had the highest labour productivity level of any province in 2007, even exceeding that of Alberta.¹²

In 2007, only three of the 15 two-digit NAICS industries in Newfoundland had labour productivity levels above Canada's. The three industries were mining, and oil and gas extraction (296.9 per cent of the Canadian level), agriculture, forestry, fishing and hunting (187.5 per cent), and information and cultural industries (108.1 per cent). Industries that had lower levels than the national average included: manufacturing (52.9 per cent of the Canadian level), administrative and support, waste management and remediation services (65.5 per cent), and other services (67.9 per cent).

Similarly to the pattern observed in labour productivity growth, Newfoundland had extremely high relative labour productivity level in mining, and oil and gas extraction in 2007, but low relative levels in almost everything else. In particular, Newfoundland's manufacturing, other services and retail industries had the lowest labour productivity levels among all the ten provinces. Meanwhile, the province's mining, and oil and gas extraction, and agriculture, forestry, fishing and hunting had the highest levels in Canada.

Table 2: Labour Productivity Levels and Growth Rates in Newfoundland and Labrador, 1997-2007

	Compound Annual Growth Rate, 1997-2007	Provincial Ranking	Province's Labour Productivity Level Relative to Canada's, 1997	Province's Labour Productivity Level Relative to Canada's, 2007	Labour Productivity Level, 2007	Provincial Ranking, 2007
	(per cent)		(Canada=100)	(Canada=100)	(1997 Dollars)	
Market Sector	4.8	1	81.2	109.7	39.6	1
Agriculture, Forestry, Fishing and Hunting	8.9	1	120.7	187.5	50.9	1
Mining, and Oil and Gas Extraction	15.3	1	57.0	296.9	233.6	1
Utilities	-0.7	4	72.1	73.8	99.3	8
Construction	-1.4	10	100.5	73.4	23.4	9
Manufacturing	-0.7	10	70.8	52.9	25.3	10
Wholesale Trade	4.0	4	91.1	93.5	39.2	5
Retail Trade	3.2	7	71.5	70.5	15.5	10
Transportation and Warehousing	-0.5	9	78.6	69.8	22.2	9
Information and Cultural Industries	4.1	6	97.3	108.1	74.2	3
FIRE*	2.0	3	89.3	93.7	65.9	8
Professional, Scientific and Technical Services	-0.9	9	93.6	74.9	20.2	8
ASWMR**	-2.2	8	84.7	65.5	13.0	8
Arts, Entertainment and Recreation	-5.1	8	121.7	81.4	13.2	5
Accommodation and Food Services	1.4	5	80.4	83.0	11.4	9
Other Services (Except Public Administration)	0.7	10	78.2	67.9	11.0	10
Absolute Equally-Weighted Average Rank		6.3				6.9
Equally-Weighted Market Sector Rank		9				7

Source: CSL Provincial Productivity Database, Appendix Tables, http://www.csls.ca/data/mfp_new.asp.

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

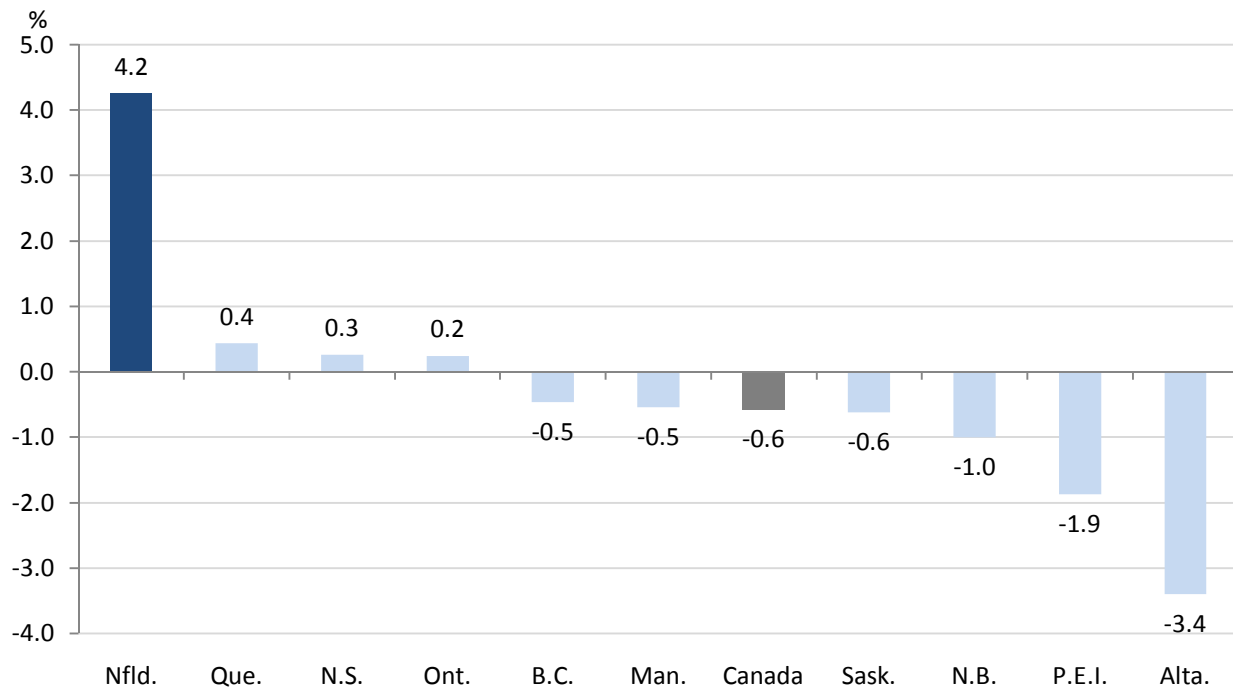
¹²In 2007, the labour productivity level of the Northwest Territories (market sector) was \$83.81 (2002 dollars) per hour. Newfoundland's labour productivity level in the same year, using 2002 dollars, was \$46.78 per hour, only 55.8 per cent that of the Northwest Territories.

