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

CENTRE FOR THE STUDY OF LIVING STANDARDS

A DETAILED ANALYSIS OF PRODUCTIVITY TRENDS IN THE FOREST PRODUCTS SECTOR IN QUEBEC, 2000-2013: ADVERSITY DRIVES PRODUCTIVITY

Jasmin Thomas

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Abstract

The Quebec forest products sector has had an above-average productivity performance in the 2000-2013 period, driven in particular by the forestry and logging subsector. While the wood product manufacturing subsector has also benefited from strong productivity gains, the productivity performance of the paper manufacturing subsector has been far from impressive. This report provides a detailed analysis of output, input and productivity trends in the Canadian forest products sector. It also looks at the key drivers of productivity in the sector, investigating potential barriers to productivity growth and discussing policies that could enable faster growth. Given the increasing role of countries with low-labour costs in several forest product markets, maintaining robust productivity growth is an imperative for the Quebec forest products sector if it wants to remain competitive internationally. In this vein, the report recommends a renewed focus on human and physical capital investment, as well as on R&D spending and the introduction of new innovative products.

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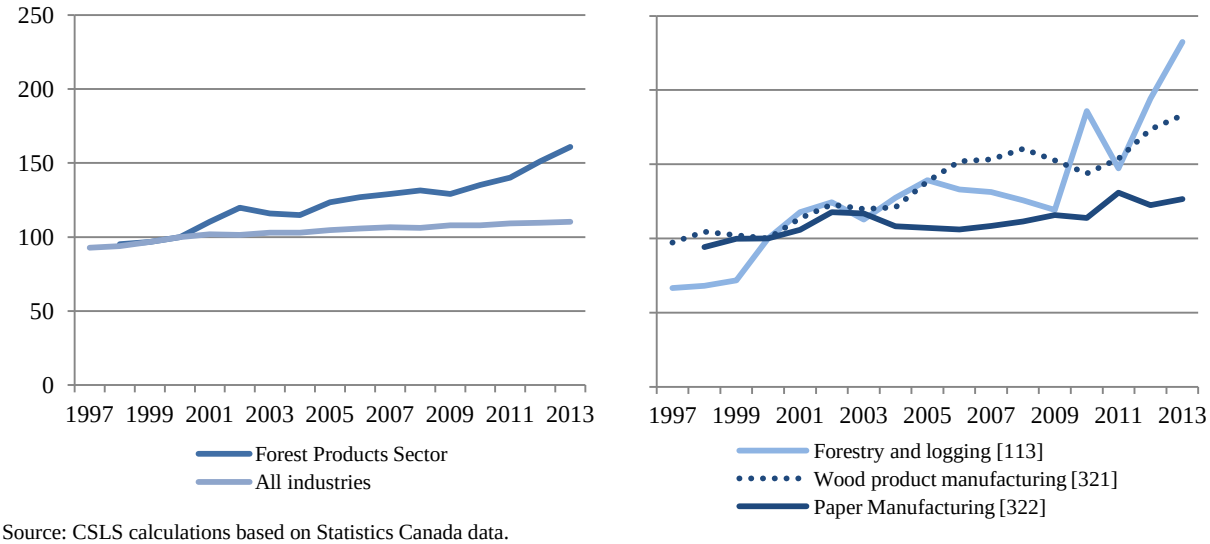
Executive Summary

In the 2000-2013 period, the forest products sector in Quebec had an above-average productivity performance, fuelled mainly by forestry and logging, although wood product manufacturing also saw strong labour productivity gains. Labour productivity growth in paper manufacturing, in contrast, has been less impressive.

Chart 1: Labour Productivity, Forest Products Sector, 2000=100, Quebec, 1997-2013



Source: CSLS calculations based on Statistics Canada data.

This report discusses these productivity trends in the Quebec forest products sector, and subsequently, attempts to identify the drivers behind the astounding productivity growth in Quebec's forest products sector by examining trends in human capital, investment, natural resources, unit labour costs, and more.

Highlights

- The forest products sector in Quebec had an excellent productivity performance between 1997 and 2013, outperforming the total economy in Quebec by far (3.7 versus 1.0 per cent per year between 2000 and 2013).

- Forestry and logging saw the fastest labour productivity growth between 2000 and 2013, growing 132 per cent (6.7 per cent per year). Labour productivity in wood product manufacturing grew 83 per cent (4.8 per cent per year), while labour productivity in paper manufacturing grew only 26 per cent (1.8 per cent per year).

- Compared to the labour productivity growth in other two-digit NAIS sectors in Quebec between 2000 and 2013, Quebec's forest products sector was the second strongest performer (3.7 per cent per year), falling only slightly behind agriculture, forestry, fishing and hunting (3.9 per cent per year).

- Quebec's forest products sector had a labour productivity level of $48.8 per hour in 2011, down from $53.3 per hour in 2005 and $50.2 per hour in 2000. It is important to note that this decline in the labour productivity level in the forest products sector is driven by declining prices (implicit prices fell 3.3 per cent per year between 2000 and 2011).

Such strong performance in the forest products sector in Quebec is quite impressive given that the forest products sector in Canada was hit by a perfect storm of structural and cyclical factors in the first decade of the twenty-first century. While the economic crisis of the late-2000s affected many industries, it was particularly severe in the forest products sector because of the dramatic decline in housing starts, especially in the United States.

In addition to the cyclical drop in demand associated with the economic crisis, there has been a continuous structural shift away from paper products to electronic media and devices, a development which gained speed in the mid- to late-2000s. The Standing Committee on Agriculture and Forestry (2009:10) makes a point of emphasizing that the "decline in demand is more structural than cyclical." Unlike demand for lumber in the housing sector, there likely will not be a rebound in the demand for traditional paper products such as newsprint (Standing Committee on Agriculture and Forestry, 2009:10).

The negative demand effects of the U.S. housing crisis and the structural shift away from paper have been exacerbated in the 2000s by an appreciation of the Canadian dollar, reducing demand further for Quebec forest product exports. The emergence of low-cost forest product producers in developing countries has been yet another factor in reducing demand for Canadian (and Quebec) forest products and contributing to the perfect storm.

Despite the confluence of all of these demand-reducing factors, the forest products sector was still able to register incredible labour productivity performance. However, this productivity performance came at the expense of employment.

In particular, in response to weakening demand, the forest products sector was forced to take drastic measures to reduce costs and maintain competitiveness; otherwise it would not have survived. Closing plants and reducing employment levels through layoffs was the most obvious way to reduce costs and Canadian forest product firms were particularly aggressive in this regard. Indeed, employment fell at a greater rate than output, which translated into significant productivity gains. Some output and input highlights include:

- Declining real GDP: between 2000 and 2013, the forest products sector in Quebec saw real GDP decline by 1.1 per cent per year, while the total economy saw increases of 1.6 per cent per year. This was driven by paper manufacturing, which saw a decline in output of 2.4 per cent per year between 2000 and 2013. Wood product manufacturing and

forestry and logging saw positive growth, 0.1 per cent per year and 0.4 per cent per year, respectively.

- A declining value added share: since the peak of 4.38 per cent in 1998 in Quebec with a nominal value added of $8.0 billion, the share of the forest products sector in nominal GDP has declined by 2.7 percentage points, representing only 1.64 per cent of GDP in all industries in 2011 with a nominal value added of $5.3 billion.

- Falling employment levels: in terms of employment, between 2000 and 2013, the forest products sector saw declines of 4.4 per cent per year, while the total economy in Quebec saw increases of 1.3 per cent per year. In forestry and logging, employment decreased by 5.6 per cent per year, while in wood product manufacturing and paper manufacturing, employment declined by 4.2 per cent per year.

Productivity Drivers

Simple growth accounting procedures show that the main driving force behind the rapid labour productivity growth in the forest products sector was multifactor productivity growth, as opposed to growth from capital intensity.

By definition, multifactor productivity growth is a residual, representing output growth that is not accounted for by measured input growth. It is often seen as a proxy for technological change, but the reality is that it encompasses a number of very different factors, such as improvements in technology and organization, capacity utilization, and increase or decreasing returns to scale, among others. Multifactor productivity growth also embeds errors due to mismeasurement of inputs and outputs.

One element embodied in multifactor productivity growth is human capital. In the forest products sector, there is evidence that the workforce is becoming increasingly educated over time. However, there is no evidence that superior productivity growth in the forest products sector is due to faster growth in human capital: changes in labour composition played only a small role in overall labour productivity growth.

A second element embodied in multifactor productivity is innovation and technological change. A good proxy for innovation and technological change is business enterprise research and development expenditures. In 2011, firms in the forest products sector in Quebec spent $130 million in research and development, down from $215 million in 2007.

To the degree that multifactor productivity (MFP) growth is determined by R&D, these data suggest that multifactor productivity growth should be weaker in recent years. However it is arguable that there is no direct link between MFP and R&D. For one, if there is a link between R&D and MFP, there tends to be a long lag. In addition, R&D investment done in the rest of Canada and internationally could benefit the Quebec forest products sector if firms engage in technological adoption. Hence, it is unclear whether research and development has impacted innovation and technological change in Quebec and subsequently multifactor productivity.

Another good proxy for innovation and technological change is investment. Between 2000 and 2013, wood product manufacturing showed dismal performance in terms of investment in real machinery and equipment (-7.7 per cent per year). In stark contrast, machinery and equipment investment between 2000 and 2013 was growing in the total economy at 2.2 per cent per year. Hence, investment via innovation and technological change is unlikely to explain fast MFP growth.

Real net investment figures, an additional proxy for technological change and innovation, are not more promising than investment growth rates. Real net investment is investment minus depreciation, and it highlights how much investment actually increases the capital stock. Between 2000 and 2013, real net investment was negative in wood product manufacturing. Low investment figures and negative net investment figures suggest that firms in the wood product manufacturing industry group in Quebec are using outdated capital assets that do not embody the latest technological innovations.

Given these results, it is unlikely that investment was a significant contributor to multifactor productivity growth through innovation or technological change.

Another element that influences multifactor productivity growth is profits. Profits can affect productivity through the composition effect, the survival effect and the investment effect. In any sector or industry, it is difficult to determine the effect of profits on productivity, since these channels push productivity in different directions. Nevertheless, profits in the forest products sector in Canada fell fairly consistently from 2000 to 2009 in all three subsectors, reviving briefly in 2004. After the recession of 2009, profits began to rise again, although there were signs that they were dipping in 2011, especially in wood product manufacturing. It is surmised that profits in Quebec displayed similar trends to those at the national level, although data is not available.

Since profits have been falling for such an extended period of time, it is likely that the positive contributions to productivity from the composition effect and the survival effect have waned, while the negative investment effect is starting to take precedence. Although, it is quite possible that there is a non-linear relationship between profits and the survival effect, which may suggest that the survival effect was only reached at a certain threshold. If profits have not recovered to a level above this threshold, then the survival effect may still be at play. The data on the number of establishments in the forest products sector only corroborates this suggestion, since the number of establishments has been falling quite steadily in all three industry groups since the mid-2000s. Hence, profits may have been a significant contributor to multifactor productivity growth between 2000 and 2013.

Productivity growth in the forest products sector is a combination of productivity growth in forestry and logging, wood product manufacturing, and paper manufacturing. For each subsector, in turn, productivity growth is the aggregation of productivity growth in more specific activities. Aggregate productivity growth depends not only on how much productivity growth each of these activities experiences (pure productivity effect) but also on how important each activity is relative to the total; shifts toward higher-productivity activities can cause the overall productivity in that sector to increase (reallocation effect). Hence, industrial and intersectoral

shifts can influence labour productivity growth. However, analysis suggests that the reallocation effect explains only a very small portion of average labour productivity growth in the forest products sector.

The overall quality of the natural resources base can also have important effects on productivity; all else constant, easily accessible and high-quality natural resources will lead to lower costs and higher productivity than hard-to-reach and low-quality natural resources. However, analysis suggests that increased productivity in Quebec is not a supply-side phenomenon: it is not driven by more favourable natural resources development.

The macroeconomic environment can also impact productivity. For example, prolonged periods of weak demand can have significantly negative impacts on productivity in the long-run, and demand, whether domestic or foreign, is driven by exchange rates, unit labour costs, income and structural changes in preferences. Hence, exchange rates, unit labour costs, income and structural changes in preferences can influence productivity.

For example, if the Canadian dollar is appreciating relative to the U.S. dollar, then U.S. customers will find that Canadian products are becoming more expensive relative to other products, the forest products sector included, leading to an decrease in export demand, and vice versa. If firms respond to declining export demand by reducing hours worked faster than output is falling, productivity will increase, and vice versa.

The appreciation of the dollar in the early- and mid-2000s would have reduced demand in the U.S. for Canadian forest products, and by definition, those in Quebec. Since approximately 80 per cent of Quebec's forest products exports are destined for the United States, demand for Quebec's forest products declined. If firms in Quebec's forest products sector responded by reducing hours worked faster than they reduced output, productivity would have increased. Hence, it is quite possible that the exchange rate affected productivity in Quebec's forest products sector in the early-2000s.

Unit labour costs (in U.S. dollars) are another important determinant of the macroeconomic environment. Quebec's forest products sector's unit labour costs experienced trends similar to Canada's manufacturing sector between 1997 and 2012. Moreover, Quebec's unit labour costs increased less than Ontario's, which suggests that compared to Ontario, Quebec's forest products sector was more competitive on the international market. This may help explain why exports dropped less sharply in Quebec as compared to Ontario. Hence, it is quite possible that unit labour costs, through their influence on exports, contributed to labour productivity growth by boosting output in Quebec's forest products sector relative to Ontario.

Domestic demand and foreign demand are also both deeply affected by income and structural changes in preferences. For example, when income in the importing country falls, demand will also fall. When foreign demand falls, real output will respond in the exporting country. In order for the firms in the exporting country to survive in the long-run, employment must decrease. If employment falls faster than real output falls, productivity will grow. In 2008-2009, the financial crisis severely reduced disposable income in the domestic economy in Canada, as well as in importing countries. Hence, it is no surprise that real output fell in response

in the forest products sector. As mentioned earlier in the report, firms wishing to survive the onslaught of reduced demand cut employment levels. A by-product of cutting employment was increased productivity.

Another important impact in the macroeconomic environment is structural changes in preferences. In the forest products sector, paper manufacturing is undergoing an interesting structural change: consumers are moving away from paper products toward electronic media. This is happening to both domestic and foreign demand. As consumers shifted away from products made in the paper manufacturing industry group to products in electronics, real output fell. When this fall was tied with declining incomes and increasing exchange rates, the decline in real output was even harsher. Similar to the impact of reduced demand for other factors, structural changes away from paper products reduced real output and firms responded by cutting labour inputs. Since the labour input fell faster than real output, labour productivity increased.

Aside from domestic and foreign demand, productivity can also be affected by prices. In particular, output prices influence productivity by changing the average quality of the firms in the sector and of the resources used. Price increases bring into production establishments or productive resources that are of relatively lower productivity and would not have been profitable at lower prices. In contrast, falling prices force less productive establishments to close, leaving only more productive establishments operating, which tends to raise the average productivity level of a subsector.

Since implicit prices in the forest products sector have been declining in the forest products sector as a whole between 2000 and 2011, this theory offers an explanation for productivity trends in the forest products sector.

The microeconomic environment is also important for productivity. In particular, taxation can influence productivity through investment decisions, which in turn affect capital intensity. Firms make investments to maximize profit by investing until the return from the last dollar invested equals the cost. Taxes on firms' profits reduce the return on investment, while tax allowances, like the allowance for capital consumption, reduce marginal costs. Promisingly, since the financial crisis of 2008-2009, forestry in Quebec has faced negative METRs, but despite extremely low METRs and a favourable exchange rate for imports, wood product manufacturing firms in Quebec still demonstrated low investment levels.

Clearly, METRs do not explain firm behaviour in the forest products sector regarding investment and they do not explain falling levels of inward foreign direct investment, which are both considered drivers of productivity; and hence, METRs in forestry do not explain the strong productivity growth that was seen over the past decade. Nevertheless, if METRs continue to remain at this level, a sustained increase in productivity may be the result, since firms may begin to invest more heavily in capital once low rates become the norm.

Finally, at the level of the microeconomic environment, lagging productivity in the forest products sector in Canada may be caused by the lack of large companies and large establishments, although establishment size is linked more closely with productivity levels than productivity growth. Large plants can offer economies of scale in the use of resources, leading to

higher productivity. Not only is plant size a potential productivity driver, firm size can be as well. FPAC (2005) notes that credit ratings from Moody's and S&P demonstrate that larger firms, with higher capitalization, have better credit ratings. Hence, economies of scale can drive productivity growth. However, in Quebec, economies of scale do not explain the recently high growth rates of labour productivity, since the number of employees per establishment and real-value added per establishment have been declining since 2004.

Table 1: Summary of Drivers, Impact and Reasoning

Driver	Impact on Productivity	Reasoning
Human capital	Negligible	The contribution of changes in labour composition to labour productivity growth is small at the national level. Hence, productivity increased due to human capital, but only marginally. It is unlikely that the story is different at the provincial level.
Innovation	Unlikely	Research and development expenditures and investment figures are decreasing, which suggests that productivity should have remained constant or decreased.
Profits	Plausible	The composition effect, the survival effect and the investment effect can be used to explain productivity trends for the forest products sector as a whole and for most of the subsectors.
Industrial and intersectoral shifts	Negligible	Industrial and intersectoral shifts explain only a small portion of productivity growth at the national level, so it is unlikely that they would explain a large portion at the provincial level.
Quality and size of natural resources	Unlikely	There has been no change or a reduction in the quality and size of the natural resources available. Hence, there should have been no change or a reduction in productivity, all else constant.
Macroeconomic environment	Plausible	Exports, influenced by exchange rates, unit labour costs, income and structural preferences, explain a decline in demand, which drove employers to reduce employment. Employment fell faster than output, thus increasing productivity.
Microeconomic environment	Unlikely	Taxation encouraged investment, but no investment was made. Regulation may have impacted productivity in the past, but it is unlikely that it has impacted current productivity trends. Theories of productivity related to economies of scale suggest that productivity should have decreased, not increased.

Successful Past, Strong Future

Overall, the forest products sector saw incredible improvement in labour productivity between 2000 and 2013. However, falling levels of investment in physical capital are worrisome, since they suggest that a number of firms in the Quebec forest products sector are using outdated capital assets that do not embody the latest technological innovations. This point becomes all the more salient given the looming possibility of a lumber supercycle. With the U.S. housing market heating up again and the strong demand for wood from China, Quebec forest product firms will have to redouble their efforts in investment in capital assets, particularly in machinery and equipment, in order to reap the benefits from the projected growing demand (De Avillez, 2014).

In addition, despite noticeable gains in the educational attainment of workers in the forest products sector in Quebec (and Canada) over the past decades, workers in the forest products sector still have lower educational attainment levels than the average worker. In a way, this is not surprising, since the sector has very specific skill needs that typically require on-the-job training or a non-university post-secondary education, instead of a university education. However, the high proportion of workers without a high school diploma, especially in forestry and logging raises legitimate concerns regarding basic literacy and numeracy skills, the lack of which can have a significant negative impact on worker productivity (De Avillez, 2014).

In summation, in a declining context, the forest products sector in Quebec was able to generate strong productivity growth, much higher than that of the business sector. There is concern that the gains in productivity have been made in an unsustainable fashion (hours worked falling faster than output). This is likely true. Going forward into a positive growth environment, it is unlikely that the current pace of productivity advance based on falling labour input can be maintained. In short, as De Avillez (2014:16) aptly stated "through a period of unprecedented restructuring, the [Quebec] forest products sector has demonstrated significant resilience despite stiffer competition and considerable terms of trade deterioration. This resilience will likely serve the sector well in the future. Further consolidation of the sector would work towards increasing its resilience, allowing it to improve its performance and continue posting strong productivity gains."

A Detailed Analysis of Productivity Trends in the Forest Products Sector in Quebec, 2000-2013: Adversity Drives Productivity[1]

The Forest Products Association of Canada (FPAC) outlined in the Vision 2020 publication a four-pronged transformation strategy for Canada's forest products sector (FPAC, 2012). The elements of this strategy included increasing productivity and competitiveness, diversifying markets and products, growing and capitalizing on green credentials, and maximizing fibre value. The Centre for the Study of Living Standards (CSLS), a not-for-profit economic research organization focusing on productivity issues, has produced this report to help advance the debate related to the FPAC vision, with particular attention to productivity issues in Quebec's forest products sector.[2]

In the past, the CSLS has produced several studies for FPAC.[3] The most recent report, entitled "A Detailed Analysis of Productivity Trends in the Canadian Forest Products Sector" was released in 2014 (De Avillez, 2014). That study provided a comprehensive analysis of productivity trends in the forestry and logging, wood products, and pulp and paper industries primarily at the national level in Canada for the 2000-2012 period.

This report broadens and deepens this earlier report by examining productivity trends and drivers in Quebec's forest products sector since 1997, with a particular focus on the 2000-2013 period.[4] This report will provide data and analysis that will support and guide future FPAC policies that are aimed at reaching the Vision 2020 challenge. The two main objectives of the report are, first, to deepen the understanding of productivity developments in Quebec's forest products sector since 2000 and the factors explaining these developments and, second, to identify possible policies and actions for both the public and private sector to improve the province's productivity performance. The report provides a detailed statistical analysis of trends in output,

[1] This report was written by Jasmin Thomas under the supervision of Andrew Sharpe. The author would like to thank Jack Mintz, Duanjie Chen and Philip Bazel for information on marginal effective tax rates; Bert Waslander for his contributions to the exports section and Evan Capeluck for extensive support throughout the writing and editorial process. The author would also like to thank Jean-François Larue and Nancy Tupper at the Forest Products Association of Canada (FPAC) for their comments. The CSLS would like to thank the FPAC for financial assistance.

[2] The CSLS has also compiled a comprehensive database on the forest products sector in Ontario and Quebec between 1997 and 2013, with additional provincial information between 2000 and 2013. The CSLS has also released a report on the productivity performance of the forest products sector in Ontario. Both the Ontario report and the database will be available at csls.ca/res_reports.asp.

[3] See Harrison and Sharpe (2009), CSLS (2003a), CSLS (2003b) and CSLS (2003c).

[4] Productivity growth estimates in this report are based on real values. Price indices have been used to ensure that price changes are not confounding productivity growth estimates. However, it is important to note that prices are difficult to measure when new products are introduced into a market. Since the forest products sector has been innovating quite heavily and exploring new products (mainly in pulp and paper), the real value productivity estimates used in this study are less precise than would be the case if the industry had made and used exactly the same products over time. We believe that this element of uncertainty in measurement is a minor one that can be ignored.

hours, employment and labour productivity in the forest products sector and its three components in Quebec, as well as a discussion of the drivers of this performance.[5]

This report proceeds as follows. The first section subsequent to the introduction provides an overview of Quebec's forest products sector and the economic conditions it has faced since the turn of the century. The second section describes Quebec's productivity performance in the forest products sector in relation to Canada as a whole and to the other Canadian provinces for which data exist between 2000 and 2013. This section focuses on the forest products sector as a whole, especially in the most recent years (2007-2013). Some detail is given at a more disaggregated level, namely the subsectors of the forest products sector, for the entire period between 2000 and 2013. Between 2007 and 2013, detail is also given on real GDP and employment, but only at the aggregate level of the forest products sector. The third section examines productivity performance in Quebec in detail at the most granular level possible, with information on nominal GDP, implicit prices, real GDP, hours worked, employment and labour productivity. The fourth section examines the drivers behind productivity growth in the forest products sector, including investment and research and development, among others. The fifth section outlines potential future directions for the sector at both the industry and firm levels.

[5] It is important to remember that productivity is only one component of the overall strategy for the forest products sector. The challenges facing the forest products sector go beyond productivity and a full treatment is beyond the scope of this report. It is also important to point out that this is not a firm-specific study, but rather a sectoral study.

I. The State of the Forest Products Sector

A. The Perfect Storm

The forest products sector in Canada was hit by a perfect storm in the first decade of the twenty-first century, when both structural and cyclical factors came together to devastate the sector. While the economic crisis of the late-2000s affected many industries, it was particularly severe in the forest products sector because of the dramatic decline in housing starts in the United States, one of the most important users of wood products (Couture & Macdonald, 2013).

In addition to the cyclical drop in demand associated with the economic crisis, there has been a continuous structural shift away from paper products to electronic media and devices, a development which gained speed in the mid- to late-2000s. The Standing Committee on Agriculture and Forestry (2009:10) makes a point of emphasizing that the "decline in demand is more structural than cyclical." Unlike demand for lumber in the housing sector, there likely will not be a rebound in the demand for traditional paper products such as newsprint (Standing Committee on Agriculture and Forestry, 2009:10).

The negative demand effects of the U.S. housing crisis and the structural shift away from paper have been exacerbated in the 2000s by an appreciation of the Canadian dollar, reducing demand further for forest product exports. The emergence of low-cost forest product producers in developing countries has been yet another factor in reducing demand for Canadian forest products and contributing to the perfect storm.

With the confluence of demand-reducing factors, the forest products sector was forced to take drastic measures to reduce costs and maintain competitiveness; otherwise it would not have survived. Closing plants and reducing employment levels through layoffs was the most obvious way to reduce costs and Canadian forest product firms were particularly aggressive in this regard. Indeed, employment fell at a greater rate than output, which translated into significant productivity gains.

These decisions to close plants and reduce employment may have been well overdue. According to the Standing Committee on Agriculture and Forestry (2009:21-22), "the weakened state of the industry had been hidden for many years by a low Canadian dollar, low energy costs and a relatively healthy demand for products made from Canadian wood. Once these factors were reversed, the industry's inherent weaknesses were revealed, creating a systemic crisis." The Senate (2009:21-22) states that "the structure of the industry at the start of this crisis can be explained by a variety of reasons, [but] likely stem from a combination of historical factors, such as an inflated sense of confidence in the future given the relative prosperity the industry had experienced for years, public policies that did not adapt to the new reality, and poor business decisions."

Hence, the forest products sector provides a unique case study of a kind not often seen or discussed. Periods of weak or negative output growth are generally associated with weak or negative labour productivity growth, just as periods of strong output growth are associated with robust productivity gains. This association is particularly strong in the manufacturing sector. For example, in the 2000s, the Ontario manufacturing sector experienced weak output growth and

saw absolute falls in labour productivity levels (Sharpe, 2015). This positive relationship between output growth and productivity growth, known in the literature as the Verdoorn Law, is caused by greater economies of scale and scope and learning by doing when output is expanding and a loss of these sources of productivity gains when output is contracting.

Given the massive downturn in the forest products sector, one might have expected a very poor productivity performance. In the case of Quebec the opposite has occurred, with labour productivity surging while output plummeted. It appears that the Verdoorn Law does not hold for the forest products sector in Quebec. The reason appears to be that the Verdoorn Law does not apply in situations where the decline in output is particularly large and the survival of the firm is in question. In such circumstances firms have no choice but to cut costs drastically by laying off workers, with employment falling more than output. The existence of slack or inefficiency can allow firms to continue to produce even though employment levels are reduced significantly. This appears to have been the situation in the forest products sector in Quebec, where the forest products sector has exhibited that it is entirely possible to sustain vigorous productivity growth despite falling employment and declining real output.

In sum, the forest products sector in Quebec and Canada has faced a grave economic crisis. This crisis is a demand-side, not a supply-side phenomenon, reflecting a downward shift in the demand curve for forest products for both structural and cyclical reasons. High-cost establishments became unprofitable when the demand for forest products fell; consequently, firms fired workers and closed operations.

The crisis was not precipitated by poor productivity growth, as the labour productivity performance of the forest products sector has historically exceeded the business sector average. While productivity estimates for the forest products sector are not available before 1997 at the provincial level, national data show that from 1981-2000 output per hour in the forest products sector advanced at over 3 per cent per year, double the 1.6 per cent rate in the overall business sector (De Avillez, 2014). This is not surprising given the potential for firms to substitute capital for labour in the forest products sector, which appears greater than in many other sectors, especially certain service industries.

B. The Forest Products Sector: Definition and Characteristics

The forest products sector is composed of three three-digit North American Industry Classification System (NAICS) industry groups: forestry and logging (113), wood product manufacturing (321), and paper manufacturing (322).

The forest products sector has a number of characteristics that distinguish it from other sectors. In particular, high capital intensity, highly competitive international markets, homogeneous goods production, output price volatility, high degrees of regulation, vertical linkages at the company level between the primary production and manufacturing activities, high degrees of foreign ownership, potentially adverse environmental impacts from production (e.g. clear cutting), periods of high profitability and a growing demand for technical skills (Sharpe and Long, 2012).

Some of the above characteristics are more important than others. For example, one of the most prominent characteristics is the highly competitive international market, which leaves firms as price takers. With little control over prices, firms in the forest products sector in times of crisis have little choice but to reduce costs, which in the short run implies layoffs or low replacement demand.

C. The Economic Context in Detail

As briefly discussed above, the economic context in the first decade of the twenty-first century was not favourable for the forest products sector; below is a more detailed discussion of the timeline and the events that contributed to such a dismal macroeconomic environment:

- U.S. housing construction peaked in 2005 at 2.1 million units and plummeted to 0.5 million units in 2009. As a result, demand for Canadian wood products (lumber in particular) collapsed in 2009 (Chart 2) (Hasselback, 2014).

- The exchange rate started to rise with the rise of the oil price to reach an all-time high of $1.1030 U.S. dollars per Canadian dollar. High exchange rates deteriorated export demand (Bank of Canada).

- In 2008-2009, the financial crisis hit home, which deteriorated overall demand in the economy; forest products were not immune to this deteriorating demand.

- The industry faced massive structural shifts, colloquially referred to as "iPadization". This shift severely reduced demand for forest products, especially paper manufacturing products.

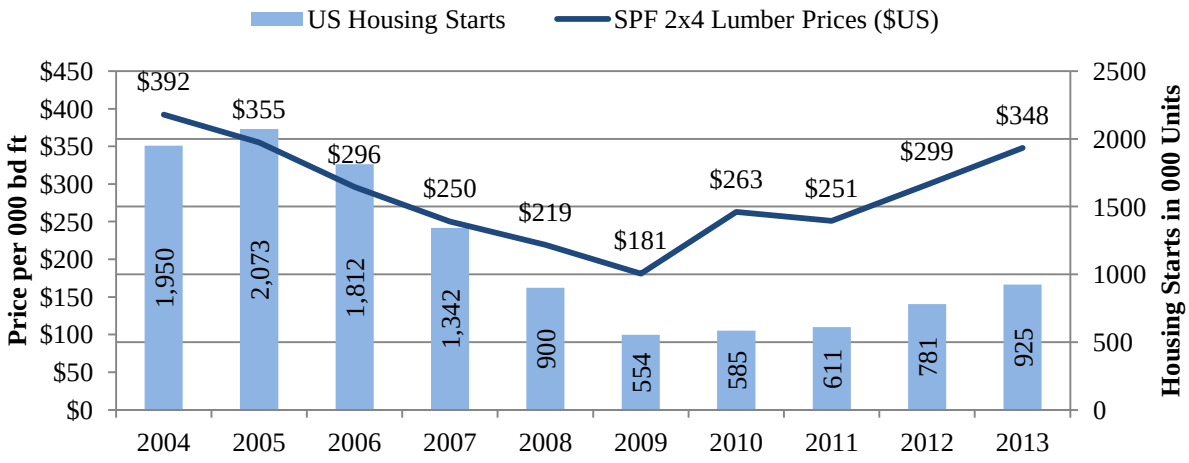
- With the terms of trade shifted in favour of imports, the industry had an opportunity to invest in plants and equipment at relatively low cost. However, throughout the period of high exchange rates, investment levels in Canada remained relatively low in most sectors. The forest products sector was not an outlier. Given the forest products sector's production processes, it should have engaged in investment in machinery and equipment; however, this was not seen in any of the forest products sector industry groups (De Avillez, 2014). This lack of investment reflects the weak demand conditions undermining profitability.

These five points neatly summarize the forest products sector and the macroeconomic context of the mid- to late-2000s. Since the end of the financial crisis, there have been signs that the confluence of negative factors is beginning to take a 180-degree turn and that the economic outlook for the Canadian forest products sector has improved considerably, especially considering the perfect storm from which it just emerged. Nevertheless, the future path of the forest products sector in Canada depends on an awareness of the continually evolving markets for forest products and an ability to adapt to changing conditions.

Quite simply, the forest products sector has no control over the macroeconomic environment in which it is operating. Like many natural resources sectors, it is highly subject to

the whims of the economic cycles and the conditions of the macro-economy. Nevertheless, this report will attempt to show that despite poor conditions in the first decade of the twenty-first century, the forest products sector in Quebec (and Canada) was able to revitalize production processes, increasing its cost competitiveness in the international market. With extremely promising productivity growth throughout this perfect storm, the forest products sector is set to take advantage of the upcoming confluence of positive factors, provided companies continue to adapt to the changing markets they face.

Chart 2: Lumber Prices and Housing Starts, 2004-2013



Source: Madison Lumber Reporter, Statistics Canada, US Census Bureau.

D. The Role of Productivity in the Forest Products Sector

FPAC's Vision 2020 Challenge highlights three main goals for the Canadian forest products sector in the next seven years (FPAC, 2012):

- Reduce the sector's environmental footprint by 35 per cent;
- Generate an additional $20 billion in economic activity with new innovations and new markets; and
- Renew the workforce, hiring 60,000 recruits, including women, Aboriginals, and immigrants.

Productivity gains can help the Canadian forest products sector achieve these three objectives. [6] Productivity growth can reduce the forest products sector's dependency on energy inputs, therefore reducing its environmental footprint. De Avillez (2014) notes how this is already happening in the Canadian forest products sector.