IV. Capital Productivity

Capital productivity, defined as real GDP per unit of capital services, increased at a rate of 4.2 per cent per year in Newfoundland's market sector during the 1997-2007 period. This is in sharp contrast with the national average, which fell 0.6 per cent per year during the period in question. The province's capital productivity growth in the market sector ranked 1st in Canada (Chart 2).

In Newfoundland, seven of the 15 two-digit NAICS industries had negative capital productivity growth rates during the period. The industries that had the worst performances were professional, scientific and technical services (-12.8 per cent per year), arts, entertainment and recreation (-4.4 per cent), and FIRE (finance, insurance, real estate, rental and leasing) (-3.8 per cent) (Table 3). The industries that had the highest positive growth rates were mining, and oil and gas extraction (19.2 per cent per year), administrative and support, waste management and remediation services (13.4 per cent), and agriculture, forestry, fishing and hunting (2.8 per cent).

Chart 2: Capital Productivity Growth Rates in Canada and the Provinces, Market Sector, 1997-2007
(Average Annual Growth Rates)



Source: CSLS Provincial Productivity Database, Appendix Tables, http://www.csls.ca/data/mfp_new.asp.

As mentioned previously, the province's market sector ranked 1st in Canada (4th if the equally-weighted market sector ranking is used), with only four of the 15 two-digit NAICS industries at 8th place or lower. The professional, scientific and technical services industry had the worst capital productivity growth rates among all provinces. In contrast, the oil, mining and gas extraction industry had the highest capital productivity growth in Canada.

Newfoundland's capital productivity level in the market sector in 2007 was 160.8 per cent of the Canadian level, up from 100.2 per cent in 1997. In 2007, only 5 of the 15 two-digit NAICS industries in the province had capital productivity levels above the Canadian average. The five industries that had capital productivity levels above Canada's in 2007 were mining, and oil and gas extraction (1,732.4 per cent of the Canadian level), administrative and support, waste management and remediation services (568.9 per cent), agriculture, forestry, fishing and hunting (154.4 per cent), utilities (115.5 per cent), and retail trade (104.0 per cent). The industries with lowest capital productivity levels in the province were professional, scientific and technical services (43.4 per cent of the Canadian level), arts, entertainment and recreation (57.4 per cent), and construction (57.7 per cent).

Newfoundland's market sector had the highest capital productivity level in Canada in 2007. However, the province ranked 8th according to the equally-weighted market sector rank. High capital productivity levels are, therefore, not a widespread characteristic of Newfoundland industries, but rather are concentrated in the province's major industries. In particular, mining, and oil and gas extraction, which ranked 1st in Canada, had a capital productivity level of \$13.41 (1997 dollars) per unit of capital services. Other industries that had high capital productivity levels in Newfoundland compared to the other provinces were administrative and support, waste management and remediation services (ranked 1st), agriculture, forestry, fishing and hunting (ranked 2nd), and utilities (ranked 2nd).

Table 3: Capital Productivity Levels and Growth Rates in Newfoundland and Labrador, 1997-2007

	Compound Annual Growth Rate, 1997-2007	Provincial Ranking	Province's Capital Productivity Level Relative to Canada's, 1997	Province's Capital Productivity Level Relative to Canada's, 2007	Capital Productivity Level, 2007	Provincial Ranking, 2007
	(per cent)		(Canada=100)	(Canada=100)	(1997 Dollars)	
Market Sector	4.2	1	100.2	160.8	3.69	1
Agriculture, Forestry, Fishing and Hunting	2.8	2	143.0	154.5	3.24	2
Mining, and Oil and Gas Extraction	19.2	1	166.6	1,732.4	13.41	1
Utilities	0.8	3	106.5	115.5	1.49	2
Construction	-0.1	6	67.1	57.7	3.94	10
Manufacturing	0.1	8	114.4	98.3	2.68	5
Wholesale Trade	1.0	3	76.5	85.9	2.73	7
Retail Trade	0.0	4	94.0	104.0	4.76	6
Transportation and Warehousing	-3.3	8	109.3	95.1	2.29	9
Information and Cultural Industries	0.1	5	89.7	85.9	1.65	10
FIRE*	-3.8	9	86.4	64.2	1.05	9
Professional, Scientific and Technical Services	-12.8	10	85.1	43.4	1.06	10
ASWMR**	13.4	1	122.1	568.9	17.53	1
Arts, Entertainment and Recreation	-4.4	6	56.7	57.3	1.18	8
Accommodation and Food Services	-1.4	6	103.3	93.4	4.02	4
Other Services (Except Public Administration)	-2.4	6	97.4	83.0	4.42	7
Absolute Equally-Weighted Average Rank		5.2				6.1
Equally-Weighted Market Sector Rank		4				8

Source: CSL Provincial Productivity Database, Appendix Tables, http://www.csls.ca/data/mfp_new.asp.