Productivity improvements also allow firms to produce the same quantity of output by using fewer inputs, which reduces unit costs. However, the sector's competitiveness depends not only on productivity but also on other factors, such as exchange rates and input costs. Labour

[6] This rest of this section is based upon De Avillez (2014).

costs, in particular, represent a challenge to the Canadian forest products sector. High labour costs make it harder for the forest products sector in Canada to compete internationally with low-wage countries such as Russia, China, and Brazil. In fact, even when compared to other developed countries, Canada's labour costs are quite high.

It is unlikely that labour costs in the Canadian forest products sector will experience a significant fall. Productivity gains can help by reducing the sector's need for labour inputs, thus reducing production costs. This means, however, that employment in the sector might *fall* in the short-run. In the medium- and long-run, however, productivity gains in the sector can prove to be an important boon.

By lowering unit production costs, productivity gains can help Canadian firms to better compete with international firms, and thus regain some of their lost market share. The increased demand for Canadian forest products may, in turn, lead to a rise in the sector's employment. Needless to say, new markets represent an important opportunity of expansion for the Canadian forest products sector and should not be ignored. The strong demand for forest products in China, in particular, has taken front-stage in the past decade.

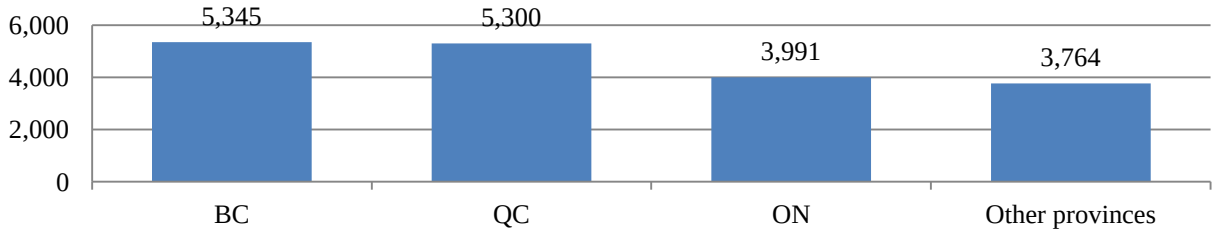
Regaining market share in established markets should also be a key objective of the Canadian forest products sector. This applies in particular to the U.S. forest products market, where Canada has lost substantial ground.

II. Quebec's Forest Products Sector in the Canadian Context

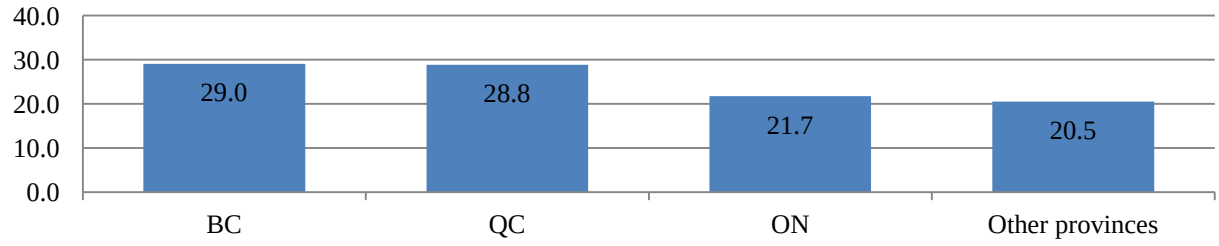
The forest products sector in Quebec rivals that of British Columbia in terms of absolute economic importance. In 2011, the most recent year for which nominal GDP data are available, the Quebec forest products sector produced $5.3 billion, representing 1.6 per cent of total nominal provincial GDP. The only province to produce more was British Columbia, with $5.34 billion, representing 2.65 per cent of the province's nominal GDP.

Chart 3: Nominal GDP, Forest Products Sector, Canada and Selected Canadian Provinces, 2011

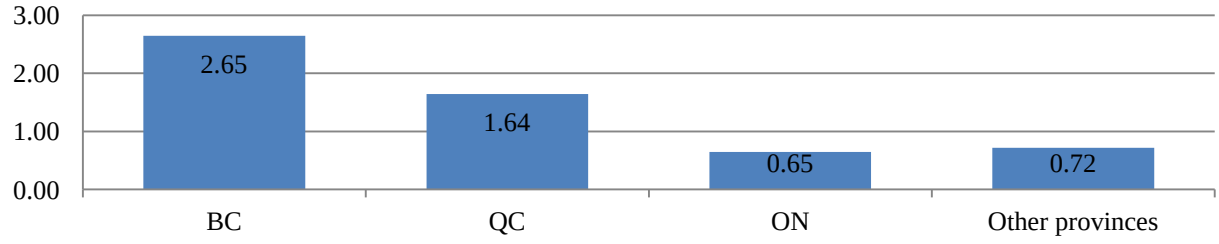
a) Millions of Current Dollars



b) Share of National Forest Products Sector



c) Share of Provincial Economy



Source: CANSIM Table 383-0030.

Nominal GDP in the forest products sector in Quebec originated mainly in the paper manufacturing sector, which generated $2.6 billion in 2011. The wood product manufacturing sector contributed $1.8 billion, while forestry and logging contributed $0.8 billion.

Table 2: Provincial Shares of Nominal Output of the Forest Products Sector in Canada, Per Cent, 2011

Province	Forest products sector	Forestry and logging	Wood product manufacturing	Paper manufacturing
ON	21.69	10.61	15.12	32.08
QC	28.81	23.04	27.47	32.53
BC	29.05	44.61	32.77	18.89
NFL	--	1.17	0.36	--
PEI	--	0.09	--	--
NS	--	2.15	1.61	--
NB	--	6.88	4.16	--
MB	1.30	0.68	1.95	1.05
SK	--	0.91	1.59	--
AB	--	9.48	14.87	--

Source: CSLS calculations based on Statistics Canada data.

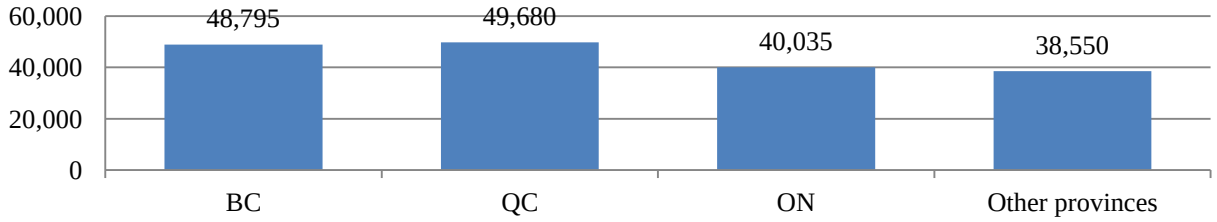
In 2011, at the total forest products level and the component level, Quebec had a larger share of the Canadian total than Ontario (28.8 per cent versus 21.7 per cent), but only outperformed British Columbia in terms of paper manufacturing (32.5 per cent versus 18.9 per cent), since British Columbia had the largest share of forestry and logging (44.6 per cent) and wood product manufacturing (32.8 per cent).

In terms of employment, similar patterns arise: Quebec and British Columbia are the largest provinces in the national forest products sector scene in 2011, while Ontario comes in behind. These three provinces make up the majority of the job opportunities in the forest products sector in Canada, since the other ten provinces account for only 21.8 per cent (Chart 4). In terms of each province's respective economy, British Columbia's forest products sector retains the most economic importance, followed by Quebec and Ontario.

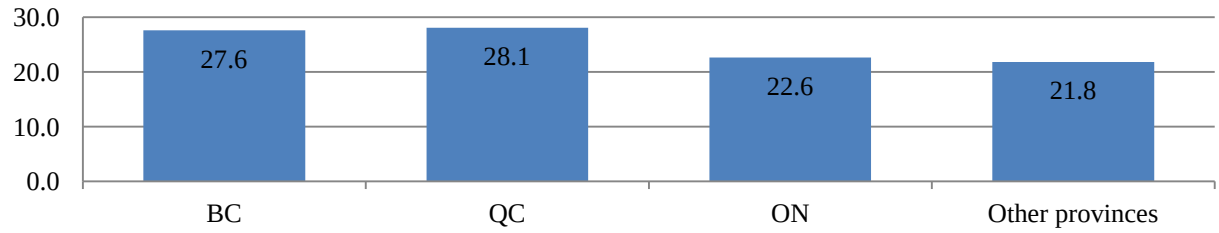
Essentially, these figures suggest that the forest products sector in Quebec is important from the perspective of the Quebec economy and from the perspective of the Canadian forest products sector. As such, maintaining the health of the Quebec forest products sector through strong productivity growth is crucial to maintaining the health of the Canadian forest products sector as a whole, as well as Quebec's economy.

Chart 4: Employment, Forest Products Sector, Canada and Selected Canadian Provinces, 2011

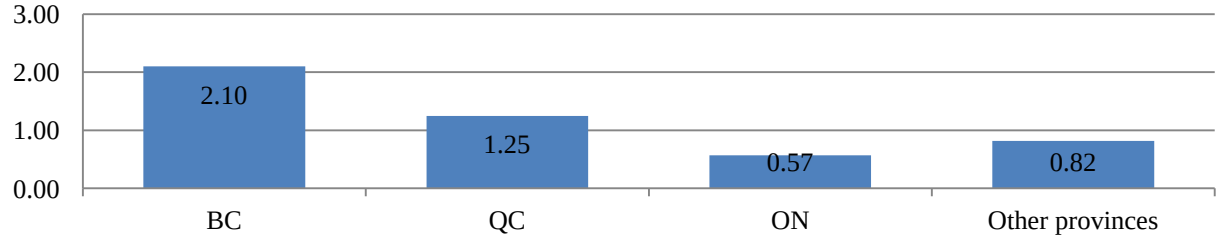
a) Number of Jobs



b) Share of National Forest Products Sector



c) Share of Provincial Economy



Source: CSLS calculations based on Statistics Canada data.

Hence, Quebec's performance relative to two other Canadian provinces, including British Columbia and Ontario, will be measured for three key variables: real GDP, hours worked, and labour productivity.[7] Unfortunately, due to the confidentiality restraints imposed by the Statistics Act, comparisons with all three provinces across all three variables cannot always be undertaken.

A. Quebec's Relative Labour Productivity Performance in the Forest Products Sector and Subsectors: 2000-2013

Quebec had the strongest labour productivity performance in the forest products sector among the provinces for which data are available between 2000 and 2013 (3.7 per cent per year) (Chart 5). British Columbia demonstrated the second strongest labour productivity growth (3.5 per cent per year), while Ontario demonstrated the weakest performance (1.0 per cent per year).[8]

[7] Data on Alberta and Manitoba are also provided when available. Data on the other five provinces are not available due to their small size. These five provinces account for less than ten per cent of the output of the forest products sector.

[8] Ontario's productivity growth between 2000 and 2013 has been analyzed in depth by the CSLS (2015).

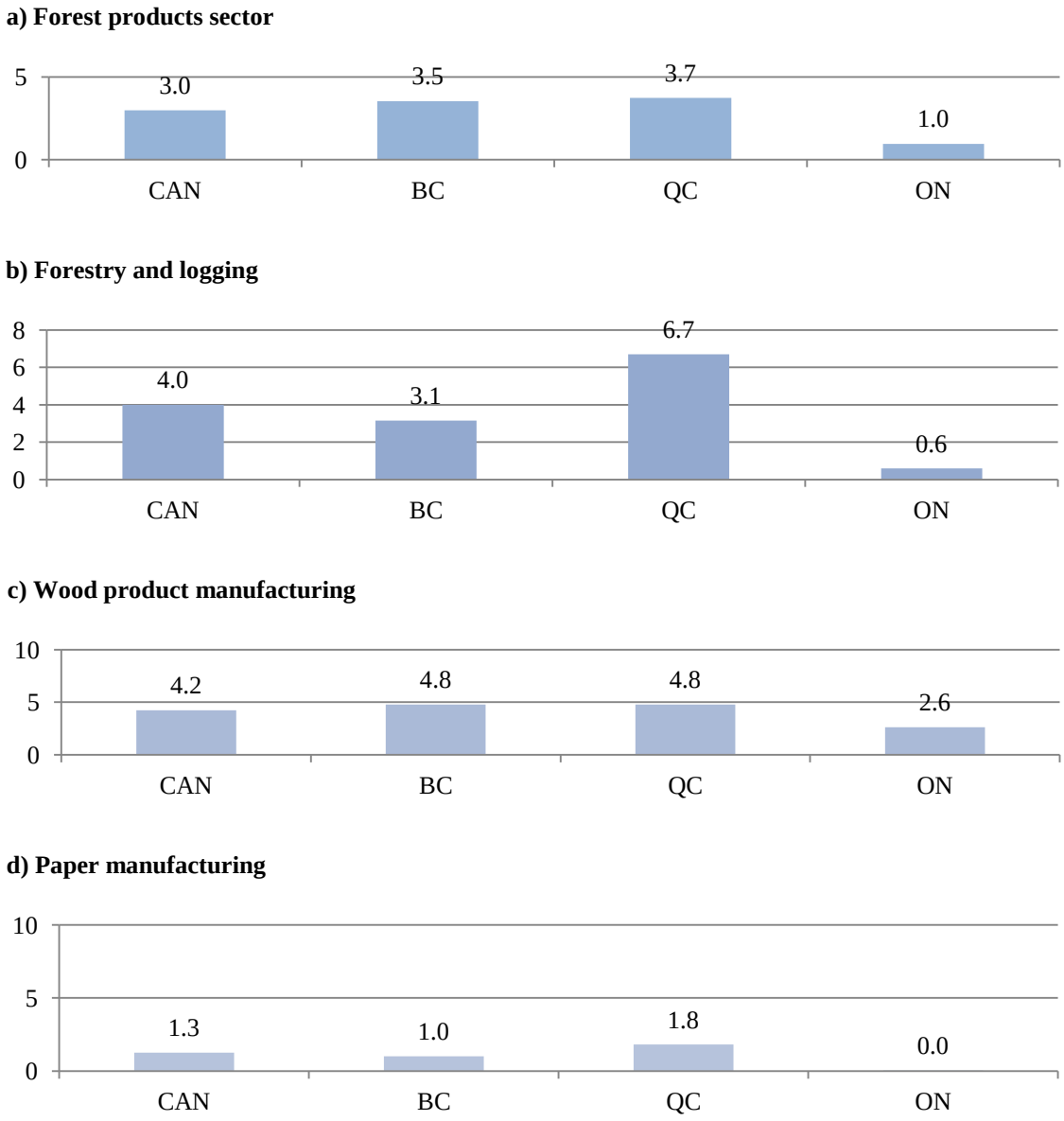
Compared to the Canadian compound average annual growth rate (3.0 per cent per year), Quebec was performing slightly above average, while relative to all industries in Canada (0.9 per cent per year) and all industries in Quebec (0.8 per cent per year), the forest products sector in Quebec was performing exceedingly well.

When broken down by subsector, Quebec demonstrated stronger labour productivity performance than Canada in all three subsectors throughout the 2000-2013 period (Chart 3). The magnitude of the difference in labour productivity growth between Canada and Quebec was the largest in forestry and logging (2.7 percentage points), while wood product manufacturing and paper manufacturing only had minor differences of 0.5-0.6 percentage points.

Relative to the other major forest products producing Canadian provinces for which data are available, Quebec's labour productivity growth between 2000 and 2013 was the strongest in every subsector, exceeding British Columbia, Manitoba, Alberta and Ontario by large margins in many cases. The only exception was labour productivity growth in wood product manufacturing in British Columbia, which was identical to Quebec's in this period. Ontario and Manitoba performed exceptionally poorly compared to Quebec in forestry and logging: Manitoba's labour productivity growth was negative (-0.8 per cent per year) and Ontario's labour productivity growth was minimal (0.6 per cent per year), while Quebec's labour productivity performance was exceedingly impressive (6.7 per cent per year). Furthermore, compared to Quebec, Ontario's labour productivity performance in paper manufacturing was extremely disappointing, as it was unchanged throughout the period between 2000 and 2013 (0.0 per cent per year). In absolute terms, Ontario's wood product manufacturing demonstrated better labour productivity growth throughout the period (2.6 per cent per year), but compared to the growth exhibited by Quebec (4.8 per cent per year), it was still far from stellar.

Hence, Quebec's labour productivity growth rates between 2000 and 2013 for the forest products sector and subsectors suggests that it was a strong contender in Canada, demonstrating top performance in two of three subsectors (forestry and logging and paper manufacturing) and comparably strong performance in the third (wood product manufacturing).

Chart 5: Labour Productivity, Forest Products Sector, Canada and Selected Provinces, Compound Average Annual Growth, 2000-2013



Source: CSLS calculations based on Statistics Canada data.

B. Quebec's Output, Labour Input and Labour Productivity Performance in the Forest Products Sector in Comparison with Other Provinces: 2007-2013

This section focuses on the most recent period (2007 to 2013) to provide a more detailed analysis of the components of labour productivity growth, namely real GDP and hours worked. As this period is more closely associated with the current economic conditions than the longer time period between 2000 and 2013, the findings of this section may be more relevant to the short-term outlook for the industry.

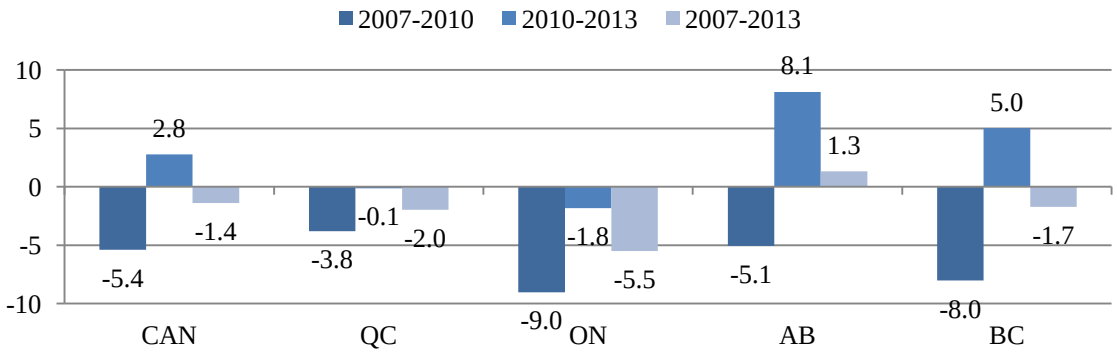
The section starts with real GDP, examining the entire period between 2007 and 2013, as well as two sub-periods (2007-2010 and 2010-2013). Next, the section examines hours worked, before combining the results to analyze labour productivity.

i. Real GDP

In terms of real GDP performance, Quebec's forest products sector sits in the middle of the pack among Canada's major forest-products-producing provinces. Between 2007 and 2013, Quebec's compound average annual growth outperformed that of Ontario (-2.0 per cent per year versus -5.5 per cent per year), while falling behind Alberta and British Columbia (1.3 per cent per year and -1.7 per cent per year) (Chart 6). The negative growth rate experienced throughout this period mostly reflects faster declining real GDP between 2007 and 2010 (-3.8 per cent per year), since real GDP hardly declined in the latter period (2010-2013), registering -0.1 per cent per year.

At the national level, real output growth in the forest products sector fell at a 5.4 per cent average annual rate between 2007 and 2010, rebounding to a positive growth rate of 2.8 per cent per year between 2010 and 2013 due to large upswings in Alberta and British Columbia. This pattern of better performance in the second sub-period was observed in all provinces, but positive growth after 2010 only occurred in the two western provinces. Both Ontario and Quebec continued to see falls in output in the forest products sector after 2010, although Ontario saw much larger falls than Quebec (-1.8 per cent per year versus -0.1 per cent per year).

Chart 6: Real GDP by Province, Forest Products Sector, Compound Average Annual Growth, 2007-2013



Source: CSLS calculations based on Statistics Canada data.

Surprisingly, despite an improvement between 2010 and 2013 relative to the period between 2007 and 2010 in absolute terms, Quebec's relative performance compared to other provinces was actually much poorer between 2010 and 2013. More specifically, between 2007 and 2010, Quebec exhibited the smallest declines in real output in the forest products sector among the provinces for which data are available, while between 2010 and 2013, Quebec only outperformed one province: Ontario. Given these results, it is not surprising that Quebec outperformed the Canadian compound average annual growth rate between 2007 and 2010, but failed to do so between 2010 and 2013. Overall, Quebec performed below the Canadian average between 2007 and 2013 (-2.0 per cent per year versus -1.4 per cent per year). In other words,

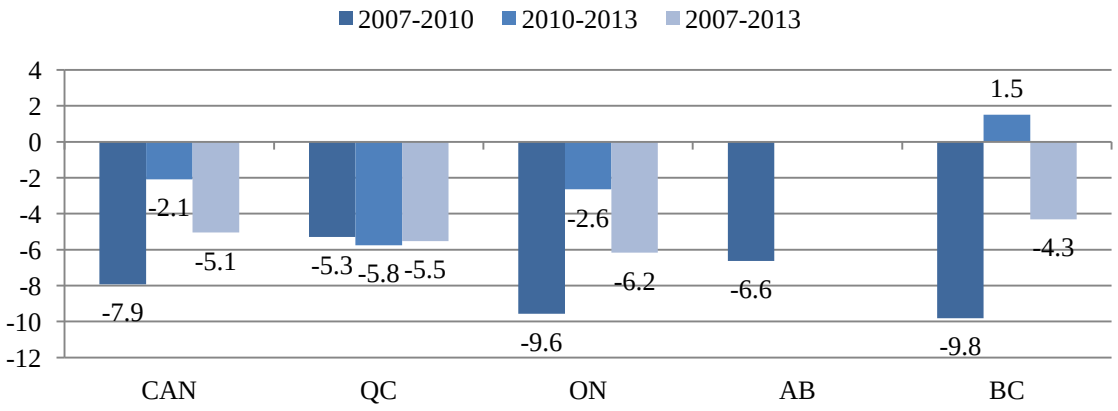
Quebec did not experience as great a decline in output in forest products as the national average between 2007 and 2010 and experienced a weaker rebound between 2010 and 2013.

ii. Hours Worked[9]

Between 2007 and 2013, hours worked in Quebec fell more than those in British Columbia (-4.3 per cent per year versus -5.5 per cent per year), but less than those in Ontario (-6.2 per cent) (Chart 7). In general, total hours worked, which is driven by employment, fell drastically in all provinces in the 2007 to 2010 period because of the 2008-2009 recession (although Quebec had the smallest declines), while it fell much less dramatically (or increased) in all provinces except Quebec in the 2010-2013 period when output growth rebounded in most provinces. Surprisingly, hours worked in Quebec actually fell faster in the second sub-period, which counters the trend observed in other provinces. In particular, when broken down into two sub-periods, hours worked in Quebec fell by 5.3 per cent per year in the first sub-period, while they fell 5.8 per cent per year in the second.

Quebec had the smallest decline in hours worked between 2007 and 2010, when compared to its peers, while it had the lowest rate of change in hours worked between 2010 and 2013. Similarly to real GDP, hours worked in Quebec did not fall as much as the Canadian average between 2007 and 2010 and more than the Canadian average between 2010 and 2013. Hours worked in Quebec fell faster than the Canadian average over the period as a whole (2007 to 2013).

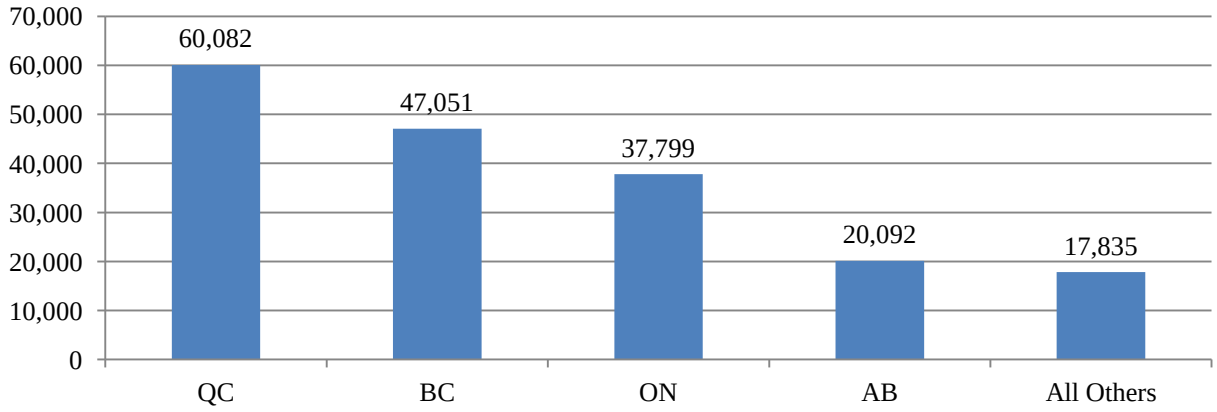
Chart 7: Hours Worked by Province, Forest Products Sector, Compound Average Annual Growth, 2007-2013



Source: CSLS calculations based on Statistics Canada data.

[9] Hours worked estimates are available from three different sources: Survey of Employment, Payroll and Hours (SEPH), Labour Force Survey (LFS) and Canadian Productivity Accounts (CPA). This report uses the CPA estimates to calculate productivity. For a discussion of the differences between these three surveys and their implications for productivity estimates, see De Avillez (2014).

Chart 8: Employment, Forest Products Sector, Selected Canadian Provinces, 2013



Source: Statistics Canada.

iii. Labour Productivity

Quebec's labour productivity in the forest products sector grew 3.7 per cent per year between 2007 and 2013; most of this strong performance took place in the 2010 to 2013 period (6.0 per cent per year) (Chart 9). Comparatively, Quebec outperformed every province between 2010 and 2013, but only outperformed one province (Ontario) between 2007 and 2010. On net, Quebec's astonishing performance between 2010 and 2013 resulted in the strongest compound average annual growth rate between 2007 and 2013, outperforming the Canadian average by 1.0 percentage points.

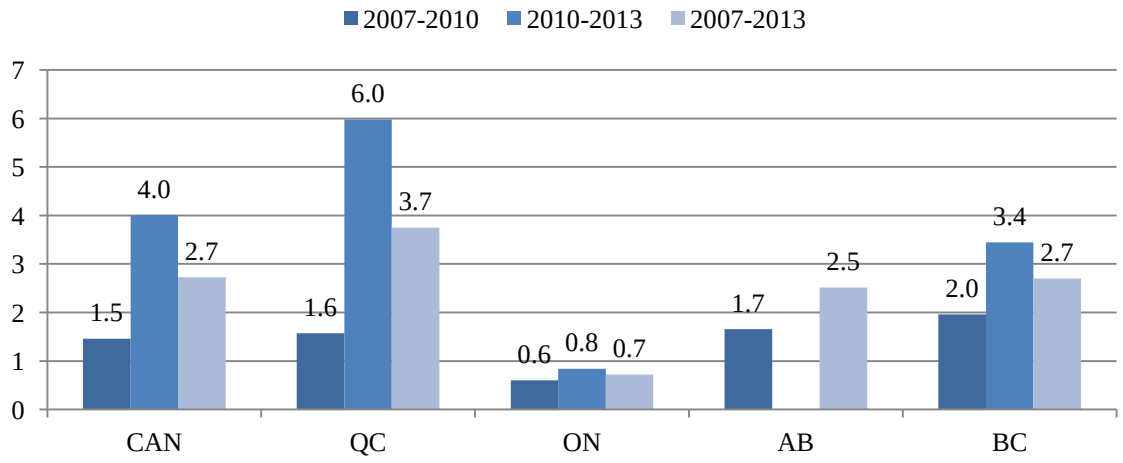
Hence, Quebec's labour productivity performance in the forest products sector is superb when compared to other selected provinces and the Canadian average. When compared to the total economy in Quebec (0.6 per cent per year) and the total economy in Canada (0.9 per cent per year), Quebec's labour productivity performance is stellar (3.7 per cent per year).

In absolute terms, labour productivity performance in Quebec was much stronger between 2010 and 2013, although real GDP growth was still negative, but not plummeting (-0.1 per cent per year). Between 2007 and 2010, Quebec's performance was mildly less promising, since there were substantially larger declines in real GDP. Nevertheless, the industry was able to undertake a much needed revamp and cut excess slack: hours worked in the forest products sector in Quebec fell faster than real GDP, generating strong productivity growth (1.6 per cent per year) throughout the period compared to all industries in Quebec (0.4 per cent per year).

In comparison to the other provinces, Quebec's labour productivity trends between 2007 and 2010 are normal: every other province for which data are available relied on downsizing operations and layoffs to generate labour productivity growth during this period, as hours worked fell faster than output. However, between 2010 and 2013, British Columbia and Alberta were able to register positive real GDP growth, suggesting that labour productivity growth in these two provinces was not wholly the result of hours worked falling faster than real GDP (British Columbia actually saw hours worked increase by 1.5 per cent per year). Labour productivity growth that is generated by rising real GDP is much more promising than labour productivity growth that relies on hours falling faster than output. In short, the perfect storm that hit the

industry may have done substantial damage in the short-term, but the overhaul that occurred as a result of the confluence of those negative factors may actually provide Quebec's forest products sector with a more competitive edge in the long run.

Chart 9: Labour Productivity by Province, Forest Products Sector, Compound Average Annual Growth, 2007-2013



Source: CSLS calculations based on Statistics Canada data.

In Quebec, the forest products sector continues to represent a decreasing portion of both GDP and hours worked. Since 2007, the forest products sector in Quebec has fallen from 2.3 per cent of nominal GDP to 1.6 per cent in 2011.[10] Hours worked in the forest products sector in Quebec as a share of total hours worked in all industries has also declined since 2007, falling from 2.1 per cent to 1.5 per cent in 2013.

The declining economic importance of the forest products sector in Quebec is not an anomaly; declining nominal GDP in the forest products sector as a share of nominal GDP in all industries has been seen across all of the provinces for which data are available. The only province to display a substantially larger decline than Quebec was British Columbia, falling from 3.8 per cent of nominal GDP in 2007 to 2.7 per cent in 2011. Declines in the share of the forest products sector in total economy nominal GDP in other provinces were similar to declines in Quebec, registering approximately 0.5 percentage points less in 2011 than in 2007.

Hours worked showed the same pattern of decline. Ontario and Alberta demonstrated smaller declines in their share of hours worked in the total economy compared to Quebec (approximately 0.30-0.35 percentage points between 2007 and 2013), while British Columbia exhibited a much larger decline than Quebec, falling from 3.5 per cent in 2007 to 2.6 per cent in 2013.

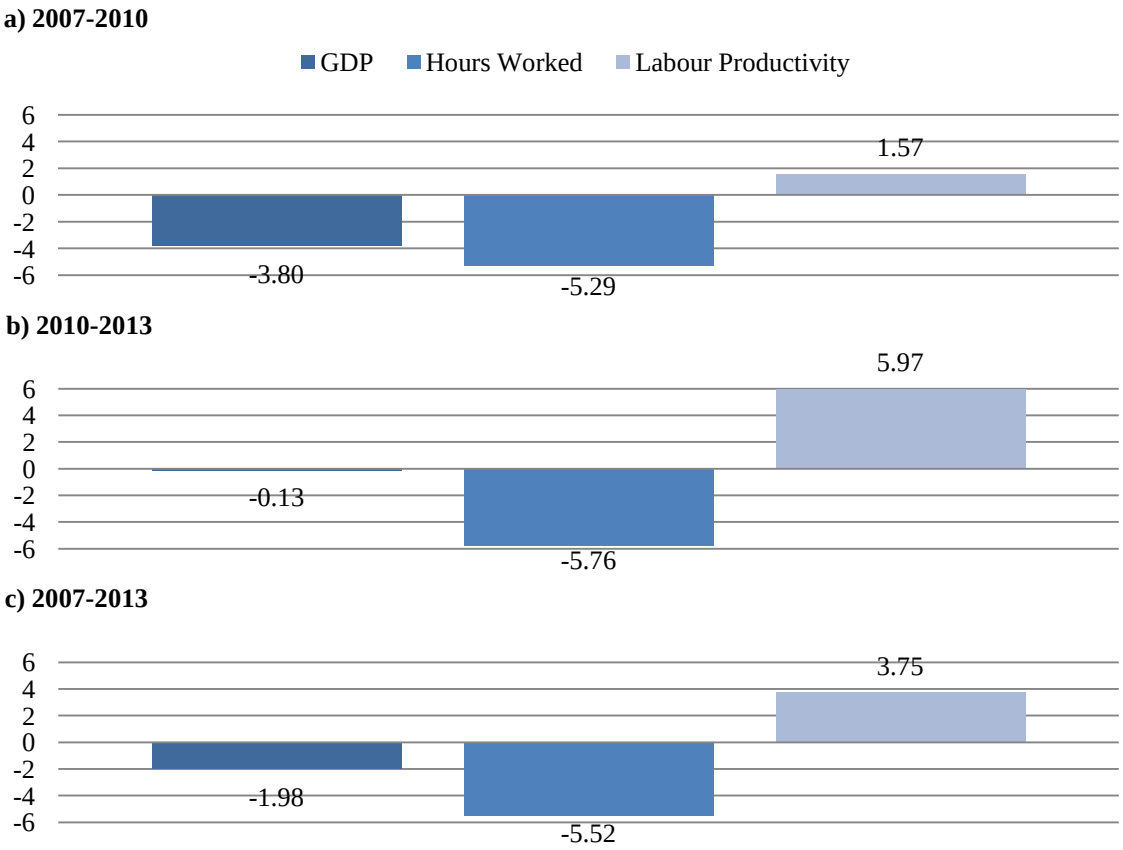
Despite a declining economic importance, the forest products sector will continue to be an important backbone for many rural communities in Quebec, providing high paying jobs. Moreover, since the forest products sector did remain active and relatively prosperous in terms of productivity in the face of a perfect storm, it is clear that the forest products sector will prove

[10] 2011 is the most recent year for which nominal GDP data are available.

resilient and crucial to the Canadian economy, albeit at a much smaller size than in the previous century.[11]

Since Ontario had less than 1.0 per cent of nominal GDP originating in the forest products sector, Quebec's forest products sector in 2011 comprised a relatively large part of nominal GDP; the only province to rely more heavily on the forest products sector than Quebec for nominal GDP was British Columbia (2.6 per cent).[12] In terms of hours worked in 2013, Quebec's forest products sector accounted for more hours worked than either Ontario's or Alberta's (0.7 and 0.8 per cent respectively), but Quebec's forest products sector represents fewer hours worked than British Columbia (2.6 per cent).

Chart 10: Output, Hours Worked, Labour Productivity, Quebec, 2007-2013



Source: CSLS calculations based on Statistics Canada data.

In sum, Quebec's forest products sector has performed strongly in terms of labour productivity given the perfect storm that hit the industry in the first decade of the 21st century. Quebec's forest products sector's real GDP responded as would be expected given the convergence of depressive economic influences, declining rapidly between 2007 and 2010 and staying almost level between 2010 and 2013 as the economy marginally picked up. With little

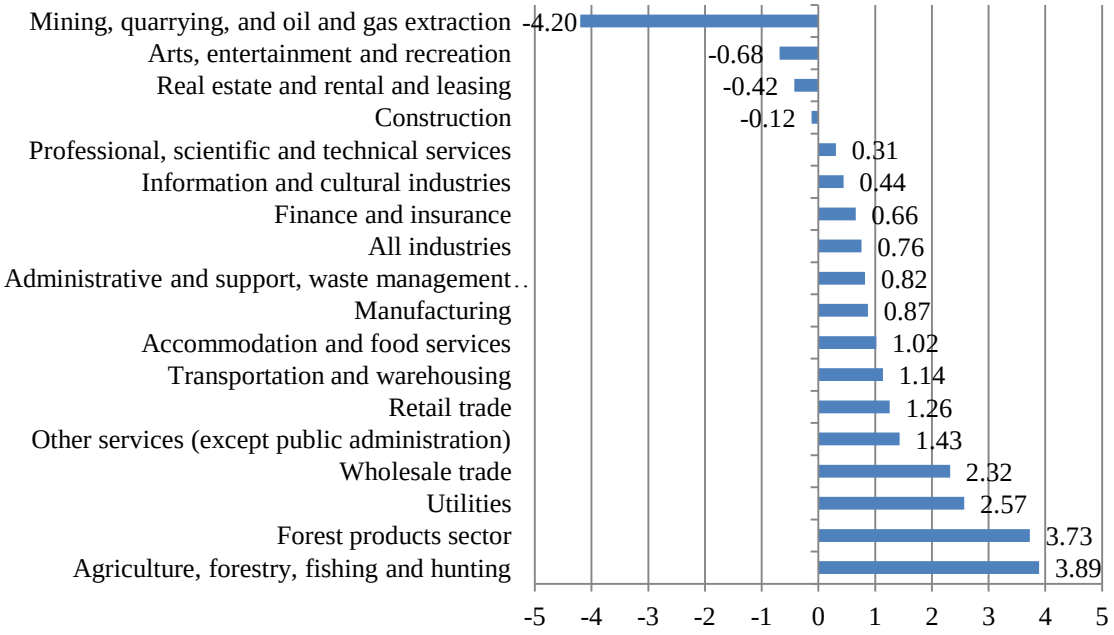
[11] For additional data on hours worked, see the CSLS database available at www.csls.ca/res_reports.asp.
[12] Manitoba and Alberta also had less than 1.0 per cent of their nominal GDP originating in the forest products sector.

control over demand and macroeconomic conditions, the forest products sector in Quebec responded aptly and quickly by cutting hours worked by more than real GDP fell. This timely response resulted in above-average labour productivity growth throughout both sub-periods, especially in the latter time period (2010-2013).

C. Labour Productivity Growth in Quebec in the Forest Products Sector Relative to Two-Digit NAICS Industries and Three-Digit Manufacturing Industries, 2000-2013

This subsection examines the labour productivity growth of the forest products sector in Quebec relative to other two-digit NAICS sectors and to the total economy in Quebec. The analysis looks at growth between 2000 and 2013. This time period will be broken down into two time periods: 2000-2007 and 2007-2013. In order to further isolate the effects of the crisis, the latter time period will be broken down into two additional periods: 2007-2010 and 2010-2013.

Chart 11: Labour Productivity Growth, Two-Digit NAICS Sectors, Compound Average Annual Growth, Quebec, 2000-2013



Source: CSLS calculations based on Statistics Canada data.

Between 2000 and 2013, the forest products sector had the second highest labour productivity growth of all two-digit NAICS industries in Quebec (3.7 per cent per year) (Chart 11 and Table 3). The only industry to show higher labour productivity growth during this period was agriculture, forestry, fishing and hunting (3.9 per cent per year), which contains one of the components of the forest products sector (forestry and logging). Aside from agriculture, forestry, fishing and hunting, the forest products sector exhibited labour productivity growth that was over 1.0 percentage points faster than all other two-digit NAICS industries.

When broken down by time period, the forest products sector's relative performance was outstanding in both periods. Between 2000 and 2007, the forest products sector was second best, with 3.7 per cent per year (Table 3). The only sector to outperform the forest products sector was agriculture, forestry fishing and hunting (4.0 per cent per year), with wholesale trade coming in close behind (3.6 per cent per year). Otherwise, the forest products sector outperformed all other two-digit NAICS industries by over one percentage point. Between 2007 and 2013, utilities was the top performer, demonstrating 9.3 per cent growth per year. The forest products sector was the second best performer, exhibiting 3.7 per cent per year, tied with agriculture, forestry, fishing and hunting.

When looking at these figures, it becomes immediately clear that the forest products sector has performed much more consistently across periods than other top-performing industries in terms of labour productivity. Many other sectors demonstrated differences of over one percentage point between the two sub-periods, while the forest products sector had extremely steady labour productivity growth, with only a 0.05 percentage point change between the two periods.

Table 3: Labour Productivity, Two-Digit NAICS Sectors, Compound Average Annual Growth, Quebec, 2000-2013

	2000-2007	2007-2010	2010-2013	2007-2013	2000-2013
Total economy	0.9	0.4	0.8	0.6	0.8
Forest products sector	**3.7**	**1.6**	**6.0**	**3.7**	**3.7**
Agriculture, forestry, fishing and hunting	4.0	3.6	3.9	3.7	3.9
Mining and oil and gas extraction	-4.4	0.6	-8.2	-3.9	-4.2
Utilities	-2.9	23.2	-3.0	9.3	2.6
Construction	1.2	-4.5	1.2	-1.7	-0.1
Manufacturing	1.0	0.3	1.2	0.7	0.9
Wholesale trade	3.6	2.3	-0.4	0.9	2.3
Retail trade	1.5	2.3	-0.3	1.0	1.3
Transportation and warehousing	0.6	3.1	0.5	1.8	1.1
Information and cultural industries	2.7	-3.4	-0.9	-2.1	0.4
Finance and insurance, and holding companies	1.2	-2.2	2.4	0.1	0.7
Professional, scientific and technical services	0.9	-0.5	-0.3	-0.4	0.3
Administrative and support, waste management and remediation services	1.7	-1.4	1.1	-0.2	0.8
Arts, entertainment and recreation	0.6	-4.3	-0.1	-2.2	-0.7
Accommodation and food services	1.3	0.4	1.1	0.7	1.0
Other private services	2.9	-1.2	0.6	-0.3	1.4
Real estate, rental and leasing	-1.5	1.5	0.2	0.9	-0.42

Note: The forest products sector is a composite consisting of forestry and logging, which is a part of agriculture, forestry, fishing and hunting, and wood product and paper manufacturing, which are a part of manufacturing. The figures for manufacturing and agriculture, forestry, fishing and hunting do not exclude the forest products sector industries.
Source: CSLS calculations based on Statistics Canada data.

When the latter period (2007-2013) is further broken down into two parts (2007-2010 and 2010-2013), this consistency is completely lost. Labour productivity growth in the forest products sector was equally as volatile as in the other sectors, with 1.6 per cent per year growth between 2007 and 2010 and 6.0 per cent per year growth between 2010 and 2013. Between 2007 and 2010, the forest products sector performed quite poorly (it demonstrated the sixth fastest growth). From this point of view, the forest products sector was clearly hit hard by the financial crisis of 2008-2009 and the collapse of U.S. housing between 2006 and 2009, which is captured

almost entirely in this sub-period. Between 2010 and 2013, however, labour productivity in the forest products sector skyrocketed, showing the fastest growth out of any two-digit NAICS sector. In this period, the forest products sector's labour productivity growth was over two percentage points higher than that of any other two-digit NAICS sector, even its closest competitor: agriculture, forestry, fishing and hunting.

The astonishing growth in labour productivity in the period between 2010 and 2013 suggests that the forest products sector in Quebec was willing to cut excess employment even when the economy was showing signs of recovery, signifying that the industry is smartly attempting to shed unnecessary labour to be able to compete more fervently in a leaner and meaner fashion in the future.

Table 4: Output, Employment, Productivity, Two-Digit NAICS Sectors, Compound Average Annual Growth, Quebec, 2000-2013

	Output (Real GDP)		Employment (CPA: Number of Jobs)		Productivity (Output per Hour)	
Industry	**2000-2013**	**2007-2013**	**2000-2013**	**2007-2013**	**2000-2013**	**2007-2013**
All industries	1.5	1.2	1.3	0.9	0.8	0.6
Agriculture, forestry, fishing and hunting	1.7	1.1	-1.7	-2.3	3.9	3.7
Mining, quarrying, and oil and gas extraction	-0.7	3.4	3.0	6.8	-4.2	-3.9
Utilities	1.7	2.7	-0.6	-5.8	2.6	9.3
Construction	4.2	3.6	4.7	5.4	-0.1	-1.6
Manufacturing	-1.5	-1.6	-2.0	-2.0	0.9	0.7
Wholesale trade	2.2	0.4	0.4	-0.3	2.3	0.9
Retail trade	2.8	1.5	2.2	0.8	1.3	1.0
Transportation and warehousing	1.1	0.1	0.3	-1.7	1.1	1.8
Information and cultural industries	2.0	1.1	1.7	2.4	0.4	-2.2
Finance and insurance	2.1	1.1	1.9	1.3	0.7	0.1
Real estate and rental and leasing	2.8	2.9	3.2	0.9	-0.4	0.9
Management of companies (excluding head offices)	--	--	0.5	3.1	--	--
Professional, scientific and technical services	2.6	1.9	3.0	2.5	0.3	-0.4
Administrative and support, waste management and remediation services	2.3	0.9	2.0	1.7	0.8	-0.2
Arts, entertainment and recreation	0.0	-0.9	1.5	0.8	-0.7	-2.2
Accommodation and food services	1.9	1.1	1.8	1.4	1.0	0.7
Other services (except public administration)	2.3	1.4	1.1	1.7	1.4	-0.3
Forest products sector	**-1.1**	**-2.0**	**-4.4**	**-5.5**	**3.7**	**3.8**

Source: CSLS calculations based on Statistics Canada data.

Since labour productivity figures derive from employment and output, it is informative to examine how the forest products sector's trends in these variables compare to those exhibited by other two-digit NAICS industries (Table 4). It appears that the forest products sector's strong performance relative to its peers between 2000 and 2013 was driven by one of the lowest output growth rates (-1.1 per cent per year) and the lowest employment growth rate (-4.4 per cent per year). The only sector to perform worse in terms of output was manufacturing (-1.5 per cent per year). It is worth noting that manufacturing contains two of the major forest products sector's industry groups. Between 2007 and 2013, the picture is similar. During this period, the forest

products sector had the lowest output growth of all two-digit NAICS industries. Its employment record was almost as poor, demonstrating the second worst performance (-5.5 per cent per year). The only industry to demonstrate deeper employment cuts between 2007 and 2013 was utilities (-5.8 per cent per year).

The forest products sector is composed of two industry groups that belong to the manufacturing sector. Hence, examining trends within the manufacturing sector can provide useful information concerning the relative behaviour of the forest products sector, as well as both paper manufacturing and wood product manufacturing.

Table 5: Output, Employment, Productivity, Three-Digit NAICS Manufacturing Industry Groups, Compound Average Annual Growth, Quebec, 2000-2013

	Output (Real GDP)		Employment (CPA: Number of Jobs)		Productivity (Output per Hour)	
Industry	**2000-2013**	**2007-2013**	**2000-2013**	**2007-2013**	**2000-2013**	**2007-2013**
Manufacturing	-1.5	-1.6	-2.0	-2.0	0.9	0.7
Food manufacturing	1.6	1.0	0.8	0.7	1.3	0.5
Beverage and tobacco product manufacturing	-0.7	-1.4	2.1	2.1	-1.8	-2.9
Textile and textile product mills	-9.2	-9.4	-7.3	-8.7	-1.2	0.4
Clothing and leather and allied product manufacturing		-11.4	-9.2	-10.0		-0.9
Wood product manufacturing	0.1	-0.8	-4.1	-3.5	4.8	3.0
Paper manufacturing	-2.4	-3.9	-4.2	-6.9	1.8	2.6
Printing and related support activities	-3.3	-7.3	-3.9	-6.4	0.7	-0.2
Petroleum and coal product manufacturing	-0.1	-4.0	-0.4	-3.3	0.4	-2.0
Chemical manufacturing	-1.8	-1.6	-0.1	0.7	-1.1	-1.5
Plastics and rubber products manufacturing	0.9	-0.9	-0.4	-0.8	1.6	0.1
Non-metallic mineral product manufacturing	0.2	-3.9	0.0	0.7	0.2	-4.7
Primary metal manufacturing	1.2	-0.4	-1.0	-0.3	2.5	0.9
Fabricated metal product manufacturing	-0.7	-1.3	0.1	-1.3	-0.3	0.6
Machinery manufacturing	0.2	-0.3	-0.7	-1.8	1.4	1.9
Computer and electronic product manufacturing	-10.0	-3.5	-4.2	-2.8	-5.7	-0.3
Electrical equipment, appliance and component manufacturing	0.8	3.1	-1.8	0.4	3.0	2.6
Transportation equipment manufacturing	-0.4	0.2	-0.5	0.6	0.5	0.3
Furniture and related product manufacturing	-2.1	-2.3	-3.1	-4.3	1.5	2.6
Miscellaneous manufacturing	-1.8	-3.1	-0.4	-0.2	-1.0	-2.7
Forest products sector	**-1.1**	**-2.0**	**-4.4**	**-5.5**	**3.7**	**3.8**

Source: CSLS calculations based on Statistics Canada data.

The immediate observation that stems from the output, employment and productivity figures between 2000 and 2013 and 2007 and 2013 is that the manufacturing sector did not fare too well (Table 5). In many cases, the forest products sector was not even close to the worst performer. This may be because the forest products sector's performance was boosted by forestry and logging, which is not included in this table since it is not a manufacturing industry group. Compared to the figures for real output growth, it appears that the forest products sector performed similarly to the total manufacturing sector and to many of the industry groups within the manufacturing sector. Since the forest products sector performed exceedingly well relative to

the manufacturing industry and the manufacturing industry groups in terms of labour productivity, this implies that the difference was driven by employment.

This observation is corroborated by the figures. The forest products sector cut employment at a faster rate than any other manufacturing industry group between 2000 and 2013 (-4.4 per cent per year), excluding clothing leather and allied product manufacturing (-9.2 per cent per year). Between 2007 and 2013, there were only three industry groups that cut employment faster than the forest products sector, including clothing and leather and allied product manufacturing (-10.0 per cent per year), printing and related support activities (-6.9 per cent per year) and textile and textile product mills (-8.7 per cent per year). The only other industry group that cut employment faster (paper manufacturing) is actually a part of the forest products sector. Despite stronger employment cuts, these industry groups saw extremely poor output growth during this period, which resulted in lower labour productivity figures than for the forest products sector.

D. Labour Productivity Levels in Quebec in the Forest Products Sector Relative to Two-Digit NAICS Industries, 2000-2013

This subsection examines Quebec's productivity levels in the forest products sector in relation to other two-digit NAICS sectors in Quebec and relative to the total economy in Quebec.[13] The time period in consideration is 2000 to 2011, since nominal GDP figures are only available up to 2011. This subsection reviews how labour productivity levels changed from 2000 to 2011, stopping to look at labour productivity levels in 2005.[14]

The forest products sector saw its level of labour productivity fall in absolute terms between 2000 and 2011 by $1.44 per hour worked (Table 6). No other sector saw its level of labour productivity fall. However, given that real labour productivity grew consistently (and quite quickly) throughout this time period, the fall in labour productivity exhibited by the forest products sector is entirely attributable to a fall in prices.

It is interesting to note that the entire fall in absolute labour productivity levels in the forest products sector is concentrated between 2005 and 2011. Since real labour productivity did not demonstrate significant growth differences between the two periods, this is entirely attributable to differences in the rate of price declines. Even more interestingly, labour productivity levels in the forest products sector fell from 138.2 per cent of the all-industry

[13] Labour productivity level comparisons are usually done in nominal terms, directly capturing the value generated by one hour of work (or one worker), which fluctuates with the price of the goods and services the industry produces. The main limitation of real levels is that they are a function of both real growth rates and the nominal level in an arbitrary base or reference year. As a consequence, comparisons of real labour productivity levels across industries can lead to vastly different results depending on the state of relative prices in the chosen base or reference year. In order to avoid this problem, this report focuses on nominal labour productivity levels. It is important to keep in mind that changes in nominal productivity levels incorporate not only actual productivity growth, but also price changes (De Avillez, 2014).

[14] Labour productivity levels calculated in this section use nominal output figures. To obtain a time series for nominal output covering the entire period, CANSIM Table 379-0030 was extended into the past using growth rates from CANSIM Table 379-0025. This modification was made since CANSIM Table 379-0030 covers 2007-2011, while CANSIM Table 379-0025 covers 1997-2008.

average to 97.8 per cent in thirteen years. Since real labour productivity growth was positive and the industry displayed the highest growth of any two-digit NAICS industry, this was entirely driven by falling prices.[15]

Table 6: Nominal Labour Productivity Levels, Two-Digit NAICS Sectors, Quebec, 2000, 2005, 2011[16]

	Level			Relative		
	2000	2005	2011	2000	2005	2011
All industries	36.3	42.0	49.9	100.0	100.0	100.0
Agriculture, fishing, forestry and hunting	27.9	31.2	42.3	76.7	74.4	84.9
Mining, quarrying, and oil and gas extraction	62.3	91.6	170.5	171.4	218.3	341.7
Utilities	208.7	190.9	341.4	574.5	455.1	684.2
Construction	33.1	39.6	46.5	91.2	94.3	93.2
Manufacturing	46.4	49.0	56.7	127.6	116.8	113.6
Wholesale trade	32.3	42.5	49.9	89.0	101.2	100.0
Retail trade	17.9	20.6	26.1	49.3	49.2	52.2
Transportation and warehousing	29.9	35.4	43.1	82.3	84.3	86.4
Information and cultural industries	65.5	82.6	83.1	180.4	196.9	166.7
Finance and insurance	53.2	59.6	63.5	146.3	142.0	127.3
Professional, scientific and technical services	30.6	36.5	45.8	84.1	87.1	91.7
Administrative and support, waste management and remediation services	18.5	24.0	30.7	51.0	57.2	61.6
Arts, entertainment and recreation	23.3	29.3	32.3	64.2	69.8	64.7
Accommodation and food services	13.5	18.4	19.5	37.3	43.8	39.2
Other services (except public administration)	18.0	24.6	29.5	49.5	58.7	59.1
Forest products sector	**50.2**	**53.3**	**48.8**	**138.2**	**127.1**	**97.8**

Source: CSLS calculations based on Statistics Canada data.

Relative to other industries, labour productivity levels in the forest products sector in 2000 were quite high, at 138.2 per cent of all industries (Table 6). There were only six two-digit NAICS industries with higher labour productivity levels (out of nineteen sectors in total). However, by 2011, the forest products sector had lower labour productivity levels than in 2000, while all other industries had higher labour productivity levels. This pushed the forest products sector into tenth place. It must be remembered, however, that prices have changed for different sectors in very different ways. For example, implicit prices in the forest products sector declined by 3.27 per cent per year between 2000 and 2011, while they rose by 2.38 per cent per year in all industries between 2000 and 2011.

In 2011, the forest products sector in Quebec had a level of labour productivity equivalent to $48.8 per hour worked, about two dollars less than the Canadian average. British Columbia registered the highest labour productivity levels in 2011, with $58.0 per hour, while Ontario exhibited the lowest levels ($46.8 per hour). However, within these aggregate figures,

[15] This statement is based on real productivity growth to the year 2011, which is not reported in this paper as data for real productivity are available up to and including the year 2013.

[16] Health care and social assistance and educational services have been dropped as these figures refer to hours worked in the business sector.

there is an extreme amount of variation: the industry groups within each province demonstrate an enormous amount of variability.

Table 7: Labour Productivity Levels, Forest Products Sector, Selected Canadian Provinces, 2011

	Canada	Quebec	Ontario	British Columbia	Other Provinces
Absolute Level (Dollars Per Hour)					
Forest products sector	50.7	48.8	46.8	58.0	49.0
Forestry and logging	49.0	38.5	39.9	61.2	48.5
Wood product manufacturing	38.5	36.7	29.3	46.9	38.7
Paper manufacturing	69.5	70.6	62.4	79.8	72.9
Relative Level (Canada = 100)					
Forest products sector	100.0	96.2	92.2	114.4	96.7
Forestry and logging	100.0	78.7	81.4	125.0	98.9
Wood product manufacturing	100.0	95.5	76.3	121.9	100.5
Paper manufacturing	100.0	101.5	89.7	114.7	104.8

Source: CSLS calculations based on Statistics Canada data.

In particular, in Quebec, paper manufacturing saw labour productivity reach $70.6 per hour in 2011, while wood product manufacturing sat at almost half this level, with $36.7 per hour. Forestry and logging was not much better, earning $38.5 per hour. In other provinces, the same trend arises: paper manufacturing has the highest labour productivity levels, followed by forestry and logging and wood product manufacturing. The greatest discrepancy between the three subsectors is seen in British Columbia.

Relative to Canada's level of labour productivity, Quebec is about average, while Ontario slips behind and British Columbia pulls ahead. Once again, this masks variation within the forest products sector.

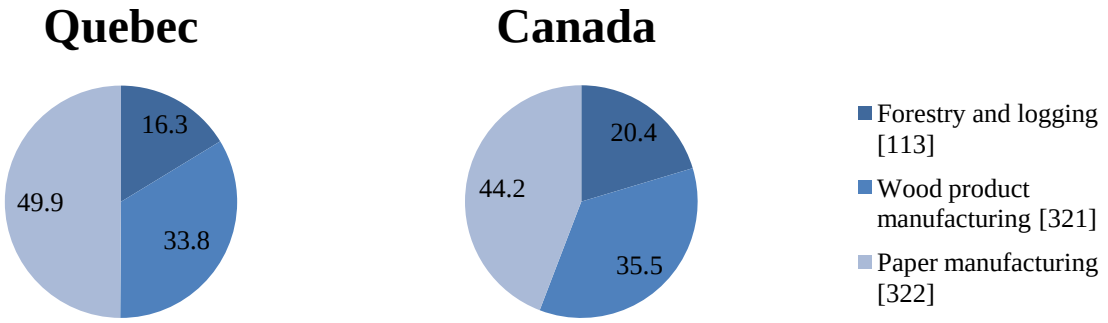
III. Detailed Analysis of Quebec's Output, Employment and Labour Productivity Performance: 1997-2013

In this section, the forest products sector in Quebec is examined in four separate subsections.[17] Following this introduction, the first subsection examines the forest products sector as a whole. The next three subsections explore the sector's three components: forestry and logging, wood product manufacturing, and paper manufacturing, in that order. The last subsection summarizes. Each subsection contains three parts examining real GDP, labour input and labour productivity over the period between 1997 and 2013, with a focus on the post-2000 period. When data permit, reference is occasionally made to the period between 1984 and 2013.[18]

A. Forest Products Sector

The forest products sector is composed of three three-digit North American Industry Classification System (NAICS) industries: forestry and logging (NAICS code 113), wood product manufacturing (NAICS code 321), and paper manufacturing (NAICS code 322).[19] Paper manufacturing accounted for one half (49.9%) of nominal forest products sector GDP in Quebec in 2011, while wood product manufacturing accounted for one third (33.8%) and forestry and logging for one sixth (16.2%) (Chart 12). In comparison with Canada as a whole, Quebec relies more heavily on paper manufacturing, and less heavily on wood product manufacturing and forestry and logging.[20]

Chart 12: Breakdown of Nominal GDP in the Forest Products Sector, Quebec, 2011

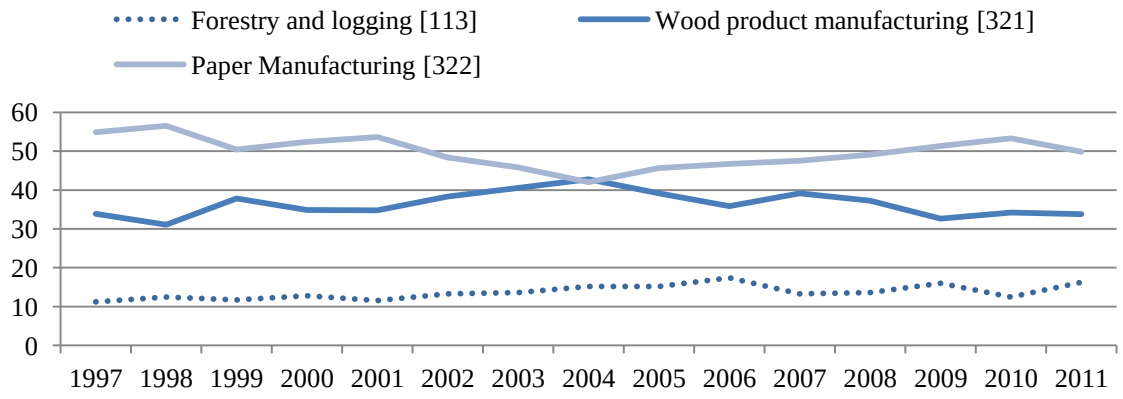


Source: CSLS calculations based on Statistics Canada data.

[17] For definitions and concepts, see Harrison and Sharpe (2009:2-7).
[18] References to the entire period between 1984 and 2013 should be interpreted with caution, since the period typically encompasses multiple Statistics Canada time series, which may not be comparable due to methodological changes in the construction of the estimates.
[19] The main exclusions from the forest products sector as defined in this report are the support activities for the forestry industry group (NAICS code 1153) and forest product trucking, both local (NAICS code 484223) and long distance (NAICS code 484233).
[20] For a better idea of what Quebec produced, see http://www.gouv.qc.ca/portail/quebec/pgs/commun/portrait/economie/exportations/?lang=en.

Since 1997, within the forest products sector in Quebec, paper manufacturing has almost consistently represented the largest portion of nominal GDP (Chart 13), followed by wood product manufacturing, which only surpassed paper manufacturing in one year (2004). Forestry and logging made up the smallest portion of forest products sector nominal GDP throughout the period examined. Whether or not this pattern will continue to persist depends on a number of factors, including the types of product innovations undertaken by all three industries, the market and the macroeconomic context, among others.

Chart 13: Breakdown of Nominal GDP in the Forest Products Sector by Subsector, Quebec, 1997-2011



Source: CSLS calculations based on Statistics Canada data.

In 2010, the last year for which data are available, there were 5,637 establishments in the forest products sector, up from 4,872 in 2004, but down from 6,044 in 2006 (Table 8). The majority of these establishments were concentrated in forestry and logging, with only a small portion concentrated in paper manufacturing.[21]

Table 8: Number of Establishments, Forest Products Sector, Quebec, 2004-2010

	Forest Products Sector	Logging	Wood Product Manufacturing	Paper Manufacturing
2004	4,872	2,762	1,770	340
2005	5,977	4,128	1,522	327
2006	6,044	4,140	1,590	314
2007	6,007	4,123	1,575	309
2008	5,882	4,066	1,519	297
2009	5,640	3,857	1,492	291
2010	5,637	3,873	1,490	274

Source: Statistics Canada.

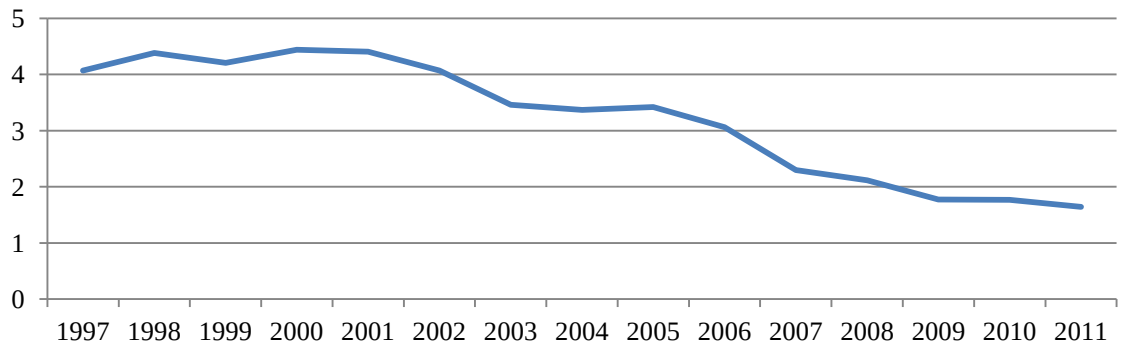
[21] The number of establishments represents a count of locations which perform manufacturing activities and normally corresponds to a plant, factory or mill. It excludes sales offices and warehouses which support manufacturing activities.

i. Output

a. Nominal GDP

The forest products sector continues to demonstrate a downward trend in terms of its share of the Quebec economy. Since the peak of 4.38 per cent in 1998 with a nominal value added of $8.0 billion, the share of the forest products sector in nominal GDP in Quebec has declined by 2.7 percentage points, representing only 1.64 per cent of GDP in all industries in 2011 with a nominal value added of $5.3 billion.[22] Despite a few minor annual movements, there is a clear, prominent long-term decline of the economic importance of the forest products sector in Quebec and at the national level (Chart 14).[23] In other words, the forest products sector in 2011 had only 37 per cent the economic importance it had in 1998, a huge decline in only thirteen years.[24]

Chart 14: Share of Forest Products Sector in Nominal GDP, Quebec, 1997-2011



Source: CSLS calculations based on Statistics Canada data.

b. Prices

The implicit GDP deflator, calculated by dividing nominal GDP by real GDP, measures how the remuneration of capital and labour combined changes given a level of production. Between 1997 and 2011 the implicit price fell by approximately 2.3 per cent per year in the forest products sector in Quebec.[25] This was entirely concentrated in the 2000-2011 period, since prices increased by 3.3 per cent per year between 1997 and 2000 (Table 9). While between 2000 and 2007, prices fell by 4.63 per cent per year. They also fell by 2.1 per cent per year between

[22] As noted earlier, this series is a composite of two time series for two sub-periods, hence this composite time series may not be as accurate as a continuous series would be.
[23] Canada's forest products sector fell from 4.3 per cent of nominal GDP in 1961 to 1.1 per cent in 2009 (De Avillez, 2014: 31).
[24] Between 1984 and 2000, the increasing share of the forest products sector in nominal GDP was a result of the faster pace of economic growth in the forest products sector relative to the rest of the economy. Between 1991 and 1998 there occurred exceptionally strong nominal GDP growth in the forest products sector (11.2 per cent per year) compared to the overall economy (3.6 per cent per year). However, between 2000 and 2013, the falling share of the forest products sector also reflected declining real output in the forest products sector.
[25] This number should be interpreted with caution, as it reflects multiple different Statistics Canada time series, which may not be directly comparable.

2007 and 2011. Nominal GDP has declined much more rapidly than real GDP between 2000 and 2007 (-4.9 per cent per year versus -0.25 per cent per year) and between 2007 and 2011 (-5.2 per cent per year and -2.0 per cent per year), unlike most other industries where the growth of nominal GDP exceeded actual output growth.

c. Real GDP

Between 1997 and 2013, real GDP in the forest products sector in Quebec grew more slowly than total economy real GDP (0.2 per cent versus 2.15 per cent) (Table 9). In recent years, output fell (-2.0 per cent per year between 2007 and 2013) after growing 5.8 per cent between 1997 and 2000 and falling 0.25 per cent between 2000 and 2007 (Table 9). More importantly, these numbers indicate that the volume of output produced by the forest products sector in Quebec in 2013 is nearly identical to the output produced in 1997. This drastic fall in real output was driven by poor economic conditions for the industry, including a structural shift away from paper to electronic media, a housing crisis in the United States and an unfavourable exchange rate. Given the forest products sector's ability to withstand the poor conditions that it faced in the early-2000s, as economic conditions improve and the forest products sector innovates and develops new products, real output growth might potentially turn around.

Table 9: Nominal GDP, Implicit Price Deflators and Real GDP, All Industries and Forest Products Sector, Compound Average Annual Growth, Quebec, 1997-2013

	Nominal GDP		Implicit Price Deflator		Real GDP	
	All Industries	Forest Products Sector	All Industries	Forest Products Sector	All Industries	Forest Products Sector
1997-2000	6.12	9.27	1.28	3.27	4.78	5.82
2000-2007	4.53	-4.88	2.67	-4.63	1.81	-0.25
2007-2013	--	--	--	--	1.25	-1.98
2007-2011	3.15	-5.16	1.86	-2.11	1.26	-3.12
2000-2013	--	--	--	--	1.55	-1.06
2000-2011	4.02	-4.98	2.38	-3.72	1.61	-1.30
1997-2013	--	--	--	--	2.15	0.20

Source: CSLS calculations based on Statistics Canada data.