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

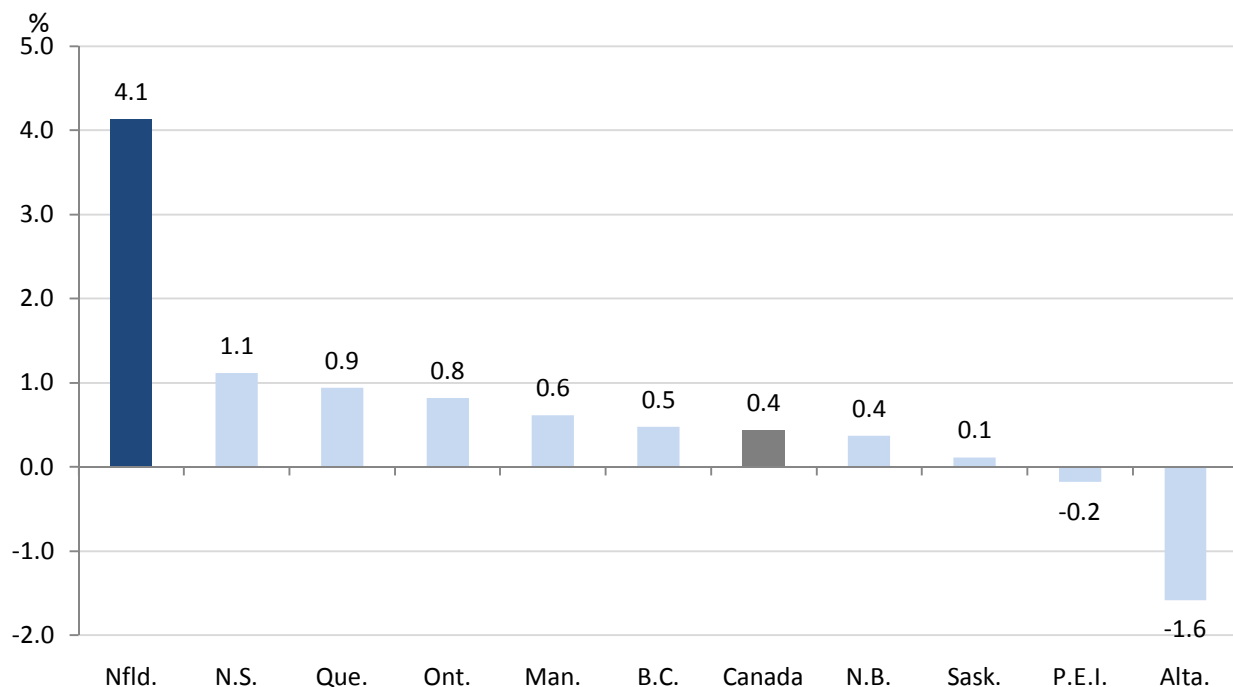
V. Multifactor Productivity

Newfoundland's multifactor productivity in the market sector grew at an average rate of 4.1 per cent per year during the 1997-2007 period. This is ten times the national average of 0.4 per cent per year, which explains why the province easily ranked first in Canada in terms of multifactor productivity growth (Chart 3).

The industry that experienced the highest multifactor productivity growth rate in Newfoundland was mining, and oil and gas extraction (18.8 per cent per year), followed by agriculture, forestry, fishing and hunting (4.6 per cent), and wholesale trade (2.9 per cent) (Table 4). The industries that had the lowest multifactor productivity growth rates were arts, entertainment and recreation (-4.6 per cent per year), professional, scientific and technical services (-3.9 per cent), and transportation and warehousing (-1.9 per cent).

Compared to the other provinces, during the 1997-2007 period Newfoundland had incredible multifactor productivity growth rates in its key industry, but abysmal growth in everything else. This is the main reason why the province had the highest market sector rank in Canada, but the second lowest equally-weighted market sector rank (only above New Brunswick). Of the 15 two-digit NAICS industries, six were ranked 9th place or lower. In particular, the following four industries had the worst multifactor productivity growth rates among all provinces: professional, scientific and technical services, construction, other services, and manufacturing. Conversely, mining, and oil and gas extraction had the highest multifactor productivity growth in Canada.

Chart 3: Multifactor Productivity Growth in Canada and the Provinces, Market Sector, 1997-2007
(Average Annual Growth Rates)



The province's multifactor productivity level in 2007 was 135.4 per cent of the Canadian level, up from 94.3 per cent in 1997. In 2007, only 4 of the 15 two-digit NAICS industries in Newfoundland had multifactor productivity levels above those of Canada. These industries were mining, and oil and gas extraction (1,453.3 per cent of the Canadian level), agriculture, forestry, fishing and hunting (165.6 per cent), administrative and support, waste management and remediation services (105.4 per cent), and utilities (103.0 per cent). In contrast, the industries with lowest multifactor productivity levels were manufacturing (64.1 per cent of the Canadian level), professional, scientific and technical services (66.4 per cent), and construction (68 per cent).

In terms of multifactor productivity levels, Newfoundland's market sector ranked 1st in Canada in 2007. However, the province ranked 9th according to the equally-weighted market sector rank. The divergence between the two rankings tells a similar story as the one we have seen in sections three and four. Namely, that in 2007 Newfoundland had extremely high multifactor productivity levels relative to Canada in its main industry (mining, and oil and gas extraction), but low levels in almost everything else. At the industry level, Newfoundland ranked 8th or below in nine of the 15 two-digit NAICS industries. In particular, the following six industries had the lowest levels in Canada: manufacturing, professional, scientific and technical services, other services, transportation and warehousing, retail trade, and FIRE.

Table 4: Multifactor Productivity Levels and Growth Rates in Newfoundland and Labrador, 1997-2007

Market Sector	Compound Annual Growth Rate, 1997-2007	Provincial Ranking	Province's Multifactor Productivity Level Relative to Canada's, 1997	Province's Multifactor Productivity Level Relative to Canada's, 2007	Provincial Ranking, 2007
	(per cent)		(Canada=100)	(Canada=100)	
Market Sector	4.1	1	94.3	135.4	1
Agriculture, Forestry, Fishing and Hunting	4.6	2	135.8	165.6	1
Mining, and Oil and Gas Extraction	18.8	1	159.1	1,453.3	1
Utilities	0.4	4	96.5	103.0	5
Construction	-1.1	10	89.3	68.0	9
Manufacturing	-0.4	10	79.8	64.1	10
Wholesale Trade	2.9	4	87.6	93.5	5
Retail Trade	1.7	7	77.7	74.5	10
Transportation and Warehousing	-1.9	9	84.1	72.9	10
Information and Cultural Industries	1.5	6	95.7	95.8	8
FIRE*	-1.8	9	90.4	75.4	10
Professional, Scientific and Technical Services	-3.9	10	92.1	66.4	10
ASWMR**	1.2	2	89.8	105.4	2
Arts, Entertainment and Recreation	-4.6	7	99.5	76.3	5
Accommodation and Food Services	0.8	4	85.7	87.6	9
Other Services (Except Public Administration)	-0.5	10	81.3	68.8	10
Absolute Equally-Weighted Average Rank		6.3			7.0
Equally-Weighted Market Sector Rank		9			9