The decline in recent years was fuelled by the financial crisis of 2008-2009, when real GDP in the forest products sector plummeted by 10.8 per cent. Compared to the impact on the total economy in Quebec (-0.8 per cent), the financial crisis of 2008-2009 was devastating for the forest products sector. Moreover, in the years since the financial crisis, the forest products sector in Quebec has not succeeded in returning to consistently positive growth, unlike the rest of the economy. However, one should not overestimate the impact of the financial crisis, as this masks a more despairing long-term trend, since output in the forest products sector in Quebec has been falling since 2005.

ii. Employment and Hours Worked

a. Employment

Employment in Quebec's forest products sector has been declining since the beginning of the 21st century, with the sharpest declines exhibited between 2007 and 2013 (-5.5 per cent per year), falling from 69,905 jobs in 2007 to 49,680 jobs in 2013. Between 2000 and 2007, employment also declined rapidly (-3.4 per cent per year), falling from 88,860 jobs in 2000 to 69,905 in 2007. Before 2000, employment in the forest products sector was on an upward trend, registering positive growth between 1998 and 2000, increasing from 82,705 workers in 1998 to 88,860 in 2000.[26] Employment peaked in 2000.

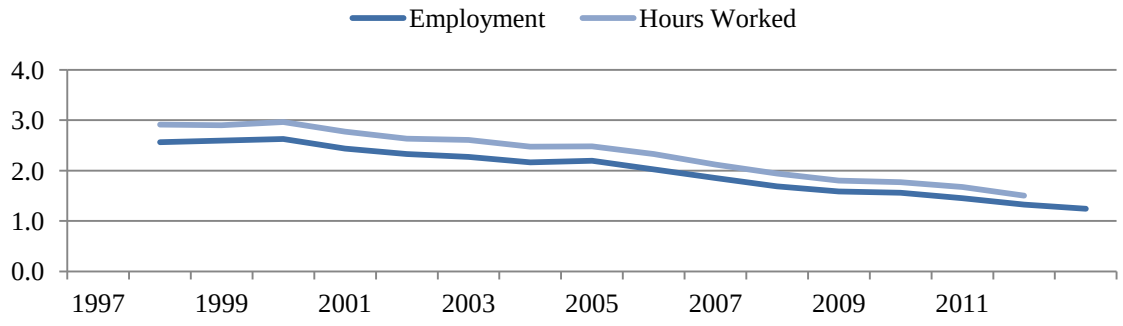
Table 10: Employment, Forest Products Sector, Quebec, Compound Average Annual Growth, 1997-2012

	All industries	Forest products sector
1997-2000	2.44	--
2000-2007	1.55	-3.37
2007-2012	0.94	-5.53
2000-2013	1.27	-4.37

Source: CSLS calculations based on Statistics Canada data.

Compared to the all-industry average, the forest products sector performed exceedingly poorly in terms of employment. Total economy employment grew consistently between 2000 and 2013 at 1.3 per cent per year, with the strongest growth between 2000 and 2007 at 1.55 per cent per year (Table 10). Employment growth was also strong between 1997 and 2000 (2.4 per cent per year). Since both the forest products sector and the total economy demonstrated strong employment growth between 1997 and 2000, this likely reflects the strong macroeconomic environment at the time. The poor employment record post-2000 in the forest products sector indicates that the industry has overhauled its production processes and removed unnecessary employment to reduce costs.

Chart 15: Share of the Forest Products Sector in Total Economy Employment and Hours Worked, Quebec, 1997-2012



Source: CSLS calculations based on Statistics Canada data.

[26] These estimates are from the Canadian Productivity Accounts (CPA). The estimates from the Survey of Employment, Payrolls and Hours (SEPH) show a similar pattern; however, these data suggest that most of the employment losses were concentrated between 2007 and 2013. The estimates of the number of workers from the Labour Force Survey (which should closely approximate the number of jobs) also show a similar pattern.

Not surprisingly, similar to real GDP and hours worked, employment trends show that the relative economic importance of the forest products sector in Quebec is in decline. Since the peak of 2.6 per cent in 2000, the share of the forest products sector in total employment in Quebec has fallen to 1.25 per cent in 2013 (Chart 15). Clearly, the forest products sector in Quebec is not the economic powerhouse of previous decades, given the structural shifts away from paper products to electronic media and the emergence of low-cost international competitors. Nevertheless, the forest products sector continues to be an integral component of the economic fabric in Quebec, providing high-paying employment to rural communities.

Within the forest products sector there has been surprising consistency in the employment share of each industry. In brief, wood product manufacturing had the greatest proportion of

Box 1: Employment Estimates

Employment estimates for the forest products sector and the three subsectors of which it is composed are available from three difference sources: Survey of Employment, Payroll and Hours (SEPH), Labour Force Survey (LFS), and Canadian Productivity Accounts (CPA). This report uses the CPA estimates to calculate productivity, but the other estimates could also have been used. For a discussion of the differences between these three surveys and their implications for productivity estimates, see De Avillez (2014).

Table 11: Employment, LFS, SEPH, CPA, Quebec, 2001-2012

a) Forest products sector	2001	2012	2001-2012
SEPH	88,347	58,264	-3.71
LFS	104,000	72,000	-3.31
CPA	83,150	52,540	-4.09

b) Forestry and logging	2001	2012	2001-2012
SEPH	14,179	7,525	-5.60
LFS	18,000	9,000	-6.78
CPA	14,895	7,960	-4.74

c) Wood product manufacturing	2001	2012	2001-2012
SEPH	40,324	27,006	-3.58
LFS	52,000	38,000	-2.91
CPA	39,395	23,705	-4.51

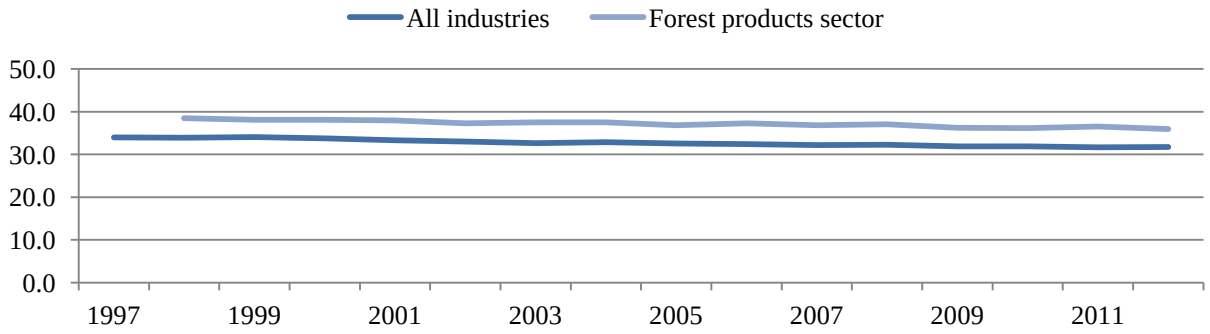
d) Paper manufacturing	2001	2012	2001-2012
SEPH	33,844	23,733	-3.17
LFS	34,000	26,000	-2.38
CPA	30,180	20,875	-3.30

* SEPH and CPA refer to the number of jobs. LFS refers to the number of persons employed.
Source: Statistics Canada. CPA employment data from CANSIM Table 383-0010 and CANSIM Table 383-0030; SEPH employment data from CANSIM Table 281-0024; LFS employment data obtained through special order. Growth rates were calculated by the CSLS.

employment between 2000 and 2013, followed by paper manufacturing and forestry and logging. As previously mentioned, this is not surprising given the relative nominal GDP shares of the industry groups and the labour requirements of their production processes. However, unlike hours worked, employment in wood product manufacturing has consistently represented a larger share than paper manufacturing since 1997. In 2013, wood product manufacturing accounted for 47.8 per cent of total employment in the forest products sector, while paper manufacturing represented 38.0 per cent.

Since employment and hours worked have displayed relatively similar trends throughout 1998-2013, it is unsurprising that the average weekly hours per job have been fairly consistent, only dipping slightly below their levels in 1998. In particular, the average weekly hours per job in Quebec's forest products sector have fallen by only 2.6 hours per week (Chart 16). The total economy in Quebec has also seen declines for average weekly hours per job, but they were slightly less pronounced at 2.2 hours per week.

Chart 16: Average Weekly Hours Per Job, Forest Products Sector, Quebec, 1997-2012



Source: CSLS calculations based on Statistics Canada data.

b. Hours Worked

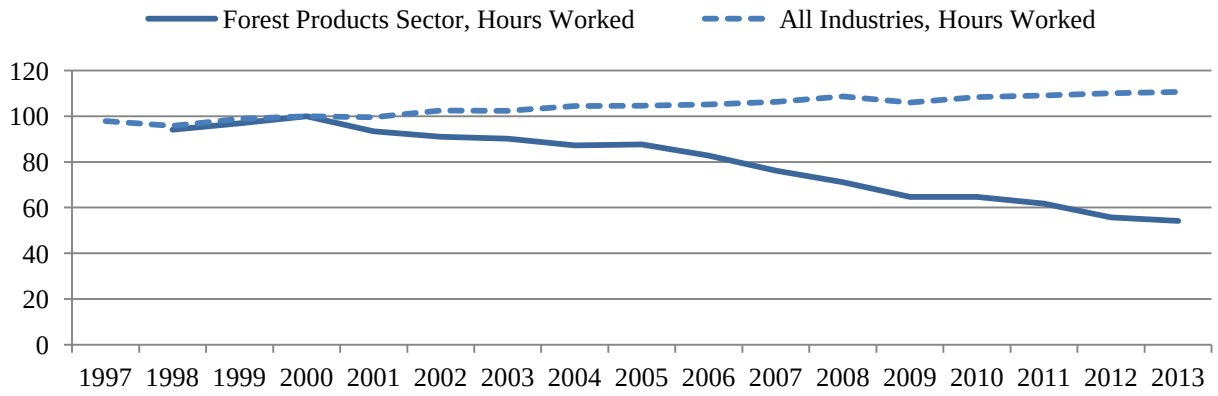
In Quebec, hours worked in the forest products sector have declined since the turn of the century, with much stronger declines in the most recent years. In particular, between 2000 and 2007, hours worked declined by 3.8 per cent per year, while between 2007 and 2013, hours declined by over 1.0 percentage points faster (5.5 per cent per year). As whole, hours worked in 2013 were only 57.5 per cent of their level in 1997 in the forest products sector in Quebec.

Compared with the total economy in all three time periods (1997-2000, 2000-2007 and 2007-2013), hours worked in the forest products sector have grown more slowly or fallen faster. Moreover, the forest products sector's share of hours worked in Quebec's economy has been steadily declining since 1997, falling from a peak of 3.0 per cent in 2000 to a low of 1.45 per cent in 2013 (Chart 15). Hence, the same conclusion can be drawn from hours worked as from real GDP: the economic importance of the forest products sector in Quebec is in decline as other industries continue to gain ground in both relative and absolute terms. However, as previously noted, this observation from the data masks the resilience or adaptability that the forest products sector has demonstrated in the face of poor macroeconomic conditions. The industry is far more cyclical than many other two-digit NAICS sectors. Hence, the ability for the forest products

sector to adjust employment levels in the long-term while maintaining output levels should be seen as an asset. Clearly, the less productive element of the industry has been removed since the early- to mid-2000s, giving the industry more room to grow more fervently when the perfect storm subsides. However, it is important to note that it is unclear whether the 2010-2013 productivity increases are due to plant-specific productivity or compositional effects caused by closure of the least productivity plants; both effects are likely at play.

For all measures of weekly hours, there has been little net change since 1997. This suggests that most of the decline in hours worked is coming from employee layoffs either associated with plant closure or downsizing or a lack of replacement demand after voluntary departure from the workforce, as opposed to fewer hours worked per worker.[27]

Chart 17: Hours Worked, Forest Products Sector, Quebec, 2000=100, 1997-2013

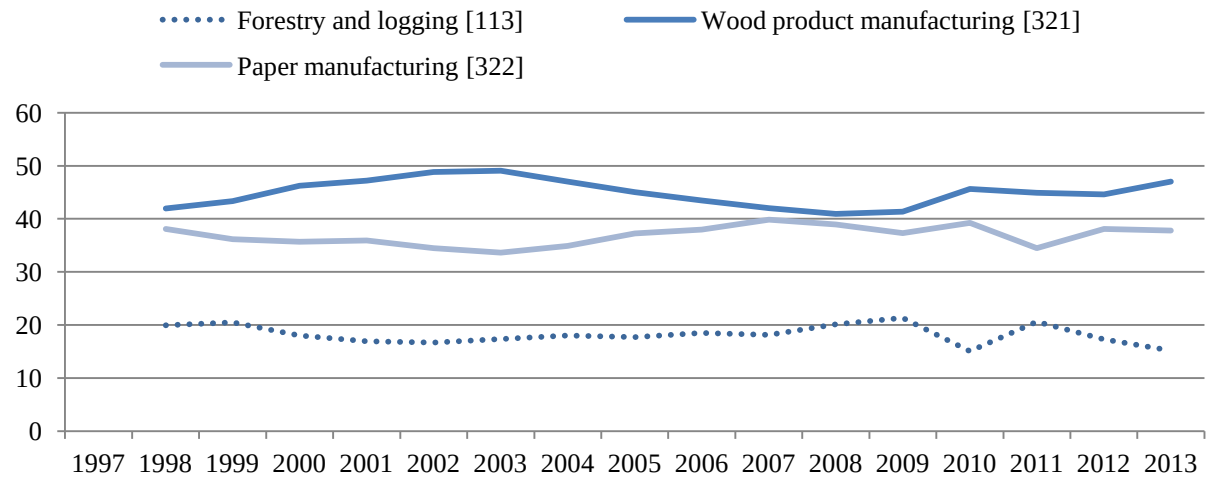


Source: CSLS calculations based on Statistics Canada data.

Unlike nominal GDP, where paper manufacturing was the most important subsector within the forest products sector, wood product manufacturing has represented the largest share of hours worked in recent years, while paper manufacturing falls in close behind. In 2013, wood product manufacturing represented 49.0 per cent of hours worked in the forest products sector, while paper manufacturing represented 37.8 per cent. Wood product manufacturing has always had the largest share of hours worked in Quebec, with paper manufacturing coming in close behind. By definition, forestry and logging accounted for 15-20 per cent of hours worked.

[27] Between 2004 and 2010, the number of forest products sector establishments rose overall, but there were declines in both wood product manufacturing and paper manufacturing, which saw the number of establishments fall from 1,770 to 1,490 and from 340 to 274, respectively. Forestry and logging saw an increase from 2,077 to 3,873.

Chart 18: Breakdown of Hours Worked by Subsector, Forest Products Sector, Quebec, 1997-2013



Source: CSLS calculations based on Statistics Canada data.

iii. Labour Productivity

Quebec's forest products sector has sustained positive labour productivity growth since 1998, with the strongest growth post-2000 (3.7 per cent per year). This means that the level of output per hour worked in the forest products sector was 61 per cent higher in 2013 than in 2000. Surprisingly, there was a considerable amount of consistency in terms of labour productivity growth between 2000-2007 and 2007-2013: labour productivity growth in these two time periods only differed by 0.05 percentage points (Table 12). Compared to the total economy, labour productivity growth in the forest products sector is impressive, growing over three times faster than total economy labour productivity growth in 2000-2007 and 2007-2013 (Chart 19).

Table 12: Real GDP, Hours Worked and Labour Productivity, Quebec, Compound Average Annual Growth, 1997-2013

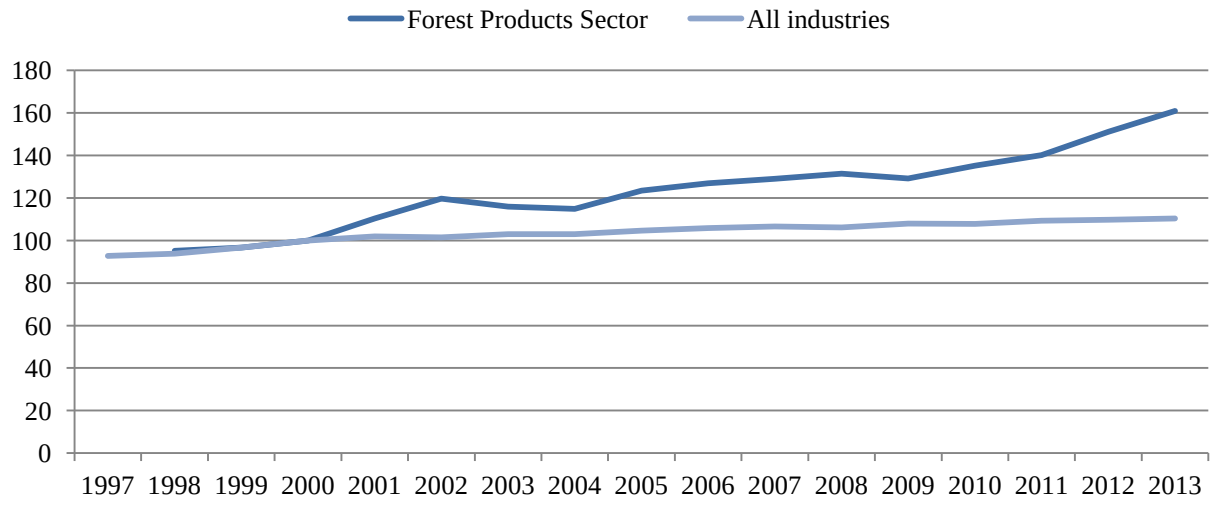
	Real GDP		Hours Worked		Labour Productivity	
	All industries	Forest products sector	All industries	Forest products sector	All industries	Forest products sector
1997-2000	2.52	5.82	2.19	--	2.54	--
2000-2007	1.81	-0.25	0.88	-3.82	0.92	3.70
2007-2010	1.01	-3.80	0.65	-5.29	0.37	1.57
2010-2013	1.48	-0.13	0.69	-5.76	0.79	5.97
2007-2013	1.25	-1.98	0.67	-5.52	0.58	3.75
2000-2013	1.55	-1.06	0.78	-4.61	0.76	3.73

Source: CSLS calculations based on Statistics Canada data.

These results are driven by hours worked falling faster than real output. In general, it is arguable that, in the long-run, this type of labour productivity growth is not sustainable, since labour productivity growth from cuts in hours worked is constrained by zero employment. In contrast, labour productivity growth from output growth is much more sustainable because there is no apparent cap on the amount that output can grow.

However, focusing on the unsustainable nature of recent labour productivity growth trends in the forest products sector in Quebec may be misplaced or misleading: the forest products sector was responding to a unique set of conditions (an appreciating Canadian dollar, a housing crisis in the United States, structural shifts, and low-cost competition) that necessitated large cuts in employment by forest product firms to sustain international competitiveness and maintain long-term industry-group vitality.

Chart 19: Labour Productivity, Forest Products Sector, 2000=100, Quebec, 1997-2013



Source: CSLS calculations based on Statistics Canada data.

B. Forestry and Logging

Forestry and logging (NAICS 113) is the three-digit NAICS subsector of the forest products sector that consists of establishments mainly concerned with growing and harvesting timber on a long production cycle (of ten years or more). Short production cycles are excluded because these require horticultural interventions before harvesting, which results in production processes that are more comparable to those in the crop production subsector.[28] In 2010, there were 3,873 establishments in logging, compared to 4,123 establishments in 2007 and 2,762 establishments in 2004.

Table 13: Number of Establishments, Logging, Quebec, 2004-2010

	Logging
2004	2,762
2005	4,128
2006	4,140
2007	4,123
2008	4,066
2009	3,857
2010	3,873

Source: Statistics Canada.

[28] Christmas trees are an example of trees that are classified under the crop production subsector.

Within the forestry and logging subsector, there are three four-digit NAICS industry groups, which each specialize in different stages of the production cycle: timber tract operations (NAICS 1131), forestry nurseries and gathering of forest products (NAICS 1132) and logging (NAICS 1133). The timber tract operations industry group includes establishments that are primarily engaged in the operation of timber tracts, for the purpose of selling standing timber. Forest nurseries and gathering of forest products includes establishments engaged in growing trees for the purpose of reforestation and those engaged in gathering forest products, such as gums, barks, balsam, needles and Spanish moss. Logging includes establishments primarily engaged in cutting timber, producing rough, round, hewn, or riven primary wood, and producing wood chips in the forest, as well as those industries engaged in cutting and transporting timber.

Unfortunately, the data on forestry and logging at the four-digit NAICS level for Quebec and Canada are extremely limited. Hence, the next subsections of this report will mainly focus on the forestry and logging industry at the three-digit level.

i. Output

a. Nominal GDP

Forestry and logging experienced strong nominal GDP growth between 1997 and 2000, at 14.1 per cent per year (Table 14). This growth was quickly reversed when nominal GDP fell 4.3 per cent per year between 2000 and 2007 and 0.2 per cent per year between 2007 and 2011.[29]

Table 14: Nominal GDP, Implicit Prices and Real GDP, Forestry and Logging, Quebec, Compound Average Annual Growth, 1997-2013

	Nominal GDP		Implicit Prices		Real GDP	
	All industries	Forestry and logging	All industries	Forestry and logging	All industries	Forestry and logging
1997-2000	6.12	14.08	1.28	-2.90	4.78	17.49
2000-2007	4.53	-4.31	2.67	-4.37	1.81	0.06
2007-2010	2.70	-7.81	1.67	-7.83	1.01	0.03
2010-2013	--	--	--	--	1.48	1.73
2007-2013	--	--	--	--	1.25	0.87
2007-2011	3.15	-0.21	1.86	-1.06	1.26	0.86
2000-2011	4.02	-2.84	2.38	-3.18	1.61	0.35
2000-2013	--	--	--	--	1.55	0.44

Source: CSLS calculations based on Statistics Canada data.

Unlike the forest products sector, forestry and logging's share of nominal GDP has remained relatively constant, with a slight increase between 1997 and 2006 (0.07 percentage points) and falling only marginally (0.04 percentage points) between 2007 and 2011. This suggests that forestry and logging has maintained its economic importance in Quebec in the past three decades, in contrast to the forest products sector as a whole.

[29] The 2000-2007 compound average annual growth in Table 14 is heavily downwardly biased by a break in the Statistics Canada time series between 2006 and 2007. Nominal GDP growth between 2000 and 2006 was 2.84 per cent per year; adding 2007 results in a compound average annual growth rate of -4.31 per cent per year for 2000-2007. The CSLS is investigating the issue with Statistics Canada.

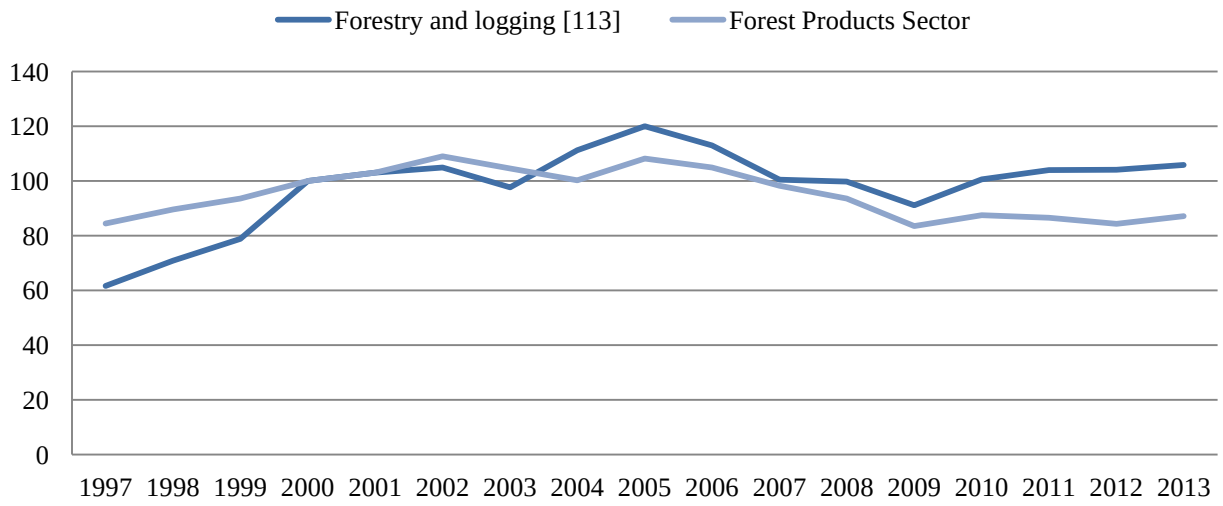
b. Prices

Prices in forestry and logging have been falling quite quickly over the past sixteen years. Falling prices indicate that nominal GDP growth understates real output growth. Between 1997 and 2000, prices declined by almost three per cent per year, while they fell by 4.4 per cent per year between 2000 and 2007 (Table 14). They continued to fall by 1.1 per cent per year thereafter (Table 14).

c. Real GDP

Between 1997 and 2000 real GDP growth in the forestry and logging industry was enormous, registering 17.5 per cent per year (Chart 20). Moreover, compared to the forest products sector as a whole, forestry and logging is in much better shape, as it has exhibited positive growth since the turn of the century (0.4 per cent per year between 2000 and 2013). However, real output growth post-2000 was much less impressive than the growth exhibited at the end of the 20th century. When broken down into two periods, forestry and logging in Quebec saw real GDP grow by 0.1 per cent per year in 2000-2007, increasing to 0.9 per cent per year in 2007-2013.

Chart 20: Real GDP, Forestry and Logging, Quebec, 2000=100, 1997-2013



Source: CSLS calculations based on Statistics Canada data.

Low growth in the later period was concentrated during and immediately after the financial crisis, when real GDP fell 11.1 per cent in 2007, 0.7 per cent in 2008 and 8.6 per cent in 2009. Since then, real GDP grew 1.8 per cent per year between 2010 and 2013. Hence, forestry and logging has had average or slightly above average performance during the recovery from the financial crisis and demonstrated strong growth between 2000 and 2013, apart from sharp declines between 2006 and 2009 (Chart 20). As previously mentioned, given the concentration of poor performance during the financial crisis, the downturn in the latter period largely reflects the

U.S. housing bust among other unfavourable factors like the appreciation of the Canadian dollar.[30]

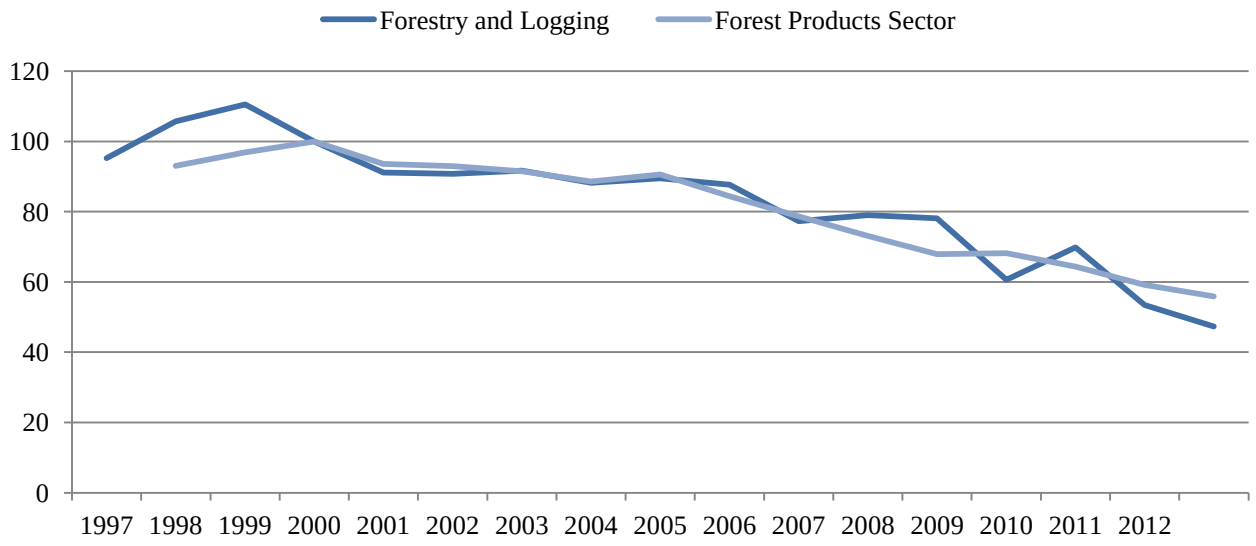
ii. Employment and Hours Worked

a. Employment

Between 1997 and 2000, employment increased 1.65 per cent per year from 14,180 to 14,895 jobs, while between 2000 and 2013, employment decreased by 5.59 per cent per year to 7,050 jobs. Similar to the case of the forest products sector as a whole, these employment declines were heavily concentrated between 2007 and 2013 (-7.8 per cent per year), but they were still quite high between 2000 and 2007 (-3.6 per cent per year) (Chart 21).[31]

Employment share figures show that forestry and logging is less economically important than it was two decades ago. In particular, forestry and logging's share of total economy employment has declined drastically, falling from 0.45 per cent in 1997 to 0.18 per cent in 2013, after peaking at 0.50 per cent in 1999.[32]

Chart 21: Employment, Canadian Productivity Accounts, Quebec, 2000=100, 1997-2012



Source: CSLS calculations based on Statistics Canada data.

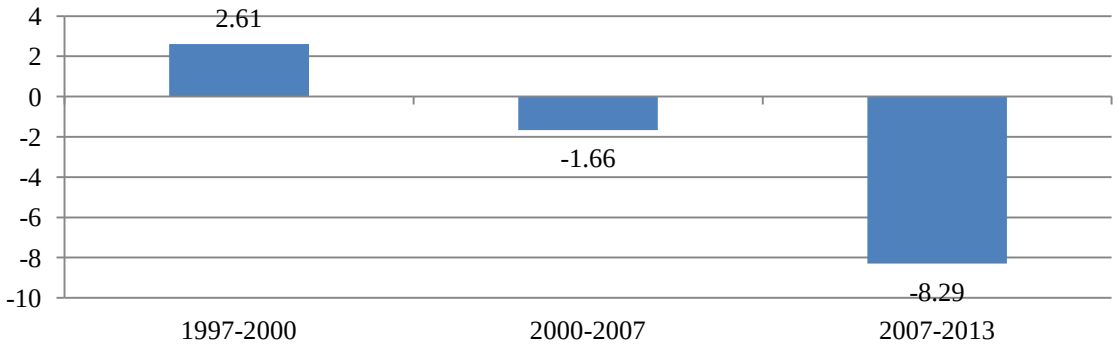
b. Hours Worked

Hours worked in the forestry and logging sector in Quebec experienced trends similar to the total forest products sector, even though output did not. Between 1997 and 2000, hours worked increased by 2.6 per cent per year, but since the turn of the century, hours worked have

[30] The number of trees cut down and output growth in the forestry and logging industry group seem disconnected.
[31] SEPH estimates display similarly consistent declines across the board. LFS estimates also show similar results.
[32] SEPH estimates suggest similarly dramatic declines: 0.46 per cent in 2001 to 0.19 per cent in 2013. LFS estimates also show declining economic importance.

declined (1.7 per cent per year between 2000 and 2007, and 8.3 per cent per year between 2007 and 2013). The steepest declines were seen between 2007 and 2013, likely reflecting the layoffs resulting from the economic crisis and the perfect storm that ravaged the industry. The sector's timely response to this perfect storm through layoffs and lower replacement rates was much needed and better positions the forest products sector in Quebec for growth in the future. By reducing slack, the sector now has more room to expand in a way that is cost-competitive.

Chart 22: Hours Worked, Forestry and Logging, Compound Average Annual Growth, Quebec, 1997-2013



Source: CSLS calculations based on Statistics Canada data.

Between 1997 and 2006, the share of forestry and logging in the total economy hours worked fell from 0.53 per cent to 0.43 per cent. From 2007 to 2013, the share fell from 0.38 per cent to 0.22 per cent.[33] The steady decline in hours worked implies a different story than the one presented by real GDP: the relative importance of forestry and logging as a source of employment has declined considerably since 1997. However, as previously discussed, a declining share of total economy output or workers does not imply that the sector will disappear. In contrast, with fewer hours worked but a stable share of nominal GDP, these results suggest that the forestry and logging industry group in Quebec is better set to face international competition in the coming decades than it was in the early-2000s.

iii. Labour Productivity

Labour productivity in the forestry and logging industry has grown enormously since 1997, with the strongest growth displayed between 1997 and 2000 (14.5 per cent per year). Labour productivity also grew quite dramatically between 2007 and 2013, registering 10.0 per cent per year. Between 2000 and 2007, labour productivity growth was strong and very impressive: 4.0 per cent per year (Table 15).

Similar to the total forest products sector, of which forestry and logging is a part, these figures show that the forestry and logging industry in the 2000s underwent a much-needed

[33] For more information on shares, see Appendix Table 2C in the database available at www.csls.cs/res_reports.asp. There are no data at the four-digit NAICS level in the Canadian Productivity Accounts. However, for the Labour Force Survey, there are data for the logging industry (NAICS code 1133). These data suggests that logging performed marginally worse than the three-digit NAICS industry to which it belongs between 2000 and 2012 (-6.1 per cent per year versus -6.0 per cent per year). There are no data on the other two component industries, timber tract operations (NAICS code 1131) and forest nurseries and gathering of forest products (NAICS code 1132).

restructuring and shed unnecessary excess labour built up during favourable times, responding in a competitive and practical fashion to the perfect storm of the mid- to late-2000s.