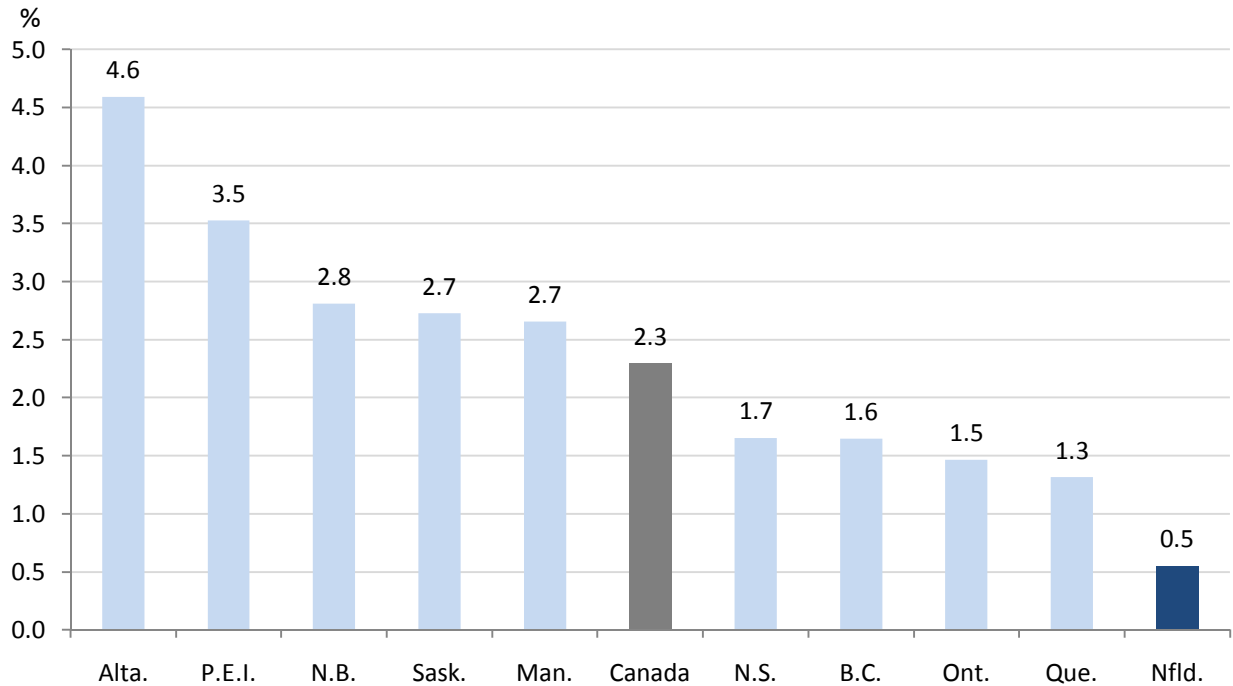
Source: CSLS Provincial Productivity Database, Appendix Tables, http://www.csls.ca/data/mfp_new.asp.

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

VI. Capital Intensity

Capital intensity, defined as capital services per hour worked (unadjusted for labour quality), grew at an average rate of 0.5 per cent per year in Newfoundland's market sector during the 1997-2007 period, well below the national average of 2.3 per cent per year. Newfoundland ranked last among the ten provinces in terms of capital intensity (Chart 4).

Chart 4: Capital Intensity Growth in Canada and the Provinces, Market Sector, 1997-2007
(Average Annual Growth Rates)



Source: CSLS Provincial Productivity Database, Appendix Tables, http://www.csls.ca/data/mfp_new.asp.

During this period, the industries that experienced the highest capital intensity growth were professional, scientific and technical services (13.7 per cent per year), FIRE (6.0 per cent), and agriculture, forestry, fishing and hunting (5.9 per cent) (Table 5). Conversely, the industries that had the lowest growth rates were administrative and support, waste management and remediation services (-13.7 per cent per year), mining, and oil and gas extraction (-3.3 per cent), and utilities (-1.5 per cent).

Even though the province ranked last according to its market sector rank, its equally-weighted rank was considerably higher, 6th place. The province's poor capital intensity growth performance was driven mostly by mining, and oil and gas extraction (which had the lowest growth rates in Canada when compared to equivalent industries in the other provinces). The province ranked 7th or below in seven of the 15 two-digit NAICS industries. In particular, it had the lowest growth rates among the ten provinces in the following three industries: administrative and support, waste management and remediation services, mining, and oil and gas extraction, and utilities. On the other hand, agriculture, forestry, fishing and hunting had the highest capital intensity growth rates in Canada when compared to the same industries in other provinces.

Table 5: Capital Intensity Levels and Growth Rates in Newfoundland and Labrador, 1997-2007

Market Sector	Compound Annual Growth Rate, 1997-2007	Provincial Ranking	Province's Capital Intensity Level Relative to Canada's, 1997	Province's Capital Intensity Level Relative to Canada's, 2007	Capital Intensity Level, 2007	Provincial Ranking, 2007
	(per cent)		(Canada=100)	(Canada=100)	(1997 Dollars)	
Market Sector	0.5	10	81.1	68.2	10.7	8
Agriculture, Forestry, Fishing and Hunting	5.9	1	84.8	121.4	15.7	4
Mining, and Oil and Gas Extraction	-3.3	10	34.3	17.1	17.4	10
Utilities	-1.5	8	67.4	63.9	66.7	9
Construction	-1.4	8	150.8	127.3	5.9	4
Manufacturing	-0.9	7	62.2	53.8	9.4	8
Wholesale Trade	3.0	6	119.1	108.9	14.4	4
Retail Trade	3.2	8	76.1	67.8	3.3	8
Transportation and Warehousing	2.9	4	71.8	73.4	9.7	8
Information and Cultural Industries	4.0	5	109.9	127.6	45.4	2
FIRE*	6.0	2	103.3	145.9	62.5	2
Professional, Scientific and Technical Services	13.7	2	110.0	172.7	19.1	1
ASWMR**	-13.7	10	69.3	11.5	0.7	10
Arts, Entertainment and Recreation	-0.7	7	213.6	142.0	11.2	3
Accommodation and Food Services	2.8	5	78.6	88.9	2.8	8
Other Services (Except Public Administration)	3.2	6	80.3	81.8	2.5	8
Absolute Equally-Weighted Average Rank		5.9				5.9
Equally-Weighted Market Sector Rank		6				6

Source: CSL Provincial Productivity Database, Appendix Tables, http://www.csls.ca/data/mfp_new.asp.

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

Newfoundland's capital intensity level in 2007 was 68.2 per cent of the Canadian level, down from 81.1 per cent in 1997. According to the market sector rank the province had the 8th lowest capital intensity level in Canada in 2007, even though its equally-weighted market sector rank is marginally better (6th place).

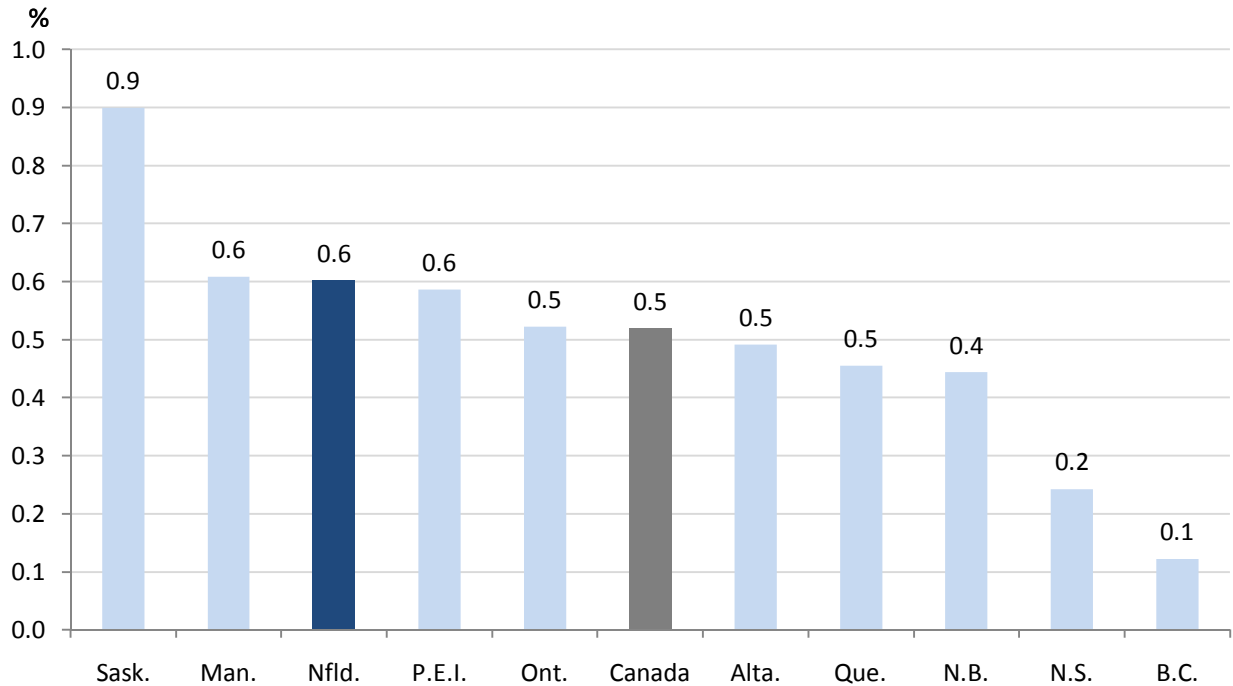
In 2007, eight of the 15 two-digit NAICS industries had capital intensity levels above the Canadian levels. Industries with high relative levels included: professional, scientific and technical services (172.7 per cent of the Canadian level), FIRE (145.9 per cent), arts, entertainment and recreation (142.0 per cent). The industries that had the lowest relative levels were administrative and support, waste management and remediation services (11.5 per cent of the Canadian level), mining, and oil and gas extraction (17.1 per cent), and manufacturing (53.8 per cent).

Compared to the other provinces, Newfoundland's industries had capital intensity levels that were either significantly above the average, or significantly below in 2007. This can be seen in the fact that eight of the 15 two-digit NAICS industries were ranked 8th or below, while the rest of the industries were ranked 4th or above. In particular, Newfoundland had the lowest capital intensity levels compared to the other provinces in the following industries: administrative and support, waste management and remediation services, and mining, and oil and gas extraction. The province had the highest capital intensity levels compared to the other provinces in professional, scientific and technical services.

VII. Labour Quality

Newfoundland's market sector experienced labour quality growth slightly above the national average during the 1997-2007 period. The province grew at an average rate of 0.6 per cent per year, while the national average was 0.5 per cent per year. The province ranked 3rd in Canada in terms of labour quality growth (Chart 5).

Chart 5: Labour Quality Growth in Canada and the Provinces, Market Sector, 1997-2007
(Average Annual Growth Rates)



Source: CSLS Provincial Productivity Database, Appendix Tables, http://www.csls.ca/data/mfp_new.asp.

During the period in question, the industries that experienced the highest labour quality growth rates in Newfoundland were agriculture, forestry, fishing and mining (1.2 per cent per year), transportation and warehousing (1.0 per cent), retail trade, and other services (both of which grew at an average annual rate of 0.8 per cent) (Table 6). The industries that had the lowest labour quality growth rates were mining, and oil and gas extraction (-0.8 per cent per year), wholesale trade (-0.3 per cent), and arts, entertainment and recreation (-0.3 per cent).

In terms of labour quality growth, the province ranked 7th or below in only five of the 15 two-digit NAICS industries. The worst comparative performances were in mining, and oil and gas extraction, wholesale trade, and arts, entertainment and recreation, all of which earned the province the last place in the ranking. Conversely, the province excelled in retail trade, and transportation and warehousing.

Table 6: Labour Quality Levels and Growth Rates in Newfoundland and Labrador, 1997-2007¹³

Market Sector	Compound Annual Growth Rate, 1997-2007	Provincial Ranking
	(per cent)	
Market Sector	0.6	3
Agriculture, Forestry, Fishing and Hunting	1.2	2
Mining, and Oil and Gas Extraction	-0.8	10
Utilities	0.3	3
Construction	0.1	3
Manufacturing	0.4	4
Wholesale Trade	-0.4	10
Retail Trade	0.8	1
Transportation and Warehousing	1.0	1
Information and Cultural Industries	0.3	6
FIRE*	0.4	6
Professional, Scientific and Technical Services	0.7	2
ASWMR**	-0.1	7
Arts, Entertainment and Recreation	-0.3	10
Accommodation and Food Services	-0.1	9
Other Services (Except Public Administration)	0.8	2
Absolute Equally-Weighted Average Rank		5.1
Equally-Weighted Market Sector Rank		3

Source: CSLs Provincial Productivity Database, Appendix Tables, http://www.csls.ca/data/mfp_new.asp.