Table 15: Real GDP, Hours Worked and Labour Productivity, Forestry and Logging, Quebec, Compound Average Annual Growth, 1997-2013

	Real GDP		Hours Worked		Labour Productivity	
	Forest Products Sector	Forestry and Logging	Forest Products Sector	Forestry and Logging	Forest Products Sector	Forestry and Logging
1997-2000	5.82	17.49	--	2.61	--	14.50
2000-2007	-0.25	0.06	-2.66	-1.66	3.70	3.96
2007-2010	-3.80	0.03	-5.29	-10.93	1.57	12.30
2010-2013	-0.13	1.73	-5.76	-5.58	5.97	7.74
2007-2013	-1.98	0.87	-5.52	-8.29	3.75	9.99
2000-2013	-1.06	0.44	-4.61	-5.87	3.73	6.70

Source: CSLS calculations based on Statistics Canada data.

Unlike the forest products sector as a whole, the forestry and logging industry group was able to sustain positive output growth throughout the entire period between 2000 and 2013 (0.44 per cent per year), which is promising given the perfect storm that hit the sector in the mid-2000s. Output growth may have fallen after 2005, but the growth in the early- and late-2000s was enough to offset the losses seen in the middle of the first decade of the 21st century, leading to overall gains for the entire period.

The strong growth in labour productivity in the forestry and logging subsector in Quebec was far more sustainable than the growth experienced by the forest products sector as a whole, since much of the labour productivity growth came from declines in hours worked as opposed to declines in real GDP. The period between 1997 and 2000 presents the best scenario for labour productivity growth in the sector: real GDP grew at 17.5 per cent per year, while employment grew at 2.4 per cent per year (Table 15). Nevertheless, despite the fact that labour productivity growth came mainly from falling hours worked between 2000 and 2013, labour productivity growth in this period is not discredited because it is entirely possible that falling hours worked reflect efficient managerial decisions on the part of forestry and logging firms, especially if these firms were looking to maintain competitiveness.

C. Wood Product Manufacturing

Wood product manufacturing (NAICS code 321) is the three-digit NAICS subsector of the forest products sector that is engaged in manufacturing products from wood. Within this subsector, there are three main four-digit NAICS industry groups: sawmills and wood preservation (NAICS code 3211), veneer, plywood and engineered wood product manufacturing (NAICS code 3212), and other wood product manufacturing (NAICS code 3219). Sawmills and wood preservation includes establishments engaged in sawing logs into lumber and similar products, or preserving these products. Veneer, plywood and engineered wood product manufacturing includes establishments that are engaged in making products that improve the natural characteristics of wood, by making veneers, plywood, reconstituted wood panel products or engineered wood assemblies. Other wood product manufacturing includes establishments

engaged in manufacturing a diverse range of wood products, such as millwork. In 2013, there were 1,409 establishments in wood product manufacturing, of which 477 were sawmills and wood preservation, 140 were veneer, plywood and engineered wood product manufacturing, and 903 were other wood product manufacturing. In 2007, there were 1,492 establishments in wood product manufacturing, while there were 1,770 in 2004.

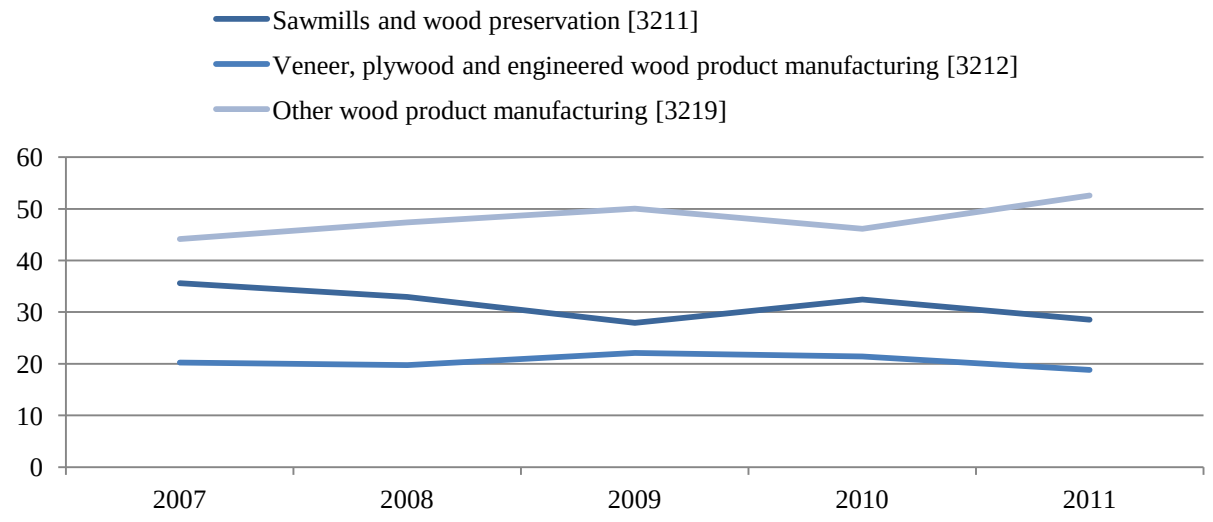
Table 16: Number of Establishments, Wood Product Manufacturing, Quebec, 2004-2010

	Wood product manufacturing (321)	Sawmills and wood preservation (3211)	Veneer, plywood and engineered wood product manufacturing (3212)	Other wood product manufacturing (3219)
2004	1,770	599	147	1,024
2005	1,522	532	151	839
2006	1,590	522	160	908
2007	1,575	497	154	924
2008	1,519	472	137	910
2009	1,492	461	139	892
2010	1,490	447	140	903

Source: Statistics Canada.

Data at the four-digit NAICS level are only available after 2007 for nominal GDP. However, the data that do exist show that other wood product manufacturing has been the largest source of nominal GDP in the wood product manufacturing subsector since 2007. Moreover, this sub-sector's share of wood product manufacturing nominal output has been rising quite steadily, perhaps due to innovations and the introduction of new products into the wood product manufacturing subsector (Chart 23).

Chart 23: Breakdown of Nominal GDP in Wood Product Manufacturing, Quebec, 2007-2011



Source: CSLS calculations based on Statistics Canada data.

Since 2007, as the share of other wood product manufacturing has increased from 44 per cent to 53 per cent, the share of sawmills and wood preservation in nominal wood product manufacturing GDP has decreased from 36 per cent to 29 per cent. Veneer, plywood and engineered wood product manufacturing has remained relatively constant at around 20 per cent. The declining economic importance of sawmills and wood preservation might signal how this industry was hit harder by the collapse of the U.S. housing construction market.

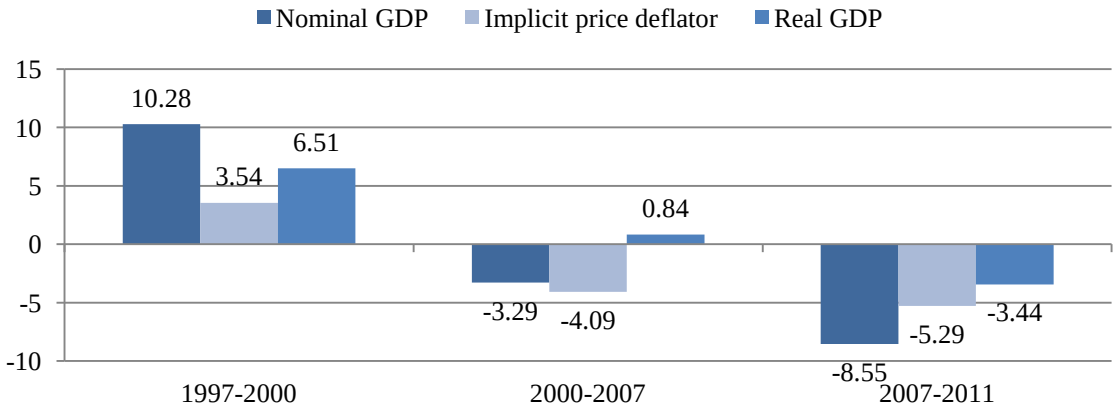
i. Output

a. Nominal GDP

Wood product manufacturing saw nominal GDP grow almost as quickly as forestry and logging between 1997 and 2000, at 10.3 per cent per year (Chart 24). However, between 2000 and 2007, this fell sharply to a decline of 3.3 per cent per year, and between 2007 and 2011, this fell even more to a decline of 8.55 per cent per year. This pattern of growth is nearly identical to the pattern exhibited by the total forest products sector between 1997 and 2011.

At the four-digit NAICS level, sawmills and wood preservation showed negative nominal GDP growth (13.5 per cent per year). Veneer, plywood and engineered wood product manufacturing also contributed to overall negative nominal GDP growth, falling 10.2 per cent per year. Likewise, other wood product manufacturing saw negative growth, but it was substantially less pronounced at only -4.4 per cent per year.

Chart 24: Nominal GDP, Implicit Prices and Real GDP, Quebec, Wood Product Manufacturing, 1997-2013



Source: CSLS calculations based on Statistics Canada data.

Unlike both the forest products sector and forestry and logging, wood product manufacturing accounted for an increasing share of the total economy in Quebec between 1984 and 2006. In particular, the share of wood product manufacturing in total economy nominal GDP increased from 1.38 per cent in 1997 to 1.55 per cent in 2000.[34] However, between 2000 and

[34] For more data on shares, see Table 1G in the Appendix Tables, available at www.csls.ca/res_reports.asp.

2006, it fell sharply to 1.1 per cent and between 2007 and 2011, this share declined even more, falling from 0.90 per cent of nominal GDP in 2007 to 0.55 per cent in 2011.[35]

The declining economic importance of wood product manufacturing is equally exhibited by the three four-digit NAICS industries of which it is composed. Between 2007 and 2011, all three subsectors (sawmills and wood preservation; veneer, plywood and engineered wood product manufacturing; and other wood product manufacturing) saw their share of total economy nominal GDP decline.

b. Prices

The GDP deflator in wood product manufacturing has been consistently declining since the turn of the century, registering -4.1 per cent per year between 2000 and 2007 and -5.3 per cent per year between 2007 and 2011 (Chart 24). According to economic theory, this decline may be tied to productivity growth, but it may also be tied to slumping demand. If the decline is tied to productivity growth, this is much more promising than if it is tied to declining demand, as it means margins are not falling.[36] It is quite possible that the two periods (2000-2007 and 2007-2013) experienced falling prices due to different factors. For example, the price decline in the later period is in part a result of declining demand stemming from the financial crisis. This conjecture is corroborated by the fact that real output fell in the wood products sector throughout this period. In contrast, the decline in the deflator between 2000 and 2007 may be the result of productivity growth, since real output increased throughout this period.

Regardless of the source, the price decline since 2000 means that nominal GDP growth understates real output growth. In contrast, since prices rose between 1997 and 2000, nominal GDP growth exceeded real GDP growth.

c. Real GDP

In wood product manufacturing, real output grew from 1997 to 2002, stagnated from 2002 to 2005, and then fell 25.4 per cent to a low in 2009. Since 2009, there has been a very weak rebound, with a significant upturn in 2013 (7.9 per cent) from the perspective of the period used in this report.[37] Wood product manufacturing saw real GDP increase between 1997 and 2000 at 6.5 per cent per year. This rate of growth fell in the next two periods, dropping to 0.8 per cent per year between 2000 and 2007 and -0.8 per cent per year between 2007 and 2013. Hence, wood product manufacturing closely approximates the trend demonstrated by the forest products sector as a whole (Chart 25).

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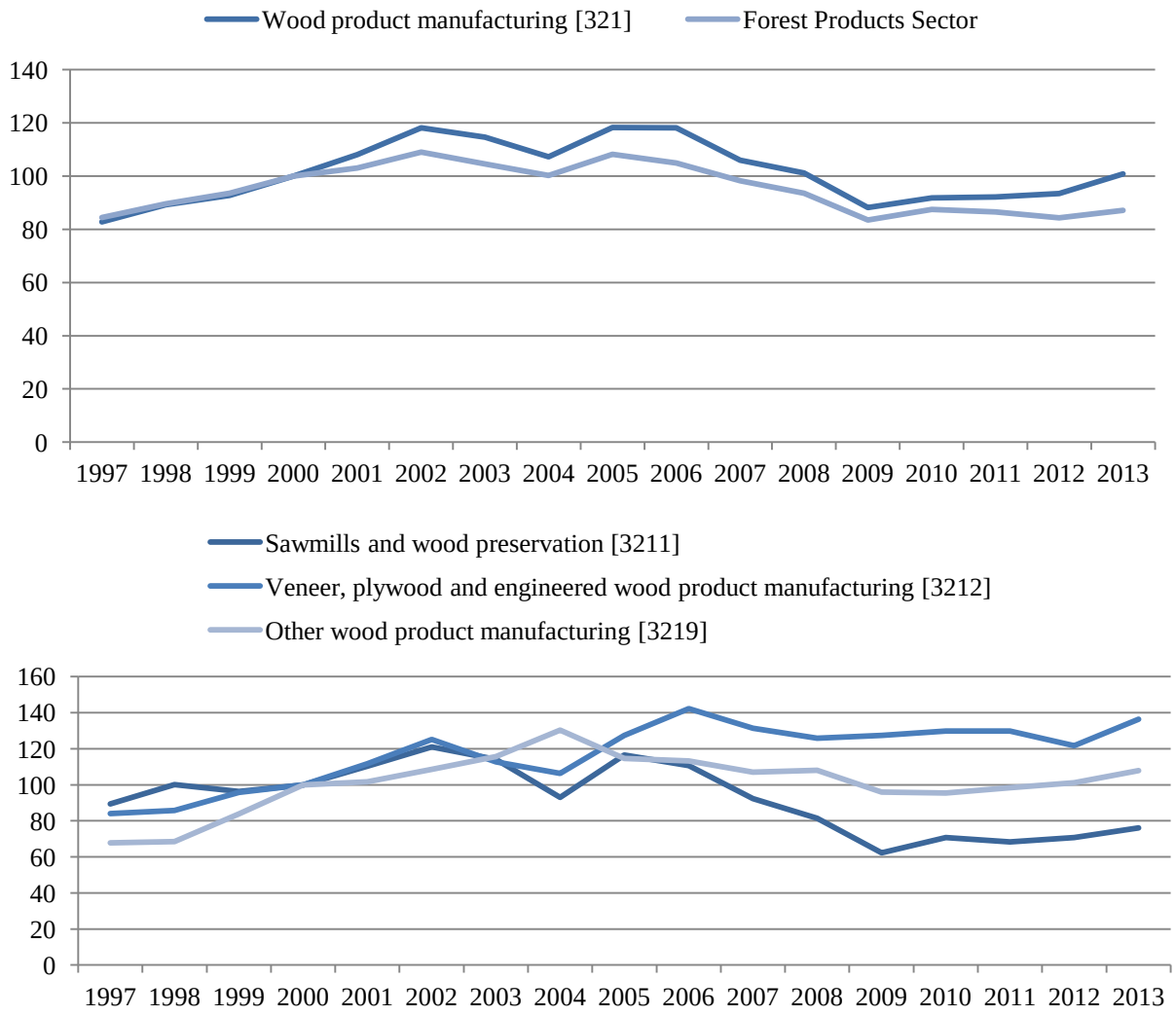
[35] We exclude a comparison between 2006 and 2007, since one Statistics Canada time series terminates in 2006 and the current price time series begins in 2007. Due to changing methodologies and definitions, these time series may not be directly comparable.

[36] Falling prices could also be related to world supply growing faster than world demand due to the emergence of new international competitors like Brazil and the southern United States.

[37] This story applies to almost all industry groups within the forest products sector for both hours worked, employment and real GDP.

Chart 25: Real GDP, Wood Product Manufacturing, Quebec, 2000=100, 1997-2013



Source: CSLS calculations based on Statistics Canada data.

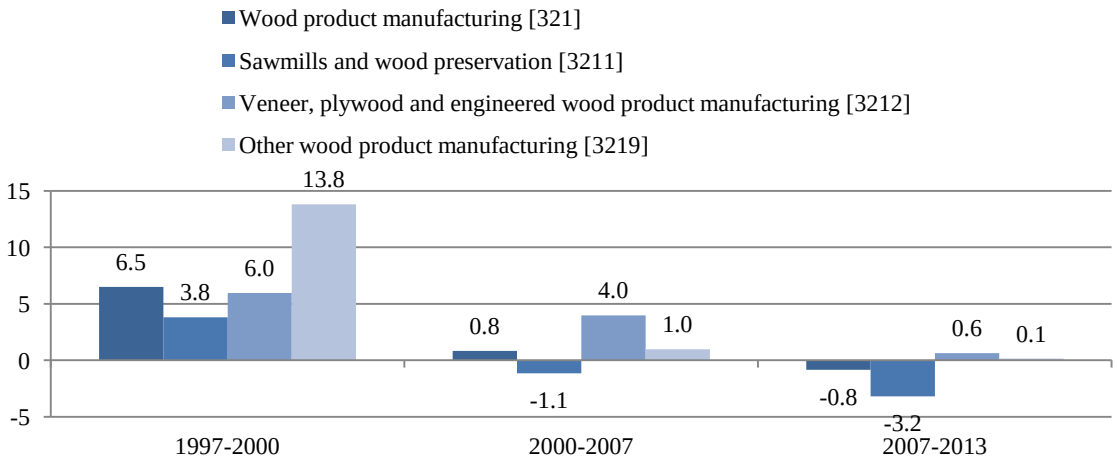
Negative growth between 2007 and 2013 was entirely due to sawmills and wood preservation, which saw real GDP decrease by 3.2 per cent per year (Chart 26). In contrast, veneer, plywood and engineered wood product manufacturing and other wood product manufacturing experienced slight increases in real GDP during this period. These differential growth rates at the four-digit NAICS industry level between 2007 and 2013 largely reflect how the three different industries were affected by the 2009 financial crisis. Output in sawmills and wood preservation was hit dramatically compared to the other two four-digit NAICS industries.

Surprisingly, the strong growth exhibited between 1997 and 2000 was driven by extremely strong growth in the other wood product manufacturing industry (13.8 per cent), while growth during the period between 2000 and 2007 was driven by the veneer, plywood and engineered wood product manufacturing industry. Clearly, the three industries have responded very differently to the context in which they are operating. The sawmills and wood preservation industry responded much more strongly to the economic crisis, while the two other wood product

manufacturing industries responded much more strongly to the growth-enhancing conditions of the late-1990s.

Unpacking the economic incentives that drove these different responses throughout these different time periods deserves serious consideration, especially in the mid- to late-2000s, given that the perfect storm may have had slightly differing effects by industry group: an appreciating Canadian dollar, the U.S. housing bust and increasingly competitive international markets should have affected each industry within wood product manufacturing, although the effects may not have been similar across all three industries within the industry group.

Chart 26: Real GDP, Wood Product Manufacturing, Quebec, Compound Average Annual Growth, 1997-2000



Source: CSLS calculations based on Statistics Canada data.

ii. Employment and Hours Worked

a. Employment

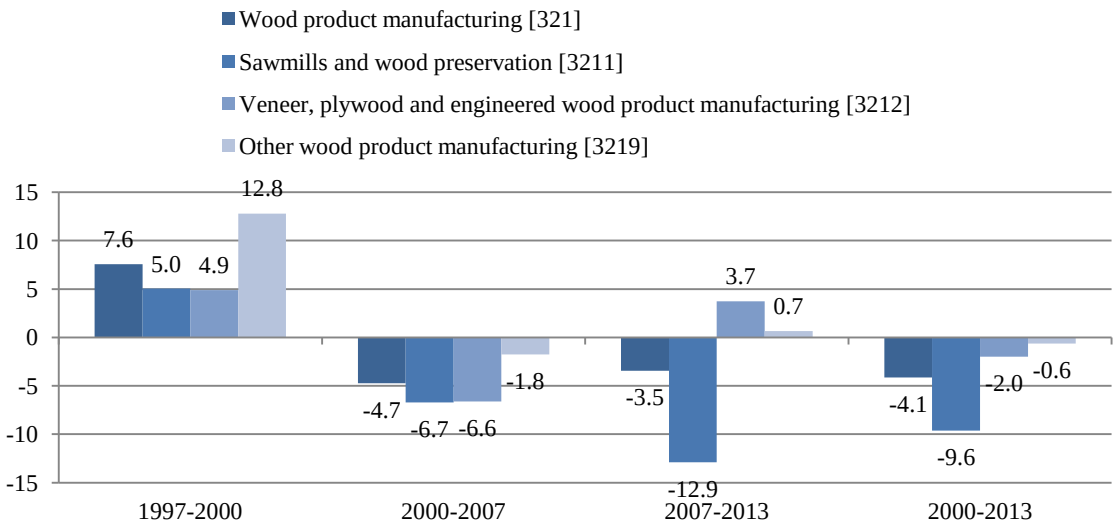
Between 2000 and 2013, employment in the wood product manufacturing industry declined by 4.15 per cent per year. This decline was concentrated quite heavily in the first part of the period, since employment declined by 4.7 per cent per year between 2000 and 2007. However, between 2007 and 2013, employment also declined quickly at 3.45 per cent per year (Chart 27).[38]

At the four-digit NAICS level, sawmills and wood preservation continually performed poorly compared to the other two industries, especially between 2000 and 2013, although veneer, plywood and engineered wood product manufacturing also demonstrated quite poor growth in the first two periods (1997-2000 and 2000-2007). However, employment in veneer, plywood and engineered wood product manufacturing actually experienced growth of 3.7 per cent per year between 2007 and 2013. In short, similar to real GDP, sawmills and wood preservation exhibited poor performance relative to its peer industries in terms of employment growth in most periods, while stronger employment growth in veneer, plywood and engineered wood product

[38] SEPH estimates of the number of workers and LFS estimates of the number of workers suggest similar trends.

manufacturing and other wood product manufacturing may reflect a number of factors, including their ability to adapt to demand conditions and innovate in the face of an evolving economic environment.

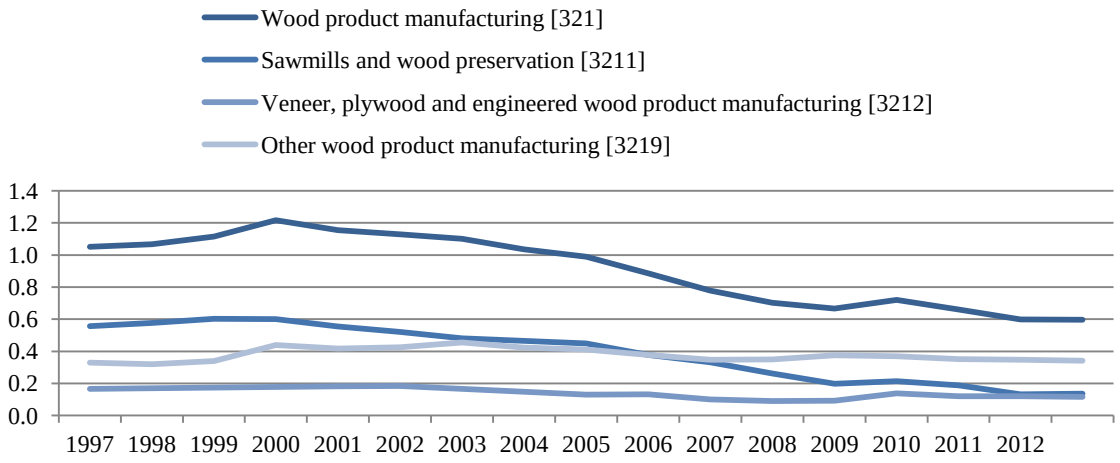
Chart 27: Employment, Canadian Productivity Accounts, Wood Product Manufacturing, Quebec, Compound Average Annual Growth, 1997-2013



Source: CSLS calculations based on Statistics Canada data.

Similar to forestry and logging, the wood product manufacturing industry has seen its share of total economy employment fall from 1.05 per cent in 1997 to 0.60 per cent in 2013, peaking at 1.22 per cent in 2000 (Chart 28). Declining economic importance in terms of employment is entirely concentrated in sawmills and wood preservation, which saw its share of total economy employment fall from 0.56 per cent in 1997 to 0.14 per cent in 2013. In contrast, veneer, plywood and engineered wood product manufacturing saw its share decline by a mere 0.05 percentage points between 1997 and 2013. An even starker contrast is presented by other wood product manufacturing, which saw its share of total economy employment increase between 1997 and 2013 (0.01 percentage points).

Chart 28: Share of Wood Product Manufacturing Employment in Total Economy Employment, Canadian Productivity Accounts, Quebec, 1997-2012



Source: CSLS calculations based on Statistics Canada data.

It is interesting to note that all three industries saw their employment shares peak in 2000, suggesting that the economic context in the late-1990s and early-2000s favoured employment in the wood product manufacturing industries.

b. Hours Worked

Hours worked in the wood product manufacturing industry followed a pattern very similar to hours worked in the total forest products sector. Between 1997 and 2000, hours worked increased 5.5 per cent per year (Table 17). In contrast, in 2000-2007 and 2007-2013, hours worked declined 5.1 per cent and 3.7 per cent, respectively.

Table 17: Hours Worked, Wood Product Manufacturing, Compound Average Annual Growth, Quebec, 1997-2013

	Forest products sector	Wood product manufacturing	Sawmills and wood preservation	Veneer, plywood and engineered wood product manufacturing	Other wood product manufacturing
1997-2000	--	5.54	3.65	2.22	10.14
2000-2007	-2.66	-5.13	-7.22	-6.65	-2.08
1997-2007					
2007-2013	-5.52	-3.74	-13.02	1.73	0.88
2000-2013	-4.61	-4.49	-9.94	-2.87	-0.73

Source: CSLS calculations based on Statistics Canada data.

At the four-digit NAICS level, hours worked showed patterns similar to those of real GDP: sawmills and wood preservation demonstrated negative growth post-2007 (-13.0 per cent per year), while veneer, plywood and engineered wood product manufacturing (1.7 per cent per year) and other wood product manufacturing (0.9 per cent per year) experienced positive growth (Table 17).

At the three-digit level, wood product manufacturing is becoming increasingly important in terms of hours worked in the forest products sector, increasing from 41.9 per cent of all hours worked in the forest products sector in 1997 to 47.0 per cent in 2013. Most of this recent growth came from other wood product manufacturing (12.8 per cent in 1997 to 27.5 per cent in 2013), with a smaller portion coming from veneer, plywood and engineered wood product manufacturing (1.6 percentage points between 1997 and 2013), while sawmills and wood preservation saw its share of wood product manufacturing hours worked decline from 22.3 per cent in 1997 to 11.1 per cent in 2013.

At the four-digit NAICS industry level, sawmills and wood preservation (52.8 per cent) and other wood product manufacturing (31.1 per cent) represented the largest shares of the total number of hours worked in the wood product manufacturing industry in 1997, while veneer, plywood and engineered wood product manufacturing represented the smallest portion by definition. In 2013, sawmills and wood preservation and other wood product manufacturing had opposite roles: sawmills and wood preservation represented only 23.3 per cent of all hours worked in wood product manufacturing, while other wood product manufacturing represented 58.5 per cent. If hours worked in sawmills and wood preservation continue their downward trend, it is likely that veneer, plywood and engineered wood product manufacturing could become the second most important source of hours worked in the wood product manufacturing sector.[39]

iii. Labour Productivity

Labour productivity in the wood product manufacturing industry displayed similar trends to the total forest products sector in the 21st century (Table 18). Since hours worked declined between 2000 and 2007 and between 2007 and 2013, while real GDP increased between 2000 and 2007 and decreased less than hours worked between 2007 and 2013, labour productivity increased in both periods.

At the four-digit NAICS industry level, labour productivity exhibited increases in all three industries: sawmills and wood preservation saw an increase of 8.7 per cent per year between 2000 and 2013; veneer, plywood and engineered wood product manufacturing saw an increase of 5.45 per cent per year between 2000 and 2013; and other wood product manufacturing saw an increase of 1.3 per cent per year between 2000 and 2013 (Table 18).

For sawmills and wood preservation, labour productivity growth was strongest between 2007 and 2013 (11.3 per cent per year), although it was also incredibly strong between 2000 and 2007 (6.55 per cent per year). In contrast, veneer, plywood and engineered wood product manufacturing and other wood product manufacturing saw their labour productivity growth entirely concentrated in the 2000 to 2007 period (11.4 per cent per year and 3.1 per cent per year respectively); their labour productivity growth was actually negative between 2007 and 2013 (1.1 per cent per year and 0.7 per cent per year). It is possible that since these sectors did not see falls in output to the same degree as sawmills and wood preservation, they were not forced to restructure.

[39] For more data on shares, see Table 2C in the Appendix Tables, available at www.csls.ca/res_reports.asp.

Table 18: Real GDP, Hours Worked and Labour Productivity, Quebec, Wood Product Manufacturing, Compound Average Annual Growth, 1997-2012

	Real GDP		Hours Worked		Labour Productivity	
	Forest products sector	Wood product manufacturing	Forest products sector	Wood product manufacturing	Forest products sector	Wood product manufacturing
1997-2000	5.82	6.51	--	5.54	--	0.92
2000-2007	-0.25	0.84	-3.82	-5.13	3.70	6.29
2007-2010	-3.80	-4.68	-5.29	-2.63	1.57	-2.10
2010-2013	-0.13	3.15	-5.76	-4.84	5.97	8.40
2007-2013	-1.98	-0.84	-5.52	-3.74	3.75	3.01
2000-2013	-1.06	0.06	-4.61	-4.49	3.73	4.76

	Real GDP			Hours Worked			Labour Productivity		
	Sawmills and wood preservation	Veneer, plywood and engineered wood product manufacturing	Other wood product manufacturing	Sawmills and wood preservation	Veneer, plywood and engineered wood product manufacturing	Other wood product manufacturing	Sawmills and wood preservation	Veneer, plywood and engineered wood product manufacturing	Other wood product manufacturing
97-00	3.81	5.96	13.81	3.65	2.22	10.14	-4.88	5.99	3.45
00-07	-1.14	3.98	0.97	-7.22	-6.65	-2.08	6.55	11.38	3.11
07-10	-8.48	-0.35	-3.78	-13.11	10.06	1.97	5.34	-9.46	-5.64
10-13	2.40	1.67	4.21	-12.94	-5.97	-0.21	17.62	8.12	4.43
07-13	-3.18	0.63	0.15	-13.02	1.73	0.88	11.32	-1.08	-0.72
00-13	-2.09	2.42	0.59	-9.94	-2.87	-0.73	8.73	5.45	1.32

Source: CSLS calculations based on Statistics Canada data.

D. Paper Manufacturing

Paper manufacturing (NAICS code 322) is a three-digit NAICS subsector in the forest products sector mainly engaged in manufacturing pulp, paper or paperboard. Paper manufacturing is composed of two four-digit NAICS industry groups: pulp, paper and paperboard mills (NAICS code 3221) and converted paper product manufacturing (NAICS code 3222). The pulp, paper and paperboard mills industry group includes establishments engaged in manufacturing pulp, paper or paperboard. Manufacturing pulp involves the separation of the cellulose fibres from the other impurities found in wood, used paper or other fibre sources, while manufacturing paper involves matting these fibres into a sheet. The converted paper product manufacturing industry group comprises establishments mainly concerned with manufacturing paper products from purchased paper and paperboard. Converted paper products are produced from paper and other materials by various cutting and shaping techniques. In 2010, there were 274 paper manufacturing establishments, of which 95 were pulp, paper and paperboard mills and 179 were converted paper product manufacturing mills. In 2007, there were 309 paper manufacturing establishments, while in 2004, there were 340.

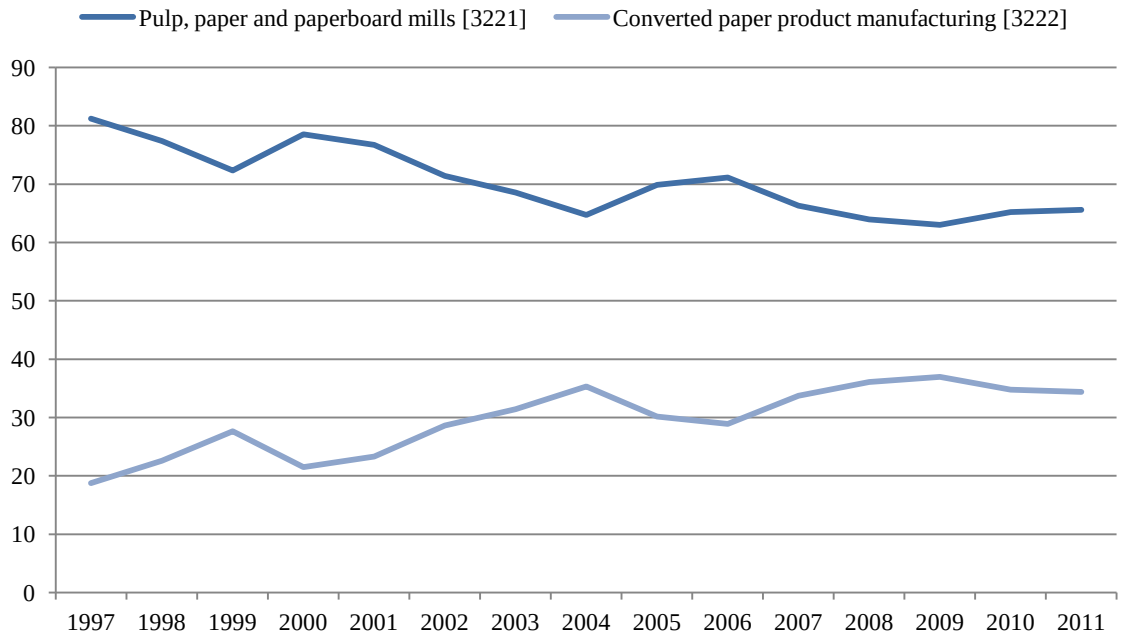
Table 19: Number of Establishments, Paper Manufacturing, Quebec, 2004-2010

	Paper manufacturing (322)	Pulp, paper and paperboard mills (3221)	Converted paper products manufacturing (3222)
2004	340	97	243
2005	327	109	218
2006	314	99	215
2007	309	94	215
2008	297	97	200
2009	291	100	191
2010	274	95	179

Source: Statistics Canada.

Since 1997, pulp, paper and paperboard mills have comprised 60-80 per cent of the total nominal GDP produced by the paper manufacturing sector, while converted paper product manufacturing has accounted for the remainder (Chart 29). However, the share of converted paper product manufacturing has been rising slowly and steadily to the detriment of the pulp, paper and paperboard mills industry. In particular, in 1997, pulp, paper and paperboard mills accounted for 81.2 per cent of paper manufacturing, while in 2011, it accounted for 65.6 per cent.

Chart 29: Breakdown of Nominal GDP in the Paper Manufacturing Sector, Quebec, 1997-2011



Source: CSLS calculations based on Statistics Canada data.

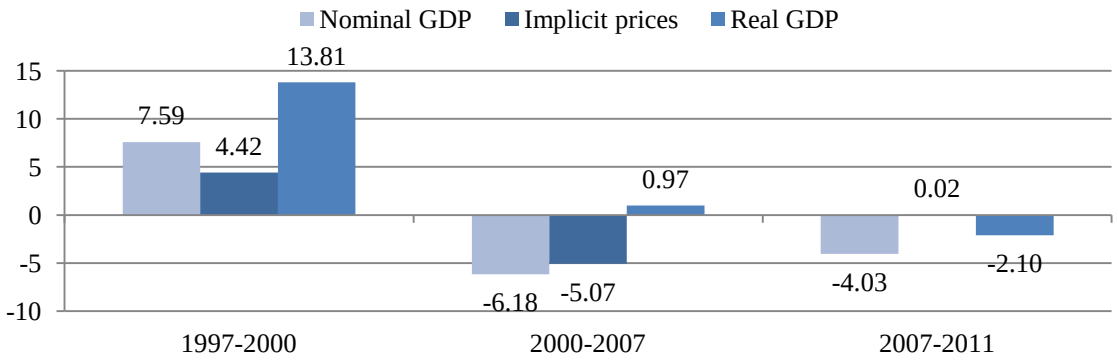
i. Output

a. Nominal GDP

Nominal GDP in the paper manufacturing subsector showed similar trends to the forest products sector as a whole: strong positive growth between 1997 and 2000 (7.6 per cent per year), and weak negative growth in 2000-2007 (-6.2 per cent per year) and 2007-2011 (-4.0 per cent per year) (Chart 30).

At the four-digit NAICS level, converted paper product manufacturing performed much more strongly than pulp, paper and paperboard mills in each period (Chart 30). Between 1997 and 2000, converted paper product manufacturing almost demonstrated double the nominal GDP growth rate of pulp, paper and paperboard mills (12.6 per cent per year versus 6.4 per cent per year). Between 2000 and 2007, growth in pulp, paper and paperboard mills (-1.4 per cent per year) was weaker and more negative than growth in converted paper product manufacturing (-0.3 per cent per year). However, between 2007 and 2011, nominal GDP in both sectors performed poorly, registering declines of -4.3 per cent per year and -3.55 per cent per year.

Chart 30: Nominal GDP, Implicit Prices and Real GDP, Paper Manufacturing, Compound Average Annual Growth, Quebec, 1997-2013

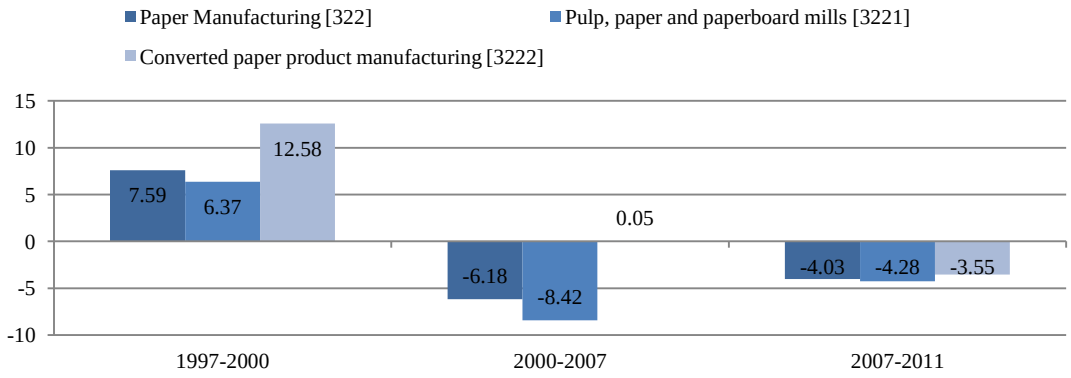


Source: CSLS calculations based on Statistics Canada data.

The share of paper manufacturing in nominal GDP manufacturing in Quebec has been falling and this is one of the main sources of the declining share of the forest products sector as a whole. Between 1997 and 2006, paper manufacturing saw its share of total economy nominal GDP fall from 2.2 per cent to 1.4 per cent. Between 2007 and 2011, the share of paper manufacturing in nominal total economy GDP fell from 1.1 per cent to 0.8 per cent.

At the four-digit NAICS level, both industries displayed trends similar to those of their parent industry group between 2007 and 2011. However, between 1997 and 2006, converted paper product manufacturing only saw the most marginal declines, from 0.42 per cent to 0.41 per cent. Hence, the entire fall in the share of paper manufacturing between 1997 and 2006 was driven by the falling economic importance of pulp, paper and paperboard mills, which saw its share of total economy nominal GDP nearly halve from 1.8 per cent in 1997 to 1.0 per cent in 2006. This declining share of pulp, paper and paperboard mills reflects the structural shift in the economy away from paper toward electronic media.[40]

Chart 31: Nominal GDP, Paper Manufacturing, Quebec, Compound Average Annual Growth, 1997-2011



Source: CSLS calculations based on Statistics Canada data.

[40] For more information on shares, see Table 1G in the Appendix Tables, available at www.csls.ca/res_reports.asp.

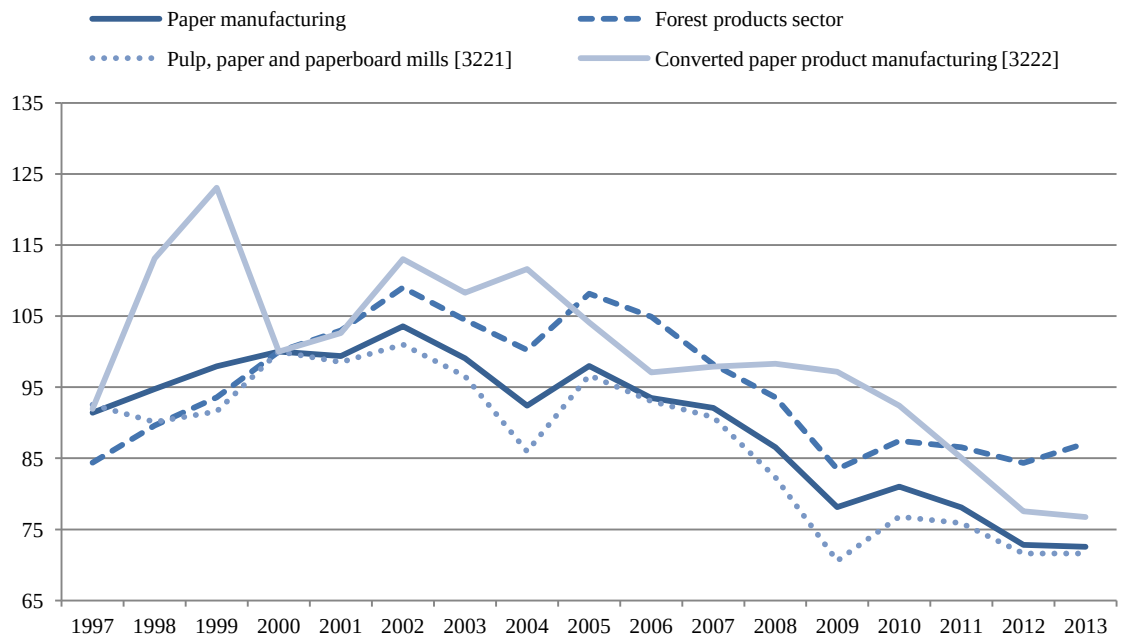
b. Prices

Prices, as measured by the implicit price index, in paper manufacturing displayed trends similar to those in the forest products sector between 1997 and 2006, but implicit prices in paper manufacturing actually increased after 2007, while they declined in the forest products sector as a whole (Chart 30). Between 1997 and 2000, prices increased by 4.42 per cent, indicating that nominal GDP understated real output growth. Between 2000 and 2007, the opposite occurred: prices declined (-5.1 per cent per year), so nominal GDP growth overstates real output growth. Interestingly, prices between 2007 and 2011 increased unlike in every other industry group within the forest products sector.

c. Real GDP

Real GDP in the paper manufacturing sector changed over time like that of the forest products sector as a whole, demonstrating positive growth between 1997 and 2000 and negative growth between 2000 and 2013 (Chart 32). In particular, real GDP grew at 3.0 per cent per year between 1997 and 2000, while it fell by 1.2 and 3.9 per cent per year in 2000-2007 and 2007-2013, respectively (Chart 30).

Chart 32: Real GDP, Paper Manufacturing, Quebec, 2000=100, 1997-2013



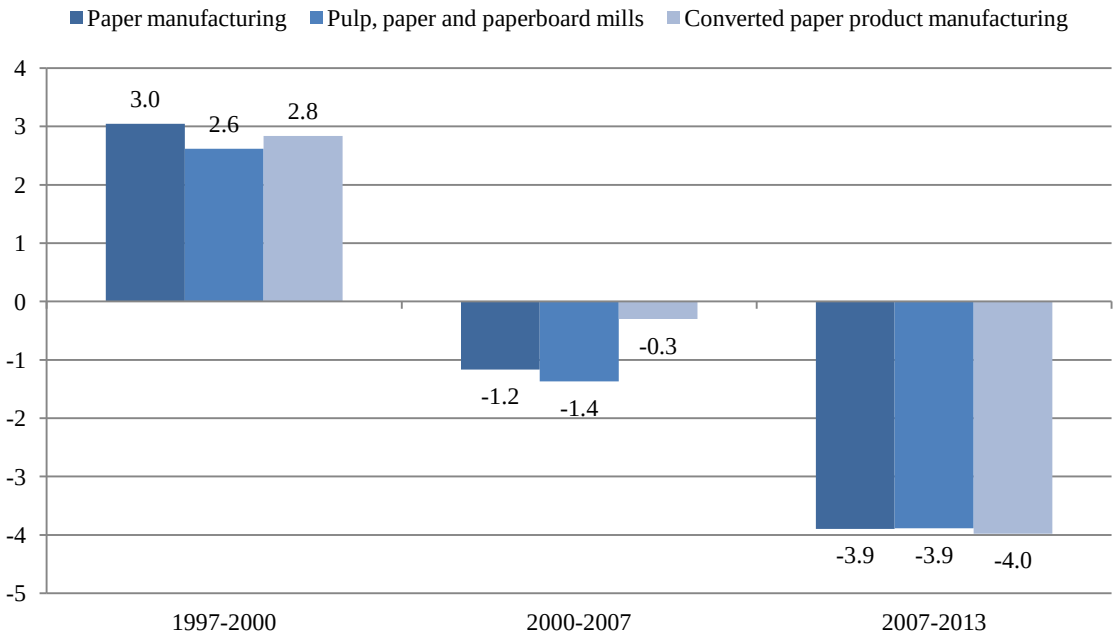
Source: CSLS calculations based on Statistics Canada data.

In contrast to many other sectors, the negative growth rate exhibited between 2007 and 2013 was not entirely caused by the financial crisis of 2008-2009. Real GDP did fall substantially in this year (-9.7 per cent), but poor performance is not limited to this economic crisis since paper manufacturing exhibited negative growth in almost every year between 2002 and 2013, excluding only 2005 and 2010. These negative growth rates, similar to nominal GDP,

are highly reflective of the structural shift away from paper toward electronic devices as well as increasing international competition in the market for paper products.

At the four-digit NAICS level, both industries (pulp, paper and paperboard manufacturing and converted paper product manufacturing) performed like the paper manufacturing sector as a whole (Chart 33). Neither industry performed better in all three periods, although converted paper product manufacturing did perform better than pulp, paper and paperboard mills between 2000 and 2007 (-0.3 per cent per year versus -1.4 per cent per year), while performing nearly identically to pulp, paper and paperboard mills between 2007 and 2013 (-4.0 per cent per year versus -3.9 per cent per year).

Chart 33: Real GDP, Paper Manufacturing Sector and Subsectors, Quebec, Compound Average Annual Growth, 1997-2013



Source: CSLS calculations based on Statistics Canada data.

ii. Employment and Hours Worked

a. Employment

Employment in the paper manufacturing sector behaved similarly to employment in the forest products sector as a whole, showing slightly positive growth between 1998 and 2000 (0.3 per cent per year), with negative growth of 1.7 per cent per year and 6.9 per cent per year in the two other periods (2000-2007 and 2007-2013) (Chart 34).[41]

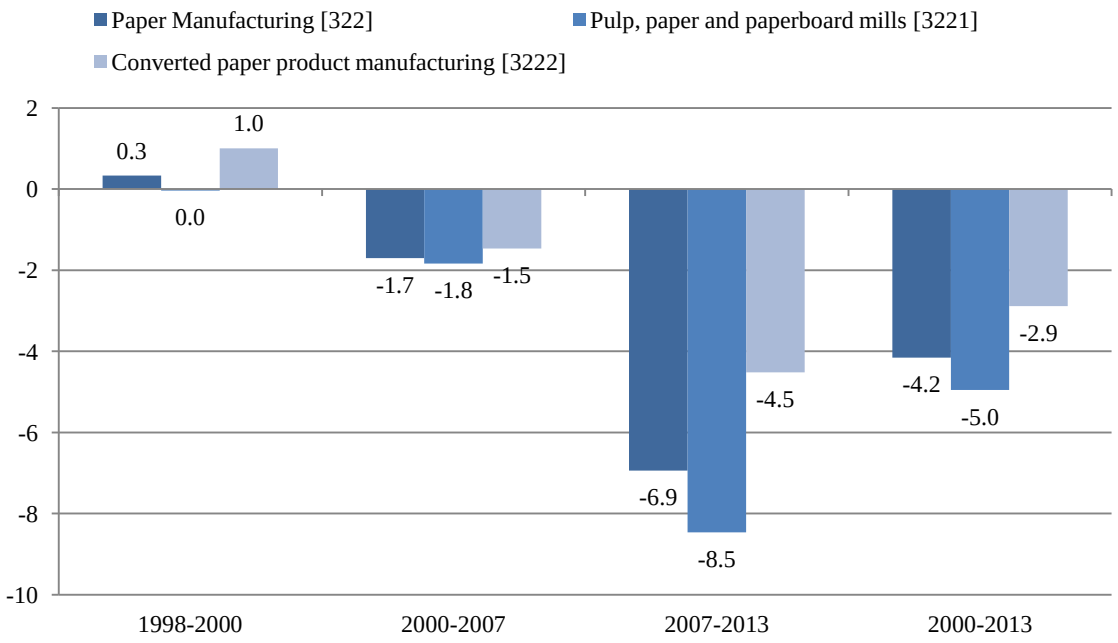
At the sub-sectoral level, pulp, paper and paperboard mills saw employment decline in all three periods, while converted paper product manufacturing experienced increases in

[41]SEPH and CPA numbers demonstrated similar trends.

employment between 1997 and 2000, only to decline between 2000 and 2007 and between 2007 and 2012 (Chart 34). Pulp, paper and paperboard mills demonstrated weaker employment performance between 2007 and 2013 than between 2000 and 2007; converted paper product manufacturing exhibited the same trend.

Like hours worked, paper manufacturing saw its economic importance as a source of employment for Quebec decline. In 1998, paper manufacturing represented 1.01 per cent of total economy employment, while in 2013 it represented only 0.47 per cent of total economy employment. This decline was seen relatively consistently throughout the entire period between 1998 and 2011, with a slight rebound in 2005. Nevertheless, this improvement was almost immediately reversed in the following year.

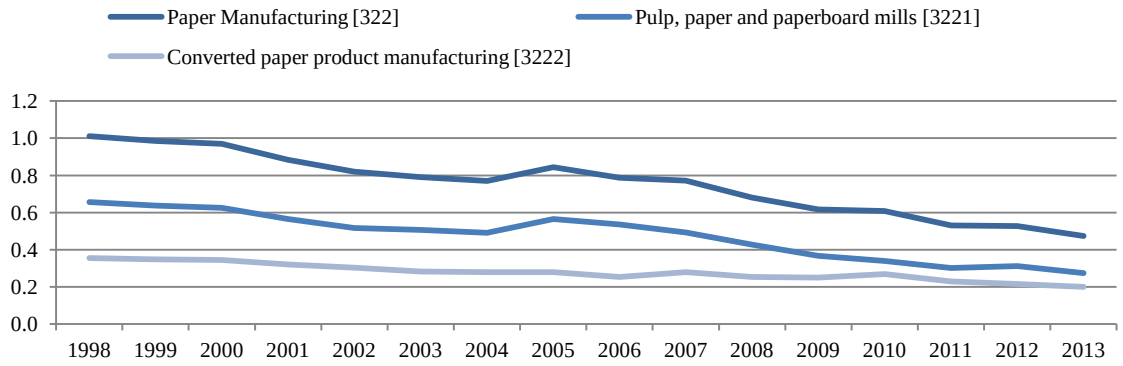
Chart 34: Employment, Paper Manufacturing, Compound Average Annual Growth, Quebec, 1997-2012



Source: CSLS calculations based on Statistics Canada data.

At the four-digit industry level, the trend demonstrated by paper manufacturing as a whole occurred almost identically in pulp, paper and paperboard mills (Chart 35). In particular, between 1998 and 2013, pulp, paper and paperboard mills decreased from 0.66 to 0.27 per cent of total economy employment. Converted paper product manufacturing also saw its share of total economy employment decrease, from 0.35 per cent in 1998 to 0.20 per cent in 2013. Unlike pulp, paper and paperboard mills (and paper manufacturing as a whole), converted paper product manufacturing did not show a slight rebound in 2005.

Chart 35: Share of Total Employment, Paper Manufacturing, Quebec, 1997-2013



Source: CSLS calculations based on Statistics Canada data.

b. Hours Worked

Hours worked in paper manufacturing were consistently declining in all three periods between 1998 and 2013 (Table 20). In particular, between 1998 and 2000, hours worked declined by 0.25 per cent per year, while they declined by 2.3 per cent per year between 2000 and 2007 and by 6.3 per cent year between 2007 and 2013.

At the four-digit NAICS industry level, pulp, paper and paperboard mills hours worked demonstrated similar patterns to the total paper manufacturing sector in all three periods. Converted paper products manufacturing, one of the industries within paper manufacturing, performed akin to the total forest products sector in two of the three periods, showing positive growth in hours worked between 1998 and 2000. These results suggest that pulp, paper and paperboard mills and converted paper product manufacturing were affected by entirely different economic conditions between 1998 and 2000, since their growth rates were divergent (pulp, paper and paperboard manufacturing always did worse), while in the following years, these two subsectors were similarly affected by their environment.

The economic importance of paper manufacturing in Quebec in terms of hours worked displays similar patterns to the economic importance of paper manufacturing in Quebec in terms of real GDP. Paper manufacturing as a whole saw its share of total economy hours worked fall from 1.11 per cent in 1997 to 0.55 per cent in 2013. The falling relative economic importance of paper manufacturing in Quebec in terms of hours worked occurred in both subsectors. Pulp, paper and paperboard mills saw its share fall from 0.72 per cent in 1997 to 0.32 per cent in 2013, while converted paper product manufacturing saw its share of hours worked halve between 1997 and 2013, falling from 0.39 per cent to 0.23 per cent.

These significant declines in hours worked as a share of total economy hours worked reflect the responses of paper manufacturing firms to the perfect storm that hit the industry in the mid- to late-2000s. All three industry groups that make up the forest products sector responded similarly by cutting hours worked to increase competitiveness and maintain sustenance until market conditions became favourable again. In this sense, paper manufacturing is not distinct from its peers: wood product manufacturing and forestry and logging. However, paper

manufacturing has had to weather an entirely different and much longer-term storm than its peers due to the structural shift from paper products to electronic media.

iii. Labour Productivity

Labour productivity growth in paper manufacturing has been less strong than in either forestry and logging or wood product manufacturing since 2000. Despite strong positive growth between 1998 and 2000 (3.0 per cent per year) and 2007 and 2013 (2.6 per cent per year), labour productivity growth was only average between 2000 and 2007 (1.2 per cent per year) (Table 20).

At the four-digit NAICS level, pulp, paper and paperboard manufacturing followed the pattern exhibited by its parent, paper manufacturing, while converted paper product manufacturing demonstrated peculiar trends. In particular, between 1997 and 2000, labour productivity growth was actually negative in this industry. This negative growth in converted paper product manufacturing was the result of stronger employment growth relative to real GDP growth.

Between 2000 and 2007, converted paper product manufacturing behaved similarly to the broader forest products sector as a whole by demonstrating positive labour productivity growth (1.2 per cent per year). However, unlike pulp, paper and paperboard mills, labour productivity growth was weaker (and barely above the total economy average of 0.6 per cent per year) between 2007 and 2013 (0.85 per cent per year).

Table 20: Real GDP, Hours Worked and Labour Productivity, Quebec, Compound Average Annual Growth, 1998-2013

	Real GDP			Hours Worked			Labour Productivity		
	Paper manufacturing	Pulp, paper and paperboard mills	Converted paper product manufacturing	Paper manufacturing	Pulp, paper and paperboard mills	Converted paper product manufacturing	Paper manufacturing	Pulp, paper and paperboard mills	Converted paper product manufacturing
1998-2000	2.74	5.34	-5.99	-0.25	-0.74	0.65	3.00	6.13	-6.60
2000-2007	-1.17	-1.37	-0.30	-2.30	-2.77	-1.47	1.16	1.44	1.19
2007-2013	-3.90	-3.88	-3.98	-6.34	-7.35	-4.79	2.61	3.74	0.85
2000-2013	-2.44	-2.54	-2.02	-4.18	-4.91	-3.02	1.82	2.49	1.03

Source: CSLS calculations based on Statistics Canada data.

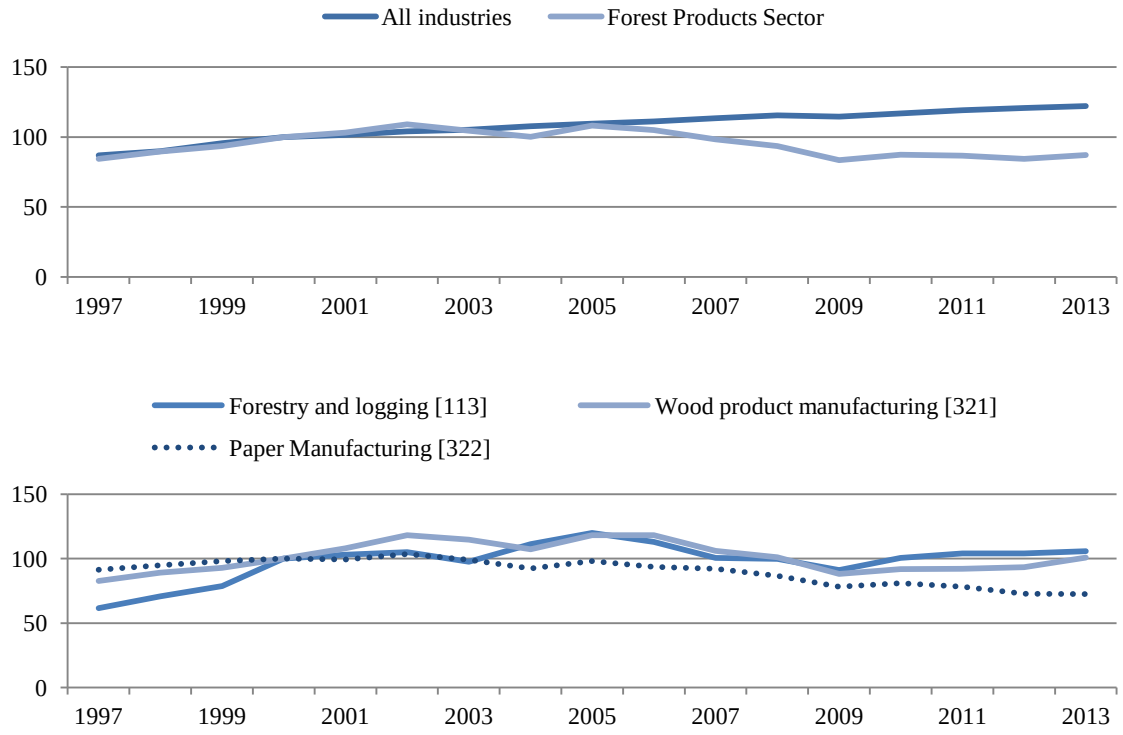
In summary, labour productivity growth may have been unsustainable throughout most of the period, but focusing on this observation ignores the necessary adjustments paper manufacturing firms undertook concerning employment and production, given the conditions that the paper manufacturing firms were facing. In short, paper manufacturing firms were shedding excess labour in order to survive in an extremely competitive and highly cyclical industry, resulting in positive labour productivity growth. In a way, Quebec's rapid employment response is exceptionally impressive since there is a general understanding that Quebec's work rules and stringent layoffs policies are much more inhibiting than those in other Canadian provinces.[42] To the degree that gains in productivity reflected a response to extreme adversity, these high productivity growth rates were likely a one-time occurrence.

[42] In Quebec, most forest products sector workers are in the manufacturing sector (data for unionization is only available at the two-digit NAICS industry level). In 2000, 41.7 per cent of workers in manufacturing were unionized

Hence, as previously mentioned, contrary to Verdoorn's law (Verdoorn, 1949), the paper manufacturing industry group (and the forest products sector as a whole) was able to display strong labour productivity growth when faced with small or declining output growth and declining employment. As previously suggested, the ability of the paper manufacturing firms (and firms in the entire forest products sector) to respond quickly and effectively to a poor macroeconomic environment is an asset that should not go unnoticed and merits further investigation.[43]

E. Summary

Chart 36: Real GDP in the Forest Products Sector, Quebec, 2000=100, 1997-2013



Source: CSLS calculations based on Statistics Canada data.

From 1997 to 2002, real output growth in the forest products sector in Quebec was robust averaging 5.3 per cent per year, above that of all industries (3.7 per cent per year). Between 2002 and 2006, real output growth in Quebec in the forest products sector was stagnant and slightly

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in Quebec, while only 34.2 per cent were unionized in manufacturing across Canada. By 2013, Canada's rate had declined to 26.6 per cent, while Quebec's rate had declined much less rapidly, to 36.8 per cent. To compare Quebec with another large forest products sector producing province, consider Ontario, where in 2000, only 31.1 per cent of workers were covered by a union. In 2013, this had dropped 10 per cent to 21.1 per cent. Clearly, Quebec's unionization rate is much higher than that in Canada as a whole and much higher than Ontario.

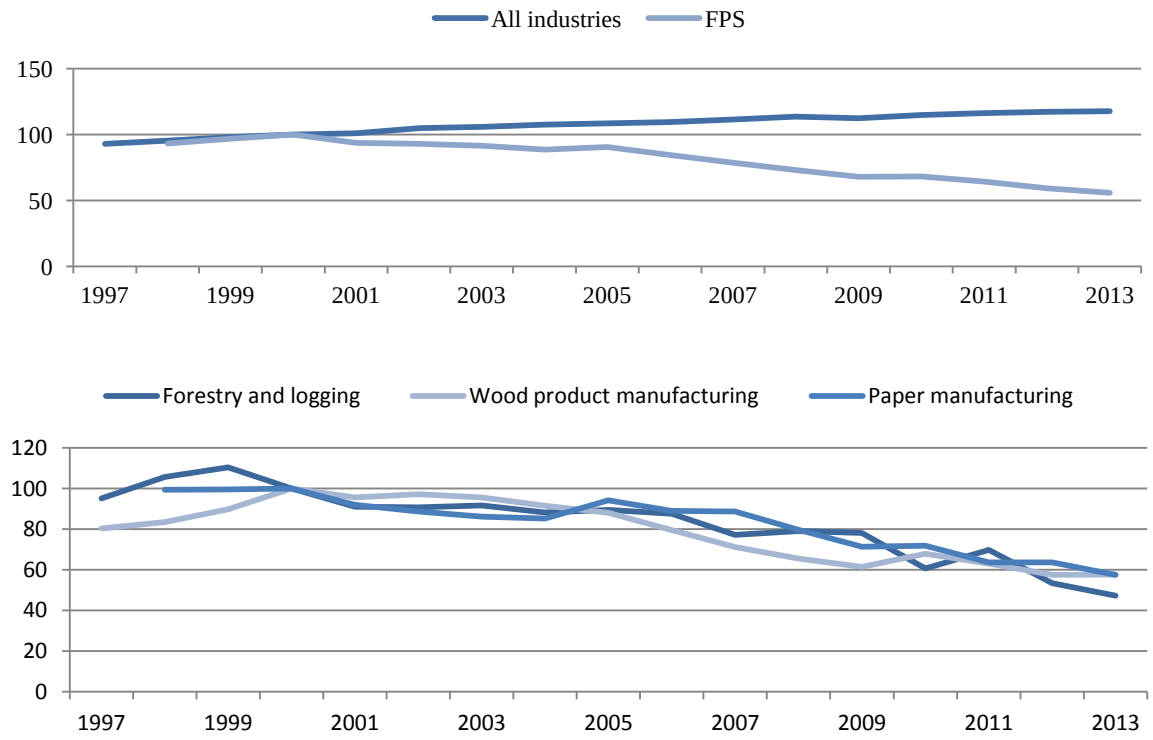
[43] Verdoorn's law is strongly visible in Ontario and discussed at great length in a recent paper published by the CSLS (2015), available at www.csls.cs/res_reports.asp. This report shows that recent declines in real output growth were associated with falling productivity levels in Ontario.

negative (-0.95 per cent per year). Between 2006 and 2009, real output growth fell precipitously (-7.3 per cent per year).

Interestingly, the peaks and troughs of the forest products sector do not align with those of all other industries. The forest products sector peaked in 2005, demonstrating strong growth of 8.2 per cent between 2000 and 2005. Between 2005 and 2009, it fell dramatically by 24.7 per cent, while after 2009, growth in the forest products sector resumed, albeit mildly, exhibiting 3.6 per cent over the four years between 2009 and 2013.

At the sub-sectoral level, forestry and logging and wood product manufacturing behaved similarly to the total forest products sector, although forestry and logging demonstrated much stronger growth than wood product manufacturing, while paper manufacturing demonstrated very mild growth in the early-2000s. Since growth deteriorated in the late-2000s, paper manufacturing actually saw real GDP fall below the levels seen in 1997, while forestry and logging and wood product manufacturing were able to maintain real GDP levels above those in 1997. In particular, between 2000 and 2005, real output grew 20.0 per cent in forestry and logging. It fell 28.8 per cent between 2005 and 2009. Between 2009 and 2013, forestry and logging resumed growth, registering 14.7 per cent over these four years. Wood product manufacturing showed a similar decline between 2005 and 2009 (30.0 per cent). Paper manufacturing was no different: -19.9 per cent between 2005 and 2009. However, paper manufacturing also saw negative growth between 2000 and 2005 (-2.0 per cent) and between 2009 and 2013 (-5.6 per cent).

Chart 37: Employment, Forest Products Sector, Quebec, 2000=100, 1997-2013

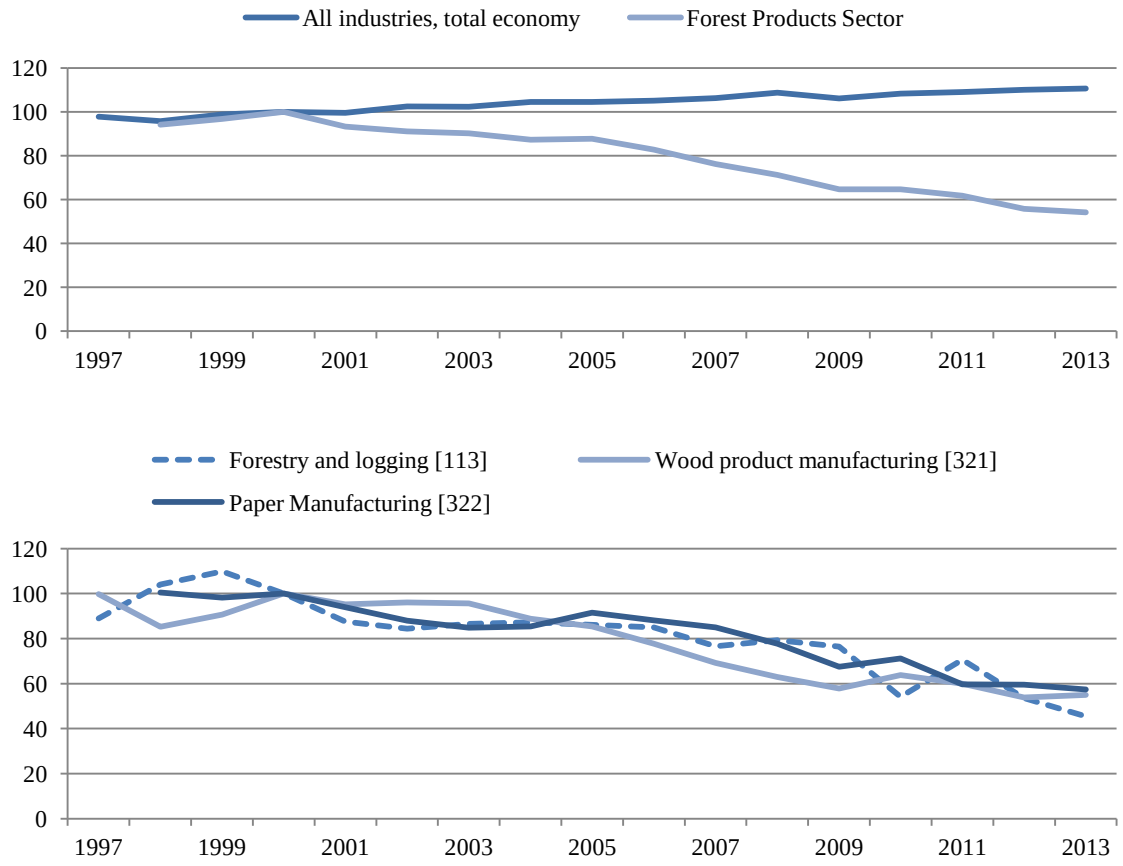


Source: CSLS calculations based on Statistics Canada data.