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

¹³ Labour quality levels are not shown here because they are assumed to be the same (and equal to 100.0) across all provinces and in Canada in the base year, 1997 (Sharpe and Thomson, 2010a). They differ after 1997, incorporating the different labour quality growth rates experienced by the provinces and Canada. For example, labour quality in Newfoundland's market sector grew at an average annual rate of 0.6 per cent over the 1997-2007 period, while Canada's labour quality grew at an average annual rate of 0.5 per cent. As a consequence, Newfoundland's labour quality level was 100.8 per cent of the Canadian level in 2007.

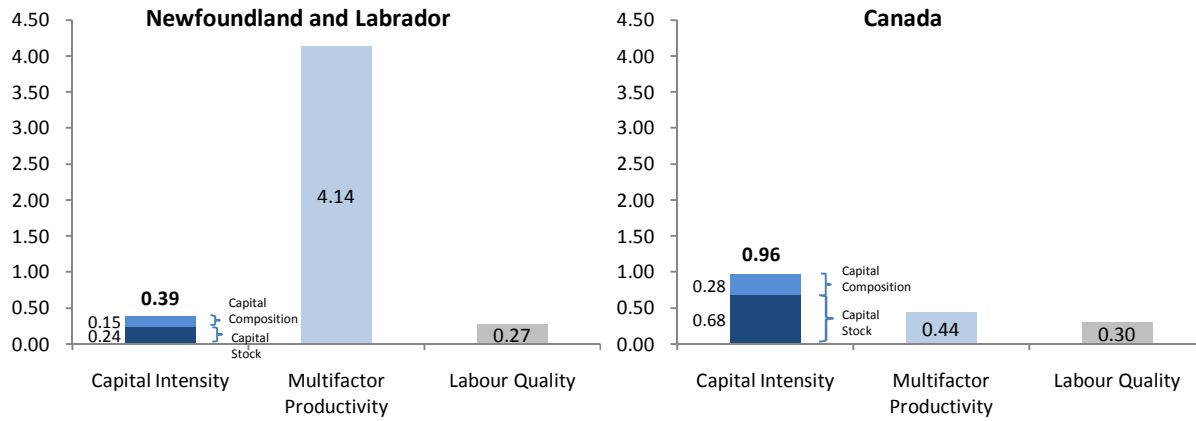
VIII. Sources of Labour Productivity Growth in the Market Sector

Newfoundland's labour productivity grew at an average rate of 4.8 per cent per year during the 1997-2007 period, almost three times the national average of 1.7 per cent per year. Charts 6 and 7 show both the percentage point and per cent contributions to labour productivity growth by the sources of growth for Newfoundland and Canada over the 1997-2007 period.

Newfoundland's labour productivity growth was driven mainly by multifactor productivity growth, which accounted for 4.14 percentage points of the overall labour productivity growth (or, alternatively, 85.9 per cent of total growth). Capital intensity growth contributed only 0.39 percentage points (7.9 per cent), of which 0.15 were due to capital composition growth (3.0 per cent) and 0.24 were due to capital stock growth (4.9 per cent). A small but steady increase in labour quality was responsible for 0.27 percentage points of the labour productivity growth experienced in the province (5.5 per cent).

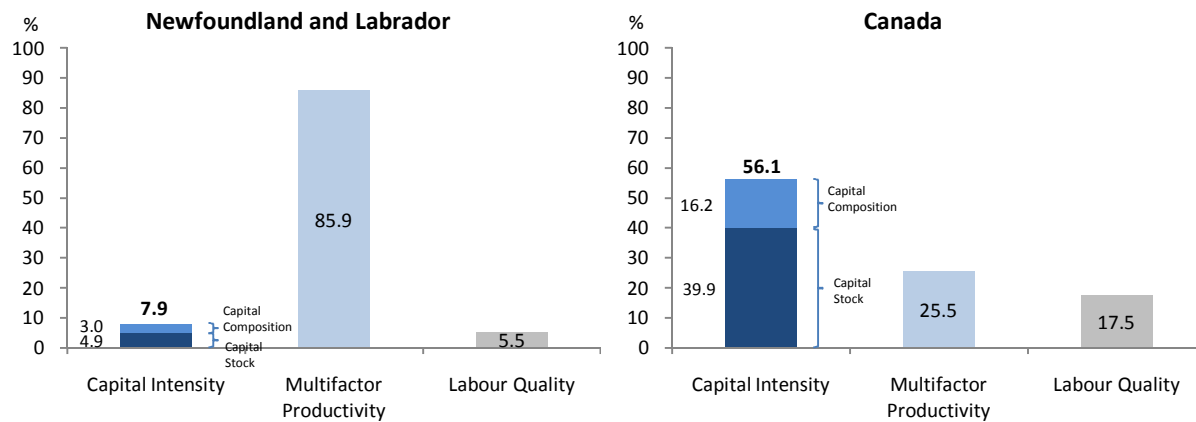
Comparing the two charts, it can be seen that this growth accounting exercise yields very different results for Newfoundland and Canada. Capital intensity growth was the main driver for labour productivity growth in Canada, accounting for 56.1 per cent of total growth, but it played only a small role in Newfoundland (7.9 per cent). Although multifactor productivity growth was also important in Canada, accounting for 25.5 per cent of labour productivity growth during the 1997-2007 period, it was far more important in Newfoundland, where it was responsible for 85.9 per cent of total growth. Labour quality growth was by far the less important component in both Newfoundland and in Canada, although its contribution to labour productivity growth was even smaller in Newfoundland than in Canada (5.5 per cent vs. 17.5 per cent, respectively).

Chart 6: Percentage Point Contribution to Labour Productivity Growth by the Source of Labour Productivity Growth in the Market Sector in Newfoundland and Labrador and in Canada, 1997 to 2007



Source: CSLS Provincial Productivity Database, Appendix Table 17, http://www.csls.ca/data/mfp_new.asp.