Employment growth, unlike real output growth, was negative in almost every period between 2000 and 2013 in every subsector. In aggregate, this resulted in employment levels in Quebec in 2013 that were 45.8 per cent lower than in 2000. At the sub-sectoral level, most of these declines were seen between 2005 and 2009.

In particular, forestry and logging saw employment fall 10.5 per cent between 2000 and 2005, 11.4 per cent between 2005 and 2009, and 30.8 per cent between 2009 and 2013, almost three times faster than in the previous two periods. Wood product manufacturing saw employment decline the most during the forest products sector's trough period (26.6 per cent between 2005 and 2009). The periods between 2000 and 2005 and 2009 and 2013 were more favourable, but still registered harsh employment cuts, with 11.9 per cent and 3.8 per cent declines each. Paper manufacturing behaved similarly to wood product manufacturing, with most cuts concentrated between 2005 and 2009 (22.9 per cent), although there were still strong declines between 2000 and 2005 (5.7 per cent) and 2009 and 2013 (13.8 per cent).

Chart 38: Hours Worked in the Forest Products Sector, Quebec, 2000=100, 1997-2013



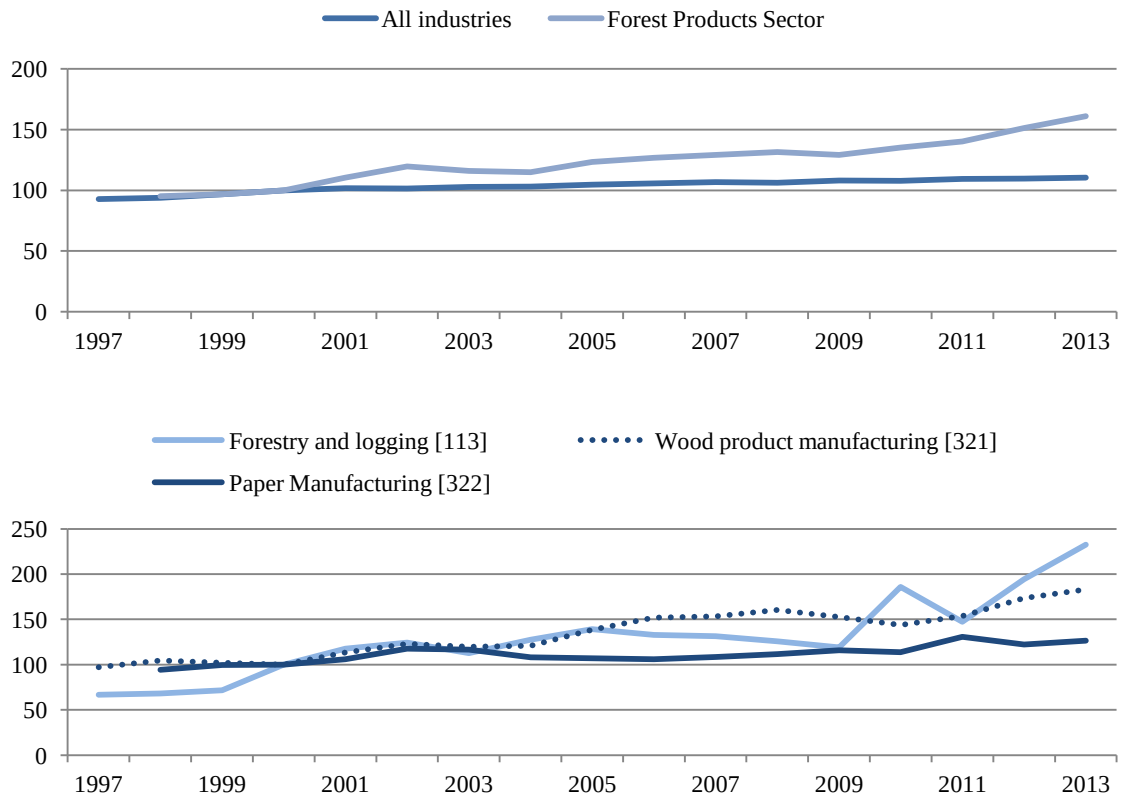
Source: CSLS calculations based on Statistics Canada data.

Since average hours worked per week remained essentially unchanged between 2000 and 2013, employment and hours worked display similar trends.

Hours worked in Quebec's forest products sector have been consistently declining since the turn of the century (Chart 39). In the late-1990s, there was a slight upward tick, but this was quickly turned around in the early 2000s. In contrast, hours worked in the total economy have been increasing since 1997 fairly steadily, excluding a minor decline in 2009. The growth in hours worked in the forest products sector in the late-1990s was a result of the favourable macroeconomic conditions at the time, while the downturn in hours worked in the early 21st century was a result of the perfect storm that hit the sector. Given such an extreme confluence of negative factors, the forest products sector as a whole demonstrate resilience; the ability to adjust hours worked rapidly in the face of economic distress has definitely proved an asset for industry vitality. Since the total economy was not as deeply affected by the perfect storm, hours worked continued to grow post-2000.

As a result of the trends in real GDP and hours worked discussed above, Quebec's labour productivity growth in the forest products sector actually outperformed the labour productivity growth of the total economy between 1997 and 2013 (Chart 39). By 2013, the forest products sector had increased labour productivity levels by nearly 70 per cent relative to 1998, while the total economy had only seen labour productivity levels increase by approximately 20 per cent. Hence, despite poor output growth after 2006 (resulting from weak demand and an unfavourable exchange rate), the forest products sector maintained strong labour productivity growth because of its ability to cut hours worked and reduce slack.

Chart 39: Labour Productivity in the Forest Products Sector, Quebec, 2000=100, 1997-2013



Source: CSLS calculations based on Statistics Canada data.

Since the forest products sector showed a peak in 2005 and a trough in 2009, it is no surprise that labour productivity growth was concentrated between 2000 and 2005 (23.4 per cent) and between 2009 and 2013 (31.7 per cent), although unlike Verdoorn's law, there was still labour productivity growth between 2005 and 2009 (5.8 per cent), stemming from the large employment cuts during this period in both wood product manufacturing and paper manufacturing.

Labour productivity growth at the sub-sectoral level largely follows this pattern. In forestry and logging, labour productivity grew 39.2 per cent between 2000 and 2005 and 113.3 per cent between 2009 and 2013. This stunning performance in the latter stemmed from the large employment falls and resumed real output growth. Unlike the forest products sector as a whole, forestry and logging actually saw labour productivity fall during the period after the peak (20.1 per cent).

Wood product manufacturing saw less stunning growth in the last period, but growth was still exemplary. In particular, labour productivity in wood product manufacturing grew 38.5 per cent between 2000 and 2005, 14.2 per cent between 2005 and 2009 and 30.5 per cent between 2009 and 2013. Most unlike Verdoorn's law, paper manufacturing registered positive productivity growth in every period, despite negative real output growth in every period. Specifically, labour productivity grew 7.1 per cent between 2000 and 2005, 8.6 per cent between 2005 and 2009 and 10.7 per cent between 2009 and 2013.

The factors driving the forest product sector's positive labour productivity growth despite negative real output growth will be examined in the next section.

IV. Factors and Drivers Explaining Productivity Development in the Forest Products Sector in Quebec, 2000-2013

This section of the report offers explanations for the productivity trends of the forest products sector in Quebec that were described in the previous section, namely that Quebec's forest products sector had the fastest labour productivity growth among the provinces for which data are available and the fastest labour productivity growth of any two-digit NAICS subsector in Quebec. More precisely, this section aims to explain the strong labour productivity growth in the forest products sector in Quebec after 2000, especially post-2007, despite the fall in output, which is normally associated with poor productivity growth. This section contains two subsections. The first subsection discusses the sources of productivity growth, while the second section discusses drivers of productivity growth. For a brief overview of the seven key drivers of productivity growth, see Harrison and Sharpe (2009:38).

After performing a brief exercise in growth accounting, which identifies the sources of productivity growth, the drivers, influences and explanations for the productivity growth in the forest products sector that are examined in this section include human capital and innovation, and the macroeconomic and microeconomic environments. Many aspects of innovation are discussed, including technological prowess and academic research, business enterprise research and development expenditures, research and development levels and intensity, research and development personnel levels and intensity, machinery and equipment levels and intensity, foreign direct investment, and the incidence of innovation. In terms of the macroeconomic environment, this report examines exports, which are influenced by prices and exchange rates, as well as income growth in the importing country and structural shifts. For the microeconomic environment, this report examines taxation, regulation and economies of scale.

A. Growth Accounting

Through a growth accounting methodology, labour productivity can be decomposed into changes resulting from capital intensity, labour composition, and multifactor productivity. Capital intensity is the amount of capital that each worker has at his or her disposal. In this report, capital intensity is measured as real capital stock (constant 2007 dollars) per hour worked. Multifactor productivity is a concept that captures all other sources of productivity change. It is the ratio of an index of output to combined labour and capital inputs. Labour composition is the ratio between labour input and hours worked, where labour input is obtained by aggregating hours worked across different categories of workers using hourly compensation as weights. Labour composition captures, very imperfectly, improvements in human capital.

During the period between 2000 and 2013, labour productivity in the forest products sector grew at a rate of 3.7 per cent per year, almost three percentage points faster than all industries in the Quebec economy (0.7 per cent per year) (Chart 40). The contribution of capital intensity was extremely small in the forest products sector (0.1 percentage points), while it was much larger in all industries (0.4 percentage points). When looking at the sources of productivity growth, the difference between the total economy and the forest products sector almost entirely lies with multifactor productivity, which contributed 3.6 percentage points to labour productivity growth in the forest products sector and 0.4 percentage points to labour productivity growth in all

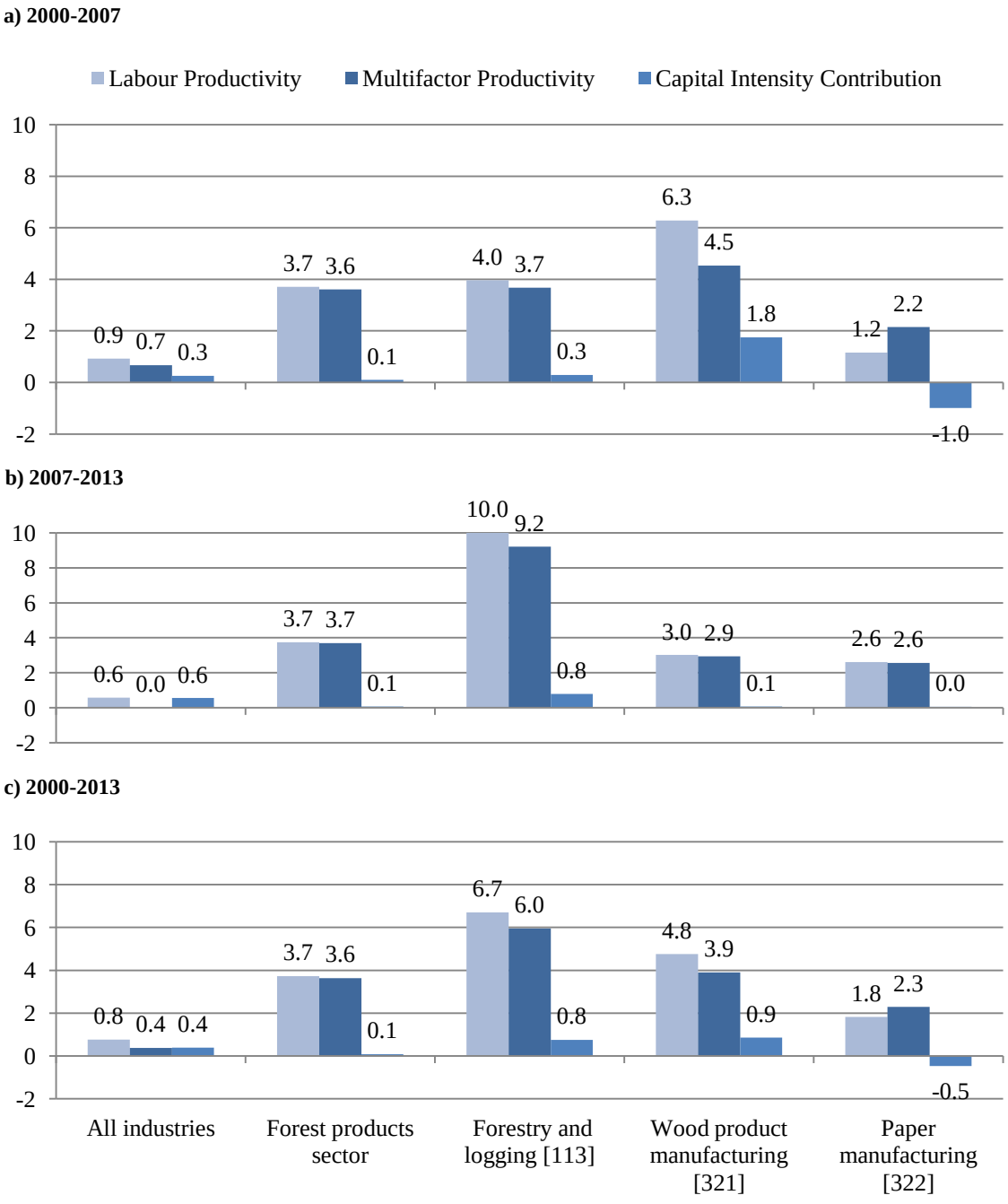
industries. The strong contribution from multifactor productivity growth is also obtained in all three forest products sector industry groups.

When broken down by period, these trends remain relatively similar at the level of the forest products sector as a whole, but there was substantial movement within the forest products sector, mainly seen in the wood product manufacturing industry group and the forestry and logging industry group. In particular, labour productivity growth in wood product manufacturing was strongly influenced by the period between 2000 and 2007 (6.3 per cent per year), since growth was weaker between 2007 and 2013 (3.0 per cent per year). Surprisingly, capital intensity contributed a substantial amount to labour productivity growth in wood product manufacturing in the period between 2000 and 2007 relative to its peers and to the total economy. However, this was sharply reversed in the period between 2007 and 2013. It is important to note that capital intensity growth is not coming from the addition of capital in this case; it is essentially coming from declining numbers of workers. In forestry and logging, the productivity gains followed the opposite time path: impressive labour productivity growth is seen between 2007 and 2013, while growth was slightly less strong (although still impressive) between 2000 and 2007. However, unlike the situation in wood product manufacturing, capital intensity contributed very little to total labour productivity growth in both periods.

In contrast to these two industry groups, paper manufacturing fit the overall picture exhibited by the forest products sector as a whole. A major source of labour productivity growth is multifactor productivity; between 2000 and 2007, the entirety of labour productivity growth derives from multifactor productivity, since capital intensity made a negative contribution to labour productivity growth in this period. Hence, despite falling hours worked, the massive decline in the capital stock caused capital intensity to fall in paper manufacturing between 2000 and 2013, resulting in negative contributions to labour productivity growth (-0.5 percentage points).[44]

[44] One possible explanation for this is that the industry closed older plants in which capital was less productive. There were many plant closures, and of course, the plants that were the least cost-efficient were most likely to be closed. It is quite possible that new machines were more productive without being more costly.

Chart 40: Sources of Labour Productivity Growth, Quebec, 2000-2013[45]



Source: CSLS calculations based on Statistics Canada data.[46]

[45] The estimates of multifactor productivity growth obtained in this paper are inconsistent with Statistics Canada estimates because capital services are not accounted for in the CSLS estimates, while they are accounted for in the Statistics Canada estimates. Capital services are not accounted for because they are not available at the three-digit NAICS industry level.

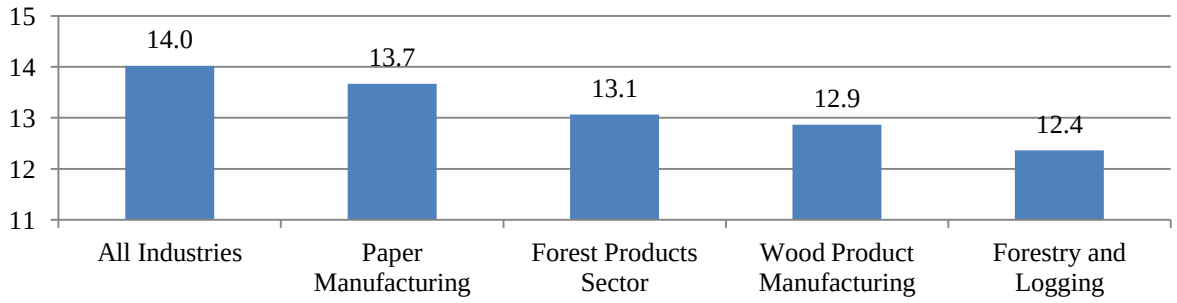
[46] Capital and labour compensation can only be calculated until 2011. However, this report applies the average capital and labour compensation between 2000 and 2011 to the period between 2000 and 2013, as capital and labour compensation are extremely steady variables.

In summary, it is clear that multifactor productivity growth was the main source of labour productivity growth in the forest products sector. This is not surprising, given the weakness of investment, and hence capital stock growth, in the sector.[47] Unfortunately, because multifactor productivity growth, a residual, is affected by many factors, this finding alone provides little insight into the drivers or determinants of the strong labour productivity experienced in the sector since 2000.

B. Human Capital

Human capital is important for labour productivity growth and its contribution is estimated in growth accounting exercises when data permit. Unfortunately, data on years of educational attainment at the three-digit NAICS level by province are not readily available. Fortunately, the distribution of workers by educational attainment is available at the provincial level and estimates of the average years of schooling of workers in the three forest products industries and in the overall sector at the national level have been generated by De Avillez (2014) (Chart 40).

Chart 41: Average Years of Schooling for Workers in the Forest Products Sector, Canada, 2012



Source: CSLS calculations based on Statistics Canada data.

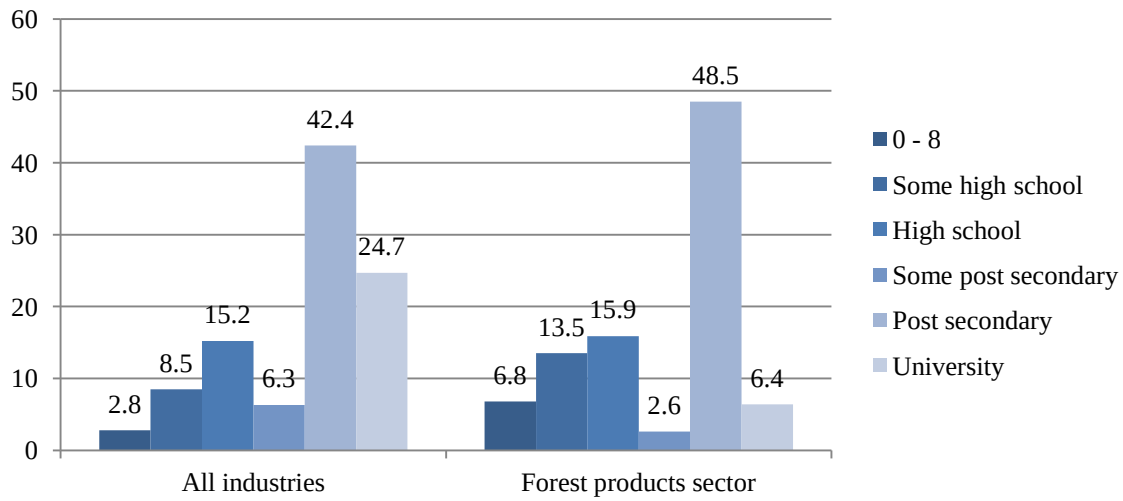
The results presented in De Avillez (2014) for educational attainment and average years of schooling likely reflect provincial trends to a great degree, since it is difficult to imagine substantial differences between the educational attainment of the workforce at the provincial level in any given sector. Essentially, workers in the Canadian forest products sector had almost one full year of education less than the average Canadian worker in the total economy. This difference is mainly derived from forestry and logging and wood product manufacturing, since a worker in paper manufacturing had almost the same level of education as the average Canadian worker.

De Avillez (2014) also notes that, much like in other industries and the total economy, the average level of schooling in the forest products sector has been on the rise over the past few decades. Even so, the overall education gap between forest products sector workers in Canada and the total economy has remained relatively stable.[48]

[47] To be discussed in an upcoming section.

[48] To some extent, the lower level of schooling in the forest products sector may reflect the fact that workers in the forest products sectors are more likely to have trades certificates than the average Canadian worker because of the occupational make-up of the sector. Although the level of schooling in the sector in terms of years of schooling may

Chart 42: Educational Attainment, All Industries and Forest Products Sector, Quebec, 2013



Source: CSLS calculations based on Statistics Canada data.

When the workforce is broken down by educational attainment, the forest products sector has a higher proportion of workers with 0 to 8 years of education, less than high school and high school, while it has a lower proportion of workers with some post-secondary or a university degree, which follows from the lower average educational attainment (Chart 41). Surprisingly, however, the forest products sector has a higher proportion of workers with a post secondary certificate or diploma. According to De Avillez (2014), these observations in Quebec are consistent with those are the national level in 2012. The only sector within the forest products sector to demonstrate a different pattern than the forest products sector as a whole was paper manufacturing, which had a higher proportion of workers with a high school diploma than the total economy. This result is not surprising given that average years of schooling in this sector were much higher than in the other two sectors at the national level.

Chart 43: Educational Attainment, All Industries and Forest Products Sector, Quebec, 2013

	0 - 8	Some high school	High school	Some post secondary	Post secondary	University
All industries	2.8	8.5	15.2	6.3	42.4	24.7
Forest products sector	6.8	13.5	15.9	2.6	48.5	6.4
Forestry and logging	20.6	23.7		5.1	38.1	
Wood product manufacturing	7.7	19.9	15.9		45.7	4.3
Paper manufacturing			22.3		56.7	14.6

Source: CSLS calculations based on Statistics Canada data.

In an earlier study of the forest products sector at the national level (De Avillez, 2014), the contribution of labour composition to total labour productivity growth was also examined. Unfortunately, due to data restrictions, the contribution of labour composition to labour productivity growth at the provincial level could not be estimated. It is likely that national results

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be lower than in other sectors, that is not necessarily a bad thing with respect to productivity growth. What is most important is that the workforce is fitted with the skills needed by the sector.

are suggestive for the provincial level, as there is probably not a large distinction between provinces in the educational attainment of forest products sector workers. Hence, national level results will be presented here.

De Avillez (2014) found that the contribution of labour composition to labour productivity growth is quite small in most cases (0.2 percentage points in the forest products sector as a whole, and 0.0-0.1 percentage points in wood product manufacturing and forestry and logging for 2000-2012). The only exception was paper manufacturing, which saw slightly larger contributions from labour composition (0.5-0.6 percentage points) between 2000 and 2012. Labour composition made a greater contribution to paper manufacturing than to the business sector (0.4 percentage points between 2000 and 2012). Since Quebec has a higher proportion of paper manufacturing, and educational attainment improved more in this sub-sector than in the other two, the contribution of labour composition to labour productivity growth in the forest products sector may be somewhat higher than in Canada as a whole.

Clearly, human capital is an important source of productivity growth for any industry, and most likely this is also the case in the forest products sector. In the forest products sector, there is evidence that the workforce is becoming increasingly educated over time. However, there is no evidence that superior productivity growth in the forest products sector in Canada is due to faster growth in human capital. Quite simply, as shown by the growth accounting analysis in De Avillez (2014), changes in labour composition, i.e., an increase in the educational attainment of forest products sector workers, only played a small role in overall labour productivity growth at the national level.[49]

C. Innovation

De Avillez (2014) outlines the approach to understanding and analyzing innovation in the forest products sector at the national level. This section examines some of these innovation indicators at the provincial level.

i. Technological Prowess and Academic Research

One of the sources used in De Avillez (2014) to measure the state of innovation in the forest products sector was the *State of Science and Technology in Canada*, a large scale survey conducted by the Council of Canadian Academies concerning the overall direction and trend of

[49] Labour shortages can affect productivity when workers in the sector have to be hired that have a lower educational attainment than would be optimal. In contrast to educational attainment, labour shortages tend to be extremely different across provinces. Luckily, Employment and Social Development Canada (ESDC) has studied recent labour market shortages and has provided the following assessment to the CSLS. In the ESDC's forthcoming study, of all the occupations in the forest products sector, there was not a single occupation demonstrating a shortage and there was one occupation demonstrating a surplus (labourers in wood, pulp and paper processing). All of the other occupations were balanced. The results presented by ESDC in their forthcoming study at the provincial level are preliminary, but they differ from De Avillez (2014) at the national level. De Avillez (2014) suggests that the forest products sector is indeed facing skill shortage problems, especially in the paper manufacturing sector, which is almost the complete reverse of the results provided by ESDC. In summary, there is no evidence of skill shortages in Quebec; there may even be surpluses, which means that labour productivity growth in the forest products sector in Quebec was likely unaffected by skill shortages.

science and technology in a number of different areas. The assessment undertaken in 2012 notes that there has been a decline in the output and impact of Canadian forestry research between the 1999-2004 and 2005-2010 periods when compared to the rest of the world. However, it also notes that "Canada's forestry research was ranked second in the world by top-cited researchers and that Canada accounts for over ten per cent of the world's papers in this subfield" (Council of Canadian Academies, 2012:164). The survey does not provide provincial level assessments, but it can be expected that, although research in forestry in Quebec has probably been declining in recent years relative to the rest of the world, the research being undertaken still comprises a large portion of the papers published in the subfield (assuming a more or less uniform distribution of publications at the provincial level in Canada).

ii. Business Enterprise Research and Development Expenditures

Another indicator of innovation is business enterprise research and development, since more research and development in principle quickens the pace of technological change and consequently, boosts labour productivity growth. This section examines business enterprise research and development (BERD) expenditures in the forest products sector and its subsectors throughout the 2000-2012 period.[50] Unfortunately, due to data restrictions at the provincial level (mainly in forestry and logging) there is little insight to be gleaned at the aggregate level of the forest products sector.

In 2011, firms in the forest products sector in Quebec spent $130 million in research and development, down from $215 million in 2007 (Table 21). Paper manufacturing research and development accounted for 70.0 per cent of total BERD in the forest products sector, with wood product manufacturing responsible for 28.5 per cent in 2011. Forestry and logging was trailing, representing 1.5 per cent of total forest products sector BERD.

Forestry and logging in Quebec has consistently represented the smallest proportion of BERD spending in the forest products sector. Paper manufacturing has tended to represent the largest portion, but there have been years in which BERD spending in wood product manufacturing has outpaced paper manufacturing, namely 2008 and 2009. Wood product manufacturing actually reached a BERD expenditure peak in 2008 ($68 million), but this high level of BERD spending has precipitously dropped since then, falling to $15 million in 2012. Between 2007 and 2012, this translated into a compound average annual growth rate of -21.1 per cent. It is interesting to note that BERD spending in paper manufacturing and in wood product manufacturing showed divergent trends in terms of averages between 2000 and 2007 and 2007 and 2012: paper manufacturing saw spending fall by over $100 million, while wood product manufacturing saw spending rise by $8 million.

[50] 2012 is the latest year for which data are available.

Table 21: Business Enterprise Expenditures in Research and Development in the Forest Products Sector, Quebec, 2000-2012

a) Millions, Current Dollars	All industries	Forestry and logging	Wood product manufacturing	Paper manufacturing
Annual Levels				
2000	3,642	..	..	157
2001	4,157	..	23	229
2002	4,153	..	..	252
2003	4,174	..	34	239
2004	4,326	..	..	208
2005	4,170	..	40	179
2006	4,830	..	51	298
2007	4,881	10	49	156
2008	4,794	11	68	64
2009	4,757	2	54	31
2010	4,764	..	43	83
2011	4,869	2	37	91
2012	4,692	..	15	84
Period Averages				
2000-2007	4,292	10	39	215
2007-2012	4,793	6	44	85
2000-2012	4,478	6	41	159

b) Compound Average Annual Growth	All industries	Forestry and logging	Wood product manufacturing	Paper manufacturing
2000-2007	4.27	..	..	-0.1
2007-2012	-0.79	..	-21.1	-11.7
2000-2012	2.13	..	..	-5.1

Source: Statistics Canada and CSLS calculations based on Statistics Canada data.

Between 2000 and 2007, average BERD expenditures were highest in paper manufacturing at $215 million, while this average expenditure level fell to $85 million between 2007 and 2012. Forestry and logging saw average BERD expenditures fall between these two periods as well, from $10 million to $6 million. In contrast, wood product manufacturing saw average BERD expenditures rise between these two periods: $39 million between 2000 and 2007 and $44 million between 2007 and 2013.

Since data at the provincial level are suppressed for certain sub-components of the forest products sector for confidentiality reasons, it is difficult to analyze the trend of BERD spending based on compound average annual growth rates. The only subsector for which this is consistently possible is paper manufacturing. The data that are available suggest that BERD expenditures were drastically reduced in all industry groups as the forest products sector was hit hard during the financial crisis. The forest products sector as a whole saw the level of BERD spending fall by 40 per cent in one year alone (2009).

The recovery in R&D spending since the recession has been virtually non-existent in forestry and logging, with expenditures in 2011 exactly equal to expenditures in 2009 ($2 million). There has been no recovery in wood product manufacturing, since expenditure figures have continued to fall since the financial crisis. Paper manufacturing, on the other hand, has presented a different story, since expenditure levels have nearly tripled in three years from the

abnormal low of $31 million in 2009, although in 2012 the level was well below that of the early 2000s.

To the degree that multifactor productivity (MFP) is determined by R&D, these data suggest that MFP should be stronger in paper manufacturing in recent years, while it should be weaker in both wood product manufacturing and forestry and logging, due to the trends in research and development levels. However there is no direct link between MFP and R&D. Indeed, one could comment that the strong MFP growth in recent years was not driven by rapid technological change coming from R&D. However, if there is a link between R&D and MFP, there tends to be a long lag. Thus, it is possible that the high levels of investment in paper manufacturing in the early-2000s were driving productivity growth in the late-2000s. If this is the case, then the low BERD spending in the late-2000s does not bode well for encouraging and driving productivity in next decade. In addition, it is also important to note that Quebec benefits from R&D investment done in the rest of Canada and internationally, which weakens the direct link between R&D investment in Quebec and productivity growth in Quebec.

Research by companies may be wide-ranging and application of the findings does not necessarily increase labour productivity. Research in the forest products sector has focused on such things as developing new applications of wood fibre, maximizing use of what is taken out of the forest, sound environmental practice, recycling materials used in pulp making, economizing on energy, and generating energy in-house. This work may have contributed to the development of new markets for forest products and saved energy and material inputs, which may have subsequently boosted industry output and improved competitiveness without necessarily contributing to improved labour productivity.

The Quebec Forest Industry Council (2010) corroborates the view of declining research and development. According to their report, firms in the forest products sector had to cut costs or shut down. Hence, investment in research was estimated to be only 0.55 per cent of revenue, a huge decline from the beginning of the decade. Returning to 1.2-2.0 per cent would be positive in both wood products and paper products. The Quebec Forestry Industry Council (2010:15) believes that this is particularly important if the industry wants to drive its transformation with innovation.

iii. Research and Development Intensity

Research and development intensity is defined as the share of BERD expenditures in nominal GDP. This is an important indicator of innovation performance. Once again, due to limited data at the provincial level concerning BERD, it is difficult to determine the trend of research and development intensity over time at the aggregate level. In 2011, BERD expenditures were 2.45 per cent of nominal output in the forest products sector (Table 22). In 2007, BERD expenditures were 3.28 per cent of nominal output. The falling share of BERD expenditures results from growth of nominal GDP and a reduction in BERD expenditures in recent years (mostly the latter).