Chart 7: Per Cent Contribution to Labour Productivity Growth by the Source of Labour Productivity Growth in the Market Sector in Newfoundland and Labrador and in Canada, 1997 to 2007



Source: CSLS Provincial Productivity Database, Appendix Table 17, http://www.csls.ca/data/mfp_new.asp.

Note: Numbers may not sum to 100 due to rounding.

Table 7 details the contributions in absolute and per cent terms of capital intensity, MFP, and labour quality growth to labour productivity growth in Newfoundland over the 1997-2007 period at the two-digit NAICS industry level.

Table 7: Contributions to Labour Productivity Growth at the Industry Level by Source in Newfoundland and Labrador, 1997-2007

	Labour Productivity	Capital Intensity			MFP	Labour Quality
		Total	Capital Composition	Capital Stock		
Percentage Point Contributions to Labour Productivity Growth						
Market Sector	4.8	0.4	0.1	0.2	4.1	0.3
Agriculture, Forestry, Fishing and Hunting	8.9	3.5	-2.7	6.3	4.6	0.6
Mining, and Oil and Gas Extraction	15.3	-3.0	-0.3	-2.7	18.8	0.0
Utilities	-0.7	-1.1	1.3	-2.4	0.4	0.1
Construction	-1.4	-0.5	-0.1	-0.4	-1.1	0.1
Manufacturing	-0.7	-0.6	-0.3	-0.4	-0.4	0.3
Wholesale Trade	4.0	1.3	0.1	1.2	2.9	-0.2
Retail Trade	3.2	0.8	0.0	0.8		0.6
Transportation and Warehousing	-0.5	0.6	0.4	0.2	-1.9	0.8
Information and Cultural Industries	4.1	2.4	0.8	1.6	1.5	0.1
FIRE*	2.0	3.7	1.4	2.2	-1.8	0.1
Professional, Scientific and Technical Services	-0.9	2.4	0.1	2.3	-3.9	0.6
ASWMR**	-2.2	-3.3			1.2	-0.1
Arts, Entertainment and Recreation	-5.1	-0.3	-0.1	-0.2	-4.6	-0.1
Accommodation and Food Services	1.4	0.6	0.0	0.6	0.8	-0.1
Other Services (Except Public Administration)	0.7	0.6	0.2	0.3	-0.5	0.6
Per Cent Contributions to Labour Productivity Growth						
Market Sector	100.0	8.0	3.0	4.9	85.9	5.5
Agriculture, Forestry, Fishing and Hunting	100.0	39.8	-30.9	70.5	51.6	6.2
Mining, and Oil and Gas Extraction	100.0	-19.6	-2.0	-17.6	123.1	0.1
Utilities	100.0	167.8	-202.1	365.4	-58.1	-10.5
Construction	100.0	31.7	5.5	26.1	73.9	-5.4
Manufacturing	100.0	87.6	36.1	50.9	56.6	-44.3
Wholesale Trade	100.0	33.5	2.9	30.5	71.0	-5.2
Retail Trade	100.0	25.5	-1.1	26.6		20.3
Transportation and Warehousing	100.0	-130.1	-89.4	-39.4	392.1	-166.6
Information and Cultural Industries	100.0	58.7	18.9	39.2	37.3	3.0
FIRE*	100.0	186.0	73.1	110.7	-89.7	6.8
Professional, Scientific and Technical Services	100.0	-263.1	-15.5	-244.8	414.7	-62.8
ASWMR**	100.0	150.7			-56.2	3.7
Arts, Entertainment and Recreation	100.0	6.4	1.7	4.6	91.8	2.2
Accommodation and Food Services	100.0	46.7	-0.9	47.6	60.7	-7.7
Other Services (Except Public Administration)	100.0	76.7	31.6	44.2	-65.0	88.6

Source: CSL Provincial Productivity Database, Appendix Tables, http://www.csls.ca/data/mfp_new.asp.

Note: Per cent contributions may not sum to 100 due to rounding.

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

IX. Sources of Labour Productivity Level Gap by Industry

Newfoundland's labour productivity level in 2007 was 109.7 per cent of the Canadian level, which implies a positive labour productivity differential of 9.7 percentage points. Table 8 makes it clear that this positive differential was driven mainly by the above average multifactor productivity level, which was responsible for 31.8 percentage points of the differential. The capital intensity and labour quality levels accounted for -22.4 and 0.4 percentage points of the differential respectively.¹⁴

Newfoundland had labour productivity gaps in 12 of the 15 two-digit NAICS industries. In most cases, the below average multifactor productivity level was the main culprit, with significant contributions to the gap that were occasionally compounded by below average capital intensity levels.

Table 8: Sources of the Labour Productivity Gap Relative to Canada for Newfoundland and Labrador at the Two-Digit Industry Level, 2007

Market Sector	Labour Productivity Relative Level	Labour Productivity Differential	Percentage Point Contributions to Labour Productivity Differential			Percent Contributions to Labour Productivity Differential			
			Capital Intensity	Multifactor Productivity	Labour Quality	Labour Productivity	Capital Intensity	Multifactor Productivity	Labour Quality
Market Sector	109.7	9.7	-22.4	31.8	0.4	100.0	-230.3	326.4	3.9
Agriculture, Forestry, Fishing and Hunting	187.5	87.5	15.8	70.2	1.5	100.0	18.1	80.3	1.7
Mining, and Oil and Gas Extraction	296.9	196.9	-285.9	484.3	-1.5	100.0	-145.2	245.9	-0.7
Utilities	73.8	-26.2	-29.1	2.6	0.3	100.0	110.8	-9.8	-1.0
Construction	73.4	-26.6	6.5	-33.2	0.1	100.0	-24.4	124.6	-0.2
Manufacturing	52.9	-47.1	-14.3	-32.8	0.0	100.0	30.3	69.7	0.0
Wholesale Trade	93.5	-6.5	3.6	-6.5	-3.6	100.0	-54.9	99.7	55.2
Retail Trade	70.5	-29.5	-9.1	-24.9	4.4	100.0	30.7	84.2	-15.0
Transportation and Warehousing	69.8	-30.2	-7.2	-26.5	3.6	100.0	23.9	88.0	-11.9
Information and Cultural Industries	108.1	8.1	13.8	-4.4	-1.2	100.0	169.6	-54.4	-15.2
FIRE*	93.7	-6.3	21.2	-27.3	-0.1	100.0	-336.6	434.5	2.0
Professional, Scientific and Technical Services	74.9	-25.1	9.8	-35.6	0.6	100.0	-39.2	141.6	-2.4
ASWMR**	65.5	-34.5	-38.1	4.3	-0.7	100.0	110.5	-12.4	2.0
Arts, Entertainment and Recreation	81.4	-18.6	7.9	-24.5	-2.1	100.0	-42.7	131.5	11.1
Accommodation and Food Services	83.0	-17.0	-2.4	-12.1	-2.4	100.0	14.3	71.4	14.2
Other Services (Except Public Administration)	67.9	-32.1	-3.7	-31.0	2.6	100.0	11.7	96.5	-8.2

Source: CCLS Provincial Productivity Database, Appendix Tables, http://www.ccls.ca/data/mfp_new.asp.

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

¹⁴ Again, it is important to bear in mind that labour quality levels were assumed to be equal to 100.0 in all provinces and in Canada for the base year of 1997. They differ after 1997, incorporating the different labour quality growth rates experienced by the provinces and Canada.

X. Conclusion

During the 1997-2007 period, Newfoundland's market sector experienced an impressive productivity performance according to all productivity measures discussed in this report. The province's labour productivity grew at an average annual rate of 4.8 per cent (almost three times the national average of 1.7 per cent), its capital productivity grew at an average annual rate of 4.2 per cent (while the national average was -0.6 per cent) and multifactor productivity growth reached 4.1 per cent per year (ten times the national average of 0.4 per cent). These results were driven mainly by one industry – namely, mining, and oil and gas extraction, which accounted for almost 60% per cent of nominal GDP in the province in 2007. During the period in question, the mining, and oil and gas extraction industry in Newfoundland showed extremely high labour productivity growth (15.3 per cent per year), capital productivity growth (19.2 per cent), and multifactor productivity growth (18.8 per cent) compared to equivalent industries in the other provinces.

Newfoundland's labour, capital, and multifactor productivity levels in the market sector in 2007 were above national levels. The province's labour productivity level, in particular, was 109.7 per cent of the national level, which implies a labour productivity differential of 9.7 percentage points. This positive differential was due mainly to the province's above average multifactor productivity level in the market sector.

Table 9 provides a summary of levels (in 1997 and 2007) and growth rates (for the 1997-2007 period) for the productivity measures discussed in this report, along with rankings that show how Newfoundland fared in comparison to the other provinces. A key observation is the sharp contrast between the province's market sector rank (1st in all three productivity categories), and its equally-weighted market sector rank (7th or lower in the three productivity categories). Taken together, these two ranks tell us that, despite high productivity growth rates and levels in mining, and oil and gas extraction, most of the other industries in the province had below average performances.

Table 9: Summary of Newfoundland and Labrador's Productivity Performance in the Market Sector

	Market Sector Growth, 1997 to 2007			Per Cent of the Canadian Level		Level Rankings, 2007	
	Compound Annual Growth Rate	Market Sector Rank	Equally-Weighted Market Sector Rank	1997	2007	Market Sector Rank	Equally-Weighted Market Sector Rank
Labour Productivity	4.8	1	10	81.2	109.7	1	7
Capital Productivity	4.2	1	4	100.2	160.8	1	8
Multifactor Productivity	4.1	1	9	94.3	135.4	1	9
Capital Intensity	0.5	10	6	81.1	68.2	8	6
Labour Quality	0.6	3	3	n.a.	n.a.	n.a.	n.a.

Source: CSLS Provincial Productivity Database, Appendix Tables, http://www.csis.ca/data/mfp_new.asp.

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Appendix – A Growth Accounting Framework

The growth accounting framework used in this report assumes a Cobb-Douglas production function such that

$$Y = AK^\alpha L^{1-\alpha} \quad (1)$$

where Y is real output, K stands for capital services, L for labour input (quality adjusted hours), A for multifactor productivity and α is the share of output that takes the form of capital compensation. The labour input L can be decomposed into hours (H) and labour quality (QL):

$$L = H * QL \quad (2)$$

Capital services can be decomposed into capital stock (SK) and capital composition (QK):

$$K = SK * QK \quad (3)$$

Capital intensity (KI) is defined as:

$$KI = \frac{K}{H} \quad (4)$$

Using (1), (2), and (4), the components of labour productivity *growth* can be decomposed as follows:

$$\Delta LP = \Delta Y - \Delta H = [\Delta QL * (1 - \alpha)] + [\Delta KI * \alpha] + \Delta A \quad (5)$$

where LP stands for labour productivity and Δ is the percentage change. This equation was used in section eight.

The province's MFP levels relative to the Canadian levels (*Relative MFP_{p,i}*) were calculated using the equation below:

$$\ln(\text{Relative MFP}_{p,i}) = \ln\left(\frac{A_{p,i}}{A_{c,i}}\right) = \ln\left(\frac{Y_{p,i}}{Y_{c,i}}\right) - k_{p,c} * \ln\left(\frac{K_{p,i}}{K_{c,i}}\right) - (1 - k_{p,c}) * \ln\left(\frac{L_{p,i}}{L_{c,i}}\right) \quad (6)$$

where $k_{p,c}$ is the average share of capital input between Canada and the province, and the subscripts c , p and i stand for Canada, province and industry, respectively.

Finally, the contributions to the relative labour productivity levels between the province and Canada (*Relative LP_{p,i}*) can be found using the following formula:

$$\ln(\text{Relative LP}_{p,i}) = \ln\left(\frac{A_{p,i}}{A_{c,i}}\right) + k_{p,c} * \ln\left(\frac{KI_{p,i}}{KI_{c,i}}\right) + (1 - k_{p,c}) * \ln\left(\frac{QL_{p,i}}{QL_{c,i}}\right) \quad (7)$$

This equation was used in section nine. For a detailed discussion about the growth accounting framework used here, refer to Sharpe and Thomson (2010a).