At the level of the industry groups, the declining share of BERD expenditures is most apparent in forestry and logging, as BERD expenditures have not yet begun to rebound from the

crisis, while nominal output started rebounding quite quickly (in every industry group, nominal GDP regained the levels seen in 2008 by 2010, excluding forestry and logging, which only saw a full recovery by 2011). Wood product manufacturing has seen large swings in research and development intensity, but compared to the early-2000s, the level of BERD expenditures relative to nominal output is, perhaps surprisingly, much higher (2.1 per cent versus 0.7 per cent). Paper manufacturing has seen its R&D intensity rebound after a large drop in 2008 and 2009 (falling 3.85 percentage points between 2007 and 2009). Research and development intensity has partially recovered in this subsector, reaching 3.44 per cent in 2011. Despite recent improvements, this level is nowhere near the peak of 7.9 per cent in 2006. Compared to all industries, R&D intensity was higher in wood product manufacturing and paper manufacturing, especially high in the case of paper manufacturing.

Table 22: Research and Development Intensity in the Forest Products Sector, Quebec, 2000-2011

	All industries	Forest products sector	Forestry and logging	Wood product manufacturing	Paper manufacturing
Annual Levels					
2000	1.74				3.22
2001	1.93			0.70	4.49
2002	1.86				5.72
2003	1.79			1.04	6.47
2004	1.77				6.02
2005	1.65			1.18	4.54
2006	1.83			1.76	7.90
2007	1.71	3.28	1.15	1.91	5.00
2008	1.63	2.30	1.30	2.94	2.10
2009	1.61	1.66	0.24	3.15	1.15
2010	1.54			2.31	2.85
2011	1.51	2.45	0.23	2.06	3.44
Period Averages					
2000-2007	1.79	3.28	1.15	1.32	5.42
2007-2011	1.60	2.42	0.73	2.47	2.91
2000-2011	1.71	2.42	0.73	1.89	4.41

Source: CSLS calculations based on Statistics Canada data.

In summary, all three industry groups in the forest products sector are showing low BERD expenditures compared to the mid-2000s, prior to the financial crisis. BERD expenditure levels are actually down more in absolute terms than in terms of intensity due to falls in nominal output between 2008 and 2009, which is not surprising in light of the recession. This means that the industry groups should make investments in innovative technologies in order to take advantage of any future commodity supercycle or potentially improving macroeconomic conditions. However, when compared to all industries in the Quebec economy, BERD spending as a share of nominal output is quite impressive.

Hence, low R&D intensity compared to the mid-2000s suggests that recent high rates of multifactor productivity growth are not coming from innovation in forestry and logging and wood product manufacturing; while the higher levels seen in the mid-2000s may explain the high level of labour productivity growth seen during this period. Paper manufacturing, on the other hand, is just a stronger case than the other two industry groups. It may have had some multifactor productivity growth resulting from research and development in both periods, but it is unlikely

that R&D explains the majority of the recent strong multifactor and labour productivity growth, especially in recent years.[51]

iv. Research and Development Personnel Level and Intensity

Research and development personnel intensity is defined here as the number of research and development personnel per one thousand workers in the sector. It is an important indicator of an industry's ability to innovate.[52]

In 2000, there were 1,370 research and development personnel in the forest products sector, but by 2012, this number had nearly halved to 635. This decline was driven by forestry and logging and by paper manufacturing, which saw declines from 91 to 34 and from 778 to 360, respectively, between 2000 and 2012. All three of the sectors of which forest products is composed reached a peak level of research and development personnel in 2007 or 2008, and all of them saw this level decline by nearly half in one year (2008 or 2009).

Table 23: Research and Development Personnel, Forest Products Sector, Quebec, 2000-2012

	Forest products sector	Forestry and logging	Wood product manufacturing	Paper manufacturing
Annual Levels				
2000			267	778
2001	1,370	91	295	984
2002	1,496	118	393	985
2003	1,606	147	491	968
2004	1,504	134	487	883
2005	1,521	127	523	871
2006	1,615	158	585	872
2007	1,778	150	627	1,001
2008	1,709	190	947	572
2009	789	81	457	251
2010	827	63	371	393
2011	798	52	321	425
2012	635	34	241	360
Period Averages				
2000-2007	1,556	132	459	918
2007-2012	1,089	95	494	500
2000-2012	1,304	112	462	719
Compound Average Annual Growth				
2000-2007	--	--	12.97	3.67
2007-2012	18.61	25.68	17.41	18.50
2000-2012	--	--	-0.85	-6.22

Source: Statistics Canada and CSLS calculations based on Statistics Canada data.

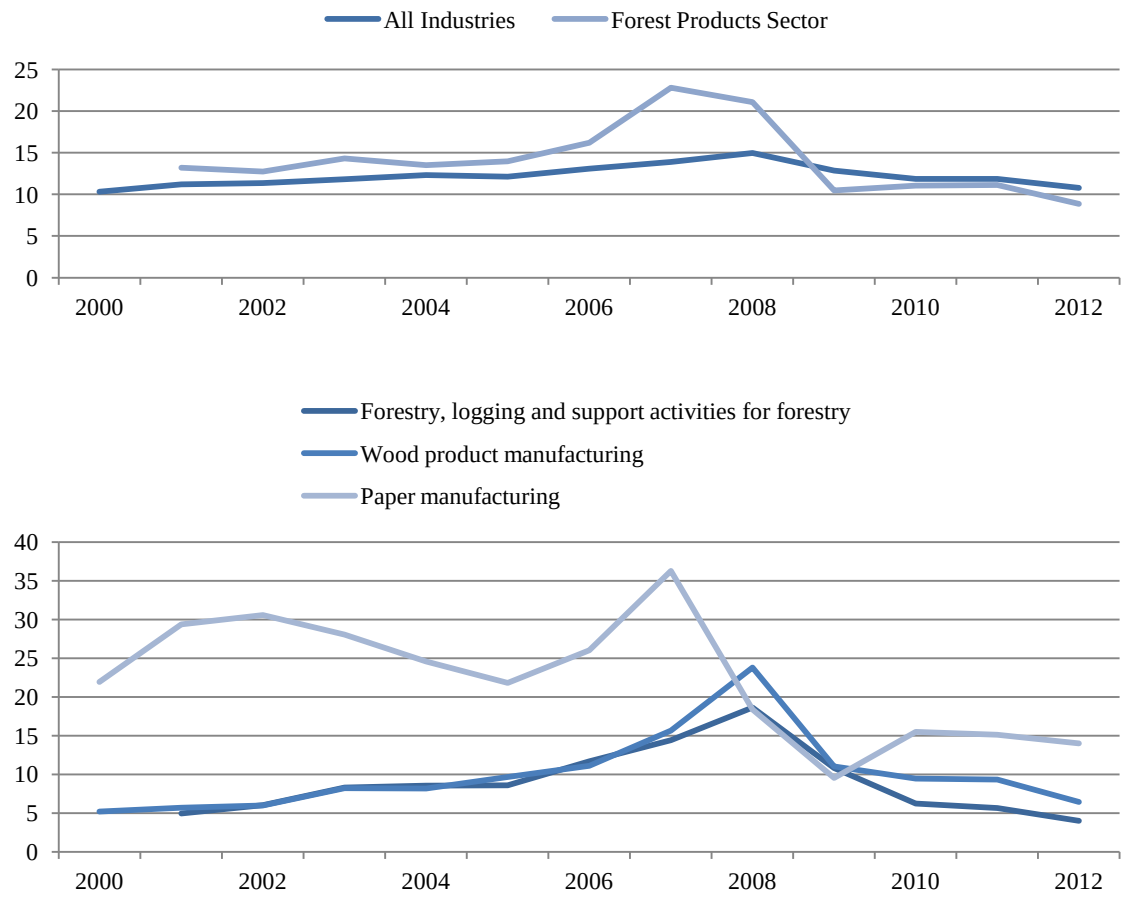
In 2012, there were 8.9 research and development personnel per one thousand workers in the forest products sector in Quebec, down 61.1 per cent from a high of 22.8 in 2007 (Chart 44).

[51] It is important to note that Quebec benefits from R&D investment done in the rest of Canada and internationally, so it is unlikely that there is a very close relationship between R&D investment in Quebec and productivity in Quebec. However, it is arguable that firms that engage in R&D can more easily implement R&D advancements made elsewhere by other firms.

[52] For information on the absolute number of research and development personnel, see Appendix Table 9A and 9B in the database available at www.csls.ca/res_reports.asp.

The level in 2012 was the lowest level seen in Quebec since 2001, the earliest year for which estimates are available. The level seen in 2012 was also below the level of all industries (10.8 research and development personnel per one thousand workers). Unfortunately, the forest products sector has not outperformed the total economy since 2008 in research and development personnel intensity, while both the total economy and the forest products sector have been trending downwards in Quebec. The fall in research and development personnel intensity derives from the fact that the number of research and development personnel is falling faster than the number of employees. In fact, between 2007, the peak year for research and development personnel numbers, and 2012, research and development personnel fell 18.6 per cent per year.

Chart 44: Research and Development Personnel Intensity within the Forest Products Sector, Quebec, Per Thousand Workers, 2000-2012



Source: CSLS calculations based on Statistics Canada data.

At the sectoral level, research and development personnel intensity has actually increased very slightly in wood product manufacturing since 2000, by 1.2 research and development personnel per one thousand workers (Chart 44). Since research and development personnel fell from 267 in 2000 to 241 in 2012, this indicates that the increase was driven by falling employment levels. Nevertheless, both forestry and logging and paper manufacturing have shown decreases in research and development personnel intensity. Paper manufacturing has exhibited the largest declines, falling from 21.9 research and development personnel per one

thousand workers in 2000 to 14.0 research and development personnel per one thousand workers in 2012 (Chart 44). However, it is important to note that the fall in paper manufacturing is largely attributable to the recession. In 2007, there were 36.3 research and development personnel per one thousand workers in paper manufacturing, while in 2009, this number fell nearly four-fold, to 9.5 research and development personnel per one thousand workers. Since employment fell quite sharply, this suggests that the absolute level of research and development personnel fell even faster. In particular, research and development personnel fell 25.7 per cent per year in forestry and logging between 2007 and 2012. It fell 17.4 per cent per year in wood product manufacturing. In paper manufacturing, it fell 18.5 per cent per year. The period between 2007 and 2012 was the period that saw the largest declines, as there were gains in all three industries between 2000 and 2007.

Wood product manufacturing and forestry and logging have shown similar, but much less pronounced, trends. Forestry and logging saw research and development intensity increase from 4.9 in 2001 to 18.6 in 2008 before falling to 4.0 in 2012. Similarly, wood product manufacturing saw research and development intensity increase from 5.2 in 2000 to 23.8 in 2008 before falling to 6.4 in 2012.

Compared to the overall economy, the forest products sector was showing strong research and development intensity until the financial crisis in 2009. This is yet another sign that the forest products sector was hit by a perfect storm and suffered much more severely from the crisis than the rest of the economy.

This evidence suggests that research and development personnel intensity was a potential contributor to multifactor productivity growth in the early- to mid-2000s. However, it is unlikely that it contributed much to labour productivity growth in the late-2000s or early-2010s.

v. Machinery and Equipment Investment Levels and Intensity

Innovation does not rely solely on research and development; it also relies on the adoption of state-of-the-art capital goods that improve the efficiency of the production process. De Avillez (2014) notes that this is particularly true for the forest products sector, where innovation tends to be embodied in physical capital.

Unfortunately, data on investment in machinery and equipment in both forestry and logging and paper manufacturing have been suppressed post-1999 for Quebec. Hence, this section will only be able to analyze machinery and equipment investment in wood product manufacturing.

Wood product manufacturing has shown dismal performance in terms of investment in real machinery and equipment between 2000 and 2013, falling 7.7 per cent per year, from $392 million in 2000 to $138 million in 2013. The decline was heavily concentrated between 2007 and 2013 (10.3 per cent per year), but there were also significant declines between 2000 and 2007 (5.4 per cent per year). In stark contrast, machinery and equipment investment between 2000 and 2013 was growing in the total economy at 2.2 per cent per year. Even during the period that captures the recessions (2007-2013), machinery and equipment investment showed positive

growth (0.8 per cent per year). Hence, this suggests that the total economy was performing more strongly than the forest products sector in terms of updating capital assets.[53]

Table 24: Machinery and Equipment Investment, Depreciation and Real Net Investment, Forest Products Sector, Quebec, 2000-2013

	Investment		Depreciation		Real Net Investment	
	All industries	Wood product manufacturing	All industries	Wood product manufacturing	All industries	Wood product manufacturing
2000	12,476	392	11,046	251	1,430	140
2001	11,137	145	11,572	255	-435	-110
2002	10,648	103	11,688	230	-1,040	-127
2003	11,321	131	11,776	209	-455	-78
2004	13,073	216	12,130	205	943	11
2005	13,831	196	12,720	209	1,111	-13
2006	14,991	257	13,387	214	1,604	43
2007	15,850	265	14,100	225	1,705	40
2008	16,500	132	14,780	220	1,720	-88
2009	13,765	83	17,997	197	-1,231	-114
2010	13,988	159	14,823	183	-835	-25
2011	14,626	144	14,773	179	-148	-34
2012	16,412	117	14,985	169	1,428	-53
2013	16,617	138	15,356	161	1,261	-23

Note: No data are available for forestry and logging and paper manufacturing.
Source: Statistics Canada.

Real net investment figures are not more promising than investment. Real net investment is investment minus depreciation and it highlights how much investment actually increases the capital stock. Between 2000 and 2013, real net investment was negative in wood product manufacturing. These low investment figures and negative net investment figures suggest that firms in the wood product manufacturing industry group in Quebec are using outdated capital assets that do not embody the latest technological innovations. The results at the provincial level in Quebec do not differ from the results obtained by De Avillez (2014) for the Canadian forest products sector as a whole.

In addition to trends in real machinery and equipment investment, there is an additional indicator of innovative activity: machinery and equipment investment intensity. This indicator is defined as real investment in machinery and equipment per hour worked and it is an important indicator of embodied technological change, keeping track of the effort made by firms in a given industry to use up-to-date equipment.

Between 2000 and 2013, machinery and equipment investment intensity fell 3.37 per cent per year in wood product manufacturing in Quebec (Table 25). The majority of this decline was seen in the latter period (2007-2013) when machinery and investment intensity declined by 6.8 per cent per year. The total economy, in contrast, showed positive growth throughout the entire period. Even when broken down into two sub-periods, the total economy displayed positive

[53] Real net investment, which is investment minus depreciation, captures the amount of investment that increases overall capital stock. In the case of wood product manufacturing in Quebec, real net investment was negative in every year after 2007. Between 2000 and 2007, the results were not much better, since real net investment fell 16.4 per cent per year. Hence, investment in wood product manufacturing in Quebec is not even sufficient enough to replace the capital stock that is depreciating.

growth, although growth between 2007 and 2013 was stunted by the recession of 2009. As is the case with research and development personnel intensity, the fall in machinery and equipment investment intensity is surprising given that hours worked fell tremendously.

Table 25: Machinery and Equipment Investment Intensity in the Forest Products Sector, Quebec, 2000-2013

	All industries	Forest products sector	Forestry and logging	Wood product manufacturing	Paper manufacturing
2000-2007	2.58	..	..	-0.33	..
2007-2013	0.12	..	..	-6.79	..
2000-2013	1.44	..	..	-3.37	..

Source: CSLS calculations based on Statistics Canada data.

The database constructed by the CSLS also provides current, constant and chained figures for investment, depreciation and real net investment for engineering construction, building construction, intellectual property products, and the aggregate for wood product manufacturing in Quebec.[54]

Table 26: Real Net Investment, Machinery and Equipment, Millions of Chained 2007 Dollars, Quebec, 2000-2013

	All industries	Forest products sector	Forestry and logging	Wood product manufacturing	Paper manufacturing
2000	1,430	x	x	140	x
2001	-435	x	x	-110	x
2002	-1,040	x	x	-127	x
2003	-455	x	x	-78	x
2004	943	x	x	11	x
2005	1,111	x	x	-13	x
2006	1,604	x	x	43	x
2007	1,750	x	x	40	x
2008	1,720	x	x	-88	x
2009	-1,231	x	x	-114	x
2010	-835	x	x	-25	x
2011	-148	x	x	-34	x
2012	1,428	x	x	-53	x
2013	1,261	x	x	-23	x

Source: CSLS calculations based on Statistics Canada data.

The investment figures for engineering construction and building construction are not much more promising than those for machinery and equipment, as they both exhibited negative growth rates between 2000 and 2013.[55] Similar to machinery and equipment, the majority of the decline in investment was seen in the period between 2007 and 2013. Engineering construction investment actually displayed positive growth between 2000 and 2007, but this was entirely offset by a rapid decline post-2006. In contrast to machinery and equipment, building construction and engineering construction, investment in intellectual property products increased throughout the entire period, by 6.9 per cent per year.

[54] These are found in the Appendix Tables 7A-7AF available at www.csls.ca/res_reports.asp.

[55] Engineering construction and building construction represent a very small portion of overall investment (on average 15.7 per cent between 2000 and 2013).

Investment in intellectual property products was actually sufficient to offset depreciation, and real net investment was positive; however, real net investment in intellectual property products demonstrated negative growth between 2000 and 2013, which suggests that if trends continue, real net investment will be negative in the future, as it is for all of the other components. [56] However, as with machinery and equipment, building construction and engineering construction both had negative real net investment in much of the period post-2006. Since these three other categories of investment also have the potential to increase productivity, it is unlikely that engineering construction and building construction have contributed to multifactor productivity growth. However, intellectual property product investment was positive and quite strong, so it would appear that the forest products industry in Quebec has purchased rights to products and processes that have helped it weather the perfect storm and compete and grow in difficult circumstances. The application of these various innovations may have contributed to labour savings.

vi. Foreign Direct Investment

De Avillez (2014) notes that foreign direct investment (FDI) in the domestic economy can foster technological diffusion, with firms introducing new production processes or adapting established production processes to new realities. In addition to generating positive technological externalities, FDI can increase product market competition. Unfortunately, data are not available at the provincial level concerning FDI. Nevertheless, national level statistics can provide a small window into potential FDI investment at the provincial level, although it is important to keep in mind that the rate of investment likely varies quite starkly by province.

At the national level, De Avillez (2014) finds that between 2000 and 2012, inward FDI declined 48 per cent in the wood product manufacturing subsector and 23 per cent in the paper manufacturing subsector. Furthermore, between 2000 and 2012, outward FDI fell 56 per cent in wood product manufacturing and 52 per cent in paper manufacturing. Although well-below the levels seen in the early-2000s, paper manufacturing FDI started to pick up pace again in the late-2000s.

These figures suggest that FDI investment in Quebec's forest products sector probably fell, which implies that technological diffusion deriving from FDI was probably minimal between 2000 and 2012. Hence, it is unlikely that FDI was contributing much to labour productivity growth through multifactor productivity.

The Quebec Forestry Industry Council (2010:7, 10) corroborates this view. It notes that it has been increasingly difficult for the industry to attract capital in recent years. This is particularly frustrating for paper manufacturing, which competes with other industries in the economy for similar resources. In addition to problems attracting capital (either domestically or internationally), the transformation costs in other market economies in the world have been trending downward, particularly in the southern United States, which is extremely competitive

[56] The SNA2008 definition of intellectual property products includes research and development, computer software and data bases, entertainment, literary or artistic originals and mineral exploration and evaluation. Intellectual property products represented, on average, 26.3 per cent of total investment between 2000 and 2013.

with its access to abundant resources of high quality and low price. This only intensifies difficulties locating investors.

vii. Incidence of Innovation[57]

De Avillez (2014) studies in great detail three surveys of innovation at the firm and plant level. These surveys are arguably important indicators of innovative activity at a much more granular level than has been studied in the previous sections of this report. The three studies he considers are the *Survey of Innovation*, the *Survey of Advanced Technologies* and the *Survey of Innovation and Business Strategy*. The national level data is, once again, suggestive of provincial level innovation, but caution should be used when applying the results to provincial level assessments.

Quite briefly, these three surveys all provide a variety of different results concerning innovative activities. The *Survey of Innovation* suggests that the forest products sector was performing quite poorly between 2002 and 2004. The *Survey of Innovation and Business Strategies* indicates that the forest products sector was performing above the total economy in terms of product and process innovation, but that it was on-par or below the manufacturing sector performance between 2007 and 2009. Finally, the *Survey of Advanced Technologies* suggests that wood product manufacturing had a higher incidence of adopting at least one advanced technology than the entire manufacturing sector, while paper manufacturing had a lower incidence of adopting just one advanced technology. When looking at results of the incidence of adoption of at least five advanced technologies, paper manufacturing outperformed the manufacturing sector as a whole, while wood product manufacturing was trailing behind.

Whether these results are indicative of innovative activities in Quebec is questionable, but they are certainly worth discussing, especially since Quebec has a high proportion of Canadian wood product and paper manufacturing plants. However, given the conflicting findings of these three surveys, it is difficult to determine whether firms in the forest products sector in Quebec were innovative or not relative to the national average.

D. Profits

There are three main paths through which profits can influence productivity:

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

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

[57] As there is no consistent time series, it is unclear how insightful these surveys are as indicators of innovation in Quebec or in Canada.

- **Investment effect**: Falling profits can also make it harder for firms to invest in research and development, or new capital, slowing down productivity growth.

In any sector or industry, it is difficult to determine the effect of profits on productivity, since these channels push productivity in different directions. De Avillez (2014) obtained data for profit levels in the Canadian forest products sector. Unfortunately, this data is not available at the provincial level. However, as with previous variables only available at the national level, inferences can be made concerning provincial level results by looking at the national picture. In this case, profits in the forest products sector in Canada fell fairly consistently from 2000 to 2009 in all three subsectors, reviving briefly in 2004. After the recession of 2009, profits began to rise again, although there were signs that they were dipping in 2011, especially in wood product manufacturing.

Chart 45: Operating Profits in the Forest Products Sector, Current Dollars, Millions, Canada, 2000-2011

Source: De Avillez (2014)

Since profits have been falling for such an extended period of time, it is likely that the positive contributions to productivity from the composition effect and the survival effect have waned, while the negative investment effect is starting to take precedence. Although, it is quite possible that there is a non-linear relationship between profits and the survival effect, which may suggest that the survival effect was only reached at a certain threshold. If profits have not recovered to a level above this threshold, then the survival effect may still be at play. The data on the number of establishments in the forest products sector only corroborates this suggestion, since the number of establishments has been falling quite steadily in all three industry groups since the mid-2000s (there was a slight upward tick in the mid-2000s, which fits nicely with the observation that profits temporarily increased in the mid-2000s).[58]

[58] The data on establishments are available in Table 8A through Table 8M in the Appendix Tables, available at www.csls.ca/res_reports.asp.

E. Industrial and Intersectoral Shifts

Productivity growth in the forest products sector is a combination of productivity growth in forestry and logging, wood product manufacturing, and paper manufacturing. For each subsector, in turn, productivity growth is the aggregation of productivity growth in more specific activities. Aggregate productivity growth depends not only on how much productivity growth each of these activities experiences (pure productivity effect) but also on how important each activity is relative to the total; shifts toward higher-productivity activities can cause the overall productivity in that sector to increase (reallocation effect).

At the national level, De Avillez (2014) found that the reallocation effect in the Canadian forest products sector has had very little impact during the 2000-2012 period. In particular, the reallocation effect explained only 4.6 per cent of average labour productivity growth during the period, while the pure productivity effect accounted for the remaining 95.4 per cent.

If the lack of a reallocation effect is also the case at the provincial level,[59] then most of the labour productivity growth in Quebec was coming from forestry and logging between 2000 and 2013, with wood product manufacturing contributing a relatively large amount as well. Since paper manufacturing had labour productivity growth that was 3.0-4.9 percentage points lower than both wood product manufacturing and forestry and logging, it did not contribute as much to overall forest products sector labour productivity growth between 2000 and 2013.

F. Quality and Size of Quebec's Natural Resources Base

The overall quality of the natural resources base can have important effects on productivity; all else constant, easily accessible and high-quality natural resources will lead to lower costs and higher productivity relative to hard-to-reach and low-quality natural resources. As Harrison and Sharpe (2009:52) state:

> "The reliance on less accessible timber stocks…can raise the cost in terms of labour and capital of producing a given quantity of logs, decreasing productivity. This tendency toward depletion and diminishing returns can be, and often is, offset by technological advances […] It is possible that Canada's relatively slow-growing forests, which result in long-distance hauling of logs […] makes super mills less viable than in other countries where wood fibre grows more quickly (Rheaume and Roberts, 2007:21). This situation could have a significant impact on productivity in the paper manufacturing subsector."

According to the *State of the Forests Annual Report 2013*, the rate of deforestation has declined in the last two decades in Canada; furthermore, this trend of declining deforestation is

[59] Chart 13 suggests that the share of each industry group in forest products sector nominal GDP in Quebec was essentially unchanged between 2000 and 2013. Since nominal shares are used to calculate labour productivity contributions, this only corroborates the assumptions that the reallocation effect is small at the provincial level.

expected to continue throughout the next four decades. The only sector that is currently producing increasing deforestation rates is the oil and gas sector, although the recent crash in crude oil prices is likely to reverse this trend, especially if crude oil prices remain low. In the forestry sector, deforestation resulting from the creation of permanent forest access has been relatively stable (between 3,600 and 3,800 hectares per year since 2000). With deforestation rates declining, it is likely that productivity has been impacted much less in recent years by inaccessible forests than it was in the past.[60]

In addition to deforestation from economic activity, forests can be reduced due to fires; however, in Quebec in 2012, there was a below-average fire season. Insects can also impact the ability for the forestry sector to harvest wood for forest products. In Quebec, alien species, such as the emerald ash borer, have continued to spread into new areas. The increasing coverage of these alien species does have the potential to impact productivity in the forest products sector in the future, but the extent to which it has in the past is unclear. Diseases that afflict Quebec's forests have also increased in prominence in recent years due to milder and more humid springs, which favour the development and spread of foliar diseases. Diseases could also affect future productivity levels in the forest products sector in Quebec. However, similar to the impact of insects, the extent to which this played a role in the past is unclear.

Harrison and Sharpe (2009) suggest that "in the long-run, the effect of [environmental changes from insects, diseases and fires, etc.] on productivity is not clear, but in the short run and medium run, the cost of adjusting can hurt productivity." Hence, the quality and size of the natural resource base in Quebec is clearly important for productivity, but it is unclear how deeply fires, diseases and insects have impacted productivity levels and productivity growth in the past two decades. It has been suggested (De Avillez, 2014a) that there is no evidence that the quality and the size of the natural resource base in Canada has played a role, either positively or negatively, in terms of productivity growth. Hence, it can also be reasonably assumed that the quality and the size of the natural resource base has played little role in Quebec in the fall in output and the jump in productivity growth.

In short, increased productivity in Quebec is not a supply-side phenomenon; it is not driven by more favourable natural resources development. However, it is interesting to note that it is quite possible that growth in the forest products sector has been hindered in recent years (or may be hindered in the future) due to the economic crisis in the forestry sector. In particular, economic crises in the forestry sector can have negative impacts on investment in forest management, which can worsen timber supply problems in the longer term (Canadian Council of Forest Ministers, 2008). If forest management suffered during the crisis, then costs would have increased for firms in the forest products sector, which would have affected both output and thereby labour productivity. Whether or not forest management practices were affected by the crisis is not investigated in this report, but it is an issue worth considering. However, it seems that there are no obvious, glaring supply side problems for fibre.

[60] The issue with deforestation is distance to sawmills and paper mills. As the trees around sawmills and paper mills are cut down, the primary resources used in production must be retrieved at greater distances, negatively impacting productivity.

G. Macroeconomic Environment

This section examines the impact of the macroeconomic environment on productivity in the forest products sector in Quebec.

First, prolonged periods of weak demand can have significantly negative impacts on productivity in the long-run. Weak demand can stem from weak foreign demand or weak domestic demand, or both. In general, demand, whether domestic or foreign, is driven by exchange rates, unit labour costs, income and structural changes in preferences. In this section, foreign demand will be examined in detail through exports. Exchange rates, unit labour costs and income in the importing country will be examined in relation to how they impact exports. This section will also analyze the effect of structural changes on demand. Domestic demand will not be studied, since the effects are similar to those stemming from foreign demand.

Second, this section examines how prices can impact productivity in the long-run.

i. Exports

In the forest products sector in Quebec, approximately 40 per cent of gross output is exported (Statistics Canada). The remainder is used for domestic consumption or as intermediate products in other production processes.

Changes in real output reflect changes in the performance of Quebec's forest products sector in foreign markets. Decreases in export demand can drive increases in productivity in the short-run if firms respond to changing demand by lowering hours worked faster than demand is falling. However, exports cannot be relied on to generate permanent productivity growth.

From 2000 to 2013, Quebec's exports in the forest products sector declined by 35.4 per cent (Table 27). Most of this decline came from declining European Union exports (-65.9 per cent) and United States exports (-42.4 per cent).

Table 27: International Exports by Destination, Forest Products Sector, Quebec, Millions of Dollars, 2000-2013

	Millions of Dollars		Share		Change
	2000	2013	2000	2013	2000-2013
United States	10,686	6,157	87.1	77.6	-42.4
European Union	855	292	7.0	3.7	-65.9
South and Central America	224	411	1.8	5.2	83.6
Other	504	1,070	4.1	13.5	112.3
Total	12,269	7,930	100.0	100.0	-35.4

Source: Canadian Forest Service

Table 28: International Exports by Product Type, Millions of Dollars, Quebec, 2000-2013[61]

	Millions of Dollars		Share		Change
	2000	2013	2000	2013	2000-2013
Primary wood products	70	86	0.6	1.1	24.2
Pulp and paper products	7,970	5,683	65.0	71.7	-28.7
Newsprint	3,056	1,557	24.9	19.6	-49.0
Wood pulp	1,096	1,114	8.9	14.0	1.6
Other	3,818	3,012	31.12	37.98	-21.11
Wood-fabricated products	4,229	2,161	34.5	27.3	-48.9
Softwood lumber	1,881	815	15.3	10.3	-56.7
Other	2,348	1,346	19.14	16.97	-42.68
Total	12,269	7,930	100.0	100.0	-35.4

Source: Canadian Forest Service

Compared to other prices, the declines experienced by the forest products industry in Canada appear to be quite severe. From 2000 to 2013, the implicit deflator of goods exported increased by 11.5 per cent, while the implicit deflator of business fixed capital formation increased by 30.2 per cent, and that of final domestic demand by 28.3 per cent.[62] Some prices dropped; the overall price of durable consumer goods declined by 7.15 per cent, while that of imported goods by 4.6 per cent, but these are less relevant for the forest products industry, which saw the prices of its products fall while prices generally increased.[63]

Behind the dramatic changes in the export sales of the industry are some major developments in product markets: a steady decline in consumption of newsprint in North America, a sharp drop in residential construction in the United States prior to the financial crisis of 2007-08, and economic growth in Asia. Newsprint consumption in North America has been declining since the turn of the century. In the United States, newspaper circulation is down from 55.8 million newspapers in 2000 to 44.4 million newspapers in 2011, as younger readers increasingly use other media to access newspaper content.

Further, the first decade of the new millennium saw a major decline of the American dollar against other currencies including the Canadian dollar, and an oil-price driven increase in

[61] The composition of exports in Quebec has also changed quite significantly between 2000 and 2013. Essentially, wood fabricated materials have fallen, dropping 7.2 percentage points in their share of total forest product exports between 2000 and 2013, while pulp and paper products and primary wood products have both seen increases in their share of exports between 2000 and 2013 (6.7 percentage points and 0.5 percentage points) (Table 27). Interestingly, the decline in international exports from Quebec was entirely concentrated in pulp and paper products and wood-fabricated materials, since primary wood products actually saw exports rise between 2000 and 2013. It is also important to note that some of the decline in pulp and paper products was seen in newsprint, since wood pulp actually saw exports increase. (This is not surprising given the structural shift that is currently underway toward electronic media, while innovative products are being designed out of wood pulp). Furthermore, the decline in wood-fabricated materials was partially the result of a decline in softwood lumber.

[62] See Statistics Canada CANSIM Table 380-0066.

[63] These figures may be slightly different than previously discussed price declines, since these are official Statistics Canada figures for prices, while those discussed earlier were implicit price deflators calculated by the CSLS.

the value of the Canadian dollar (Chart 46). These major currency realignments have hurt the competitive position of the Canadian industry in North America and Europe. Quebec has been able to benefit from growing demand in Asia (as seen in the growth of exports to other countries in Table 27), and the pulp industry in that province has found new applications for its product in the form of specialty cellulose.

Hence, in summary, exports (which are closely linked to exchange rates and many other macroeconomic variables) have the potential to impact productivity levels through foreign demand. However, as Harrison and Sharpe (2009:55) noted for exchange rates, trade-driven productivity increases cannot be permanent. Nevertheless, it is important to point out that exports have contributed to some of the productivity trends in the forest products sector in recent years, since firms in the forest products sector decreased hours worked much more quickly than output was falling.

Table 29: Exports, Volume and Price of Selected Products, Quebec, 2000-2013[64]

	Millions of Dollars		Change
	2000	2013	2000-2013
Volume (thousands of tonnes)			
Newsprint	3,788	2,354	-37.9
Other paper and paperboard	2,522	2,141	-15.1
Wood pulp	1,387	1,497	7.9
Softwood lumber (thousands of meters cubed)	9,338	4,697	-49.7
Revenue per volume unit			
Newsprint	807	662	-18.0
Other paper and paperboard	1,132	1,001	-11.6
Wood pulp	790	744	-5.8
Softwood lumber (thousands of meters cubed)	201	173	-13.9

Source: Canadian Forest Service

Below, exchange rates will be examined, as they are an important factor for explaining export trends. Exports are also impacted by the economic environment in the country to which exports are destined, especially by income growth. In addition, they are influenced by relative cost competitiveness, which can be understood through unit labour costs. These additional factors and their impact on exports will be discussed subsequently. Structural changes in preferences and their impact on the demand for forest products will equally be reviewed.

a. Exchange Rates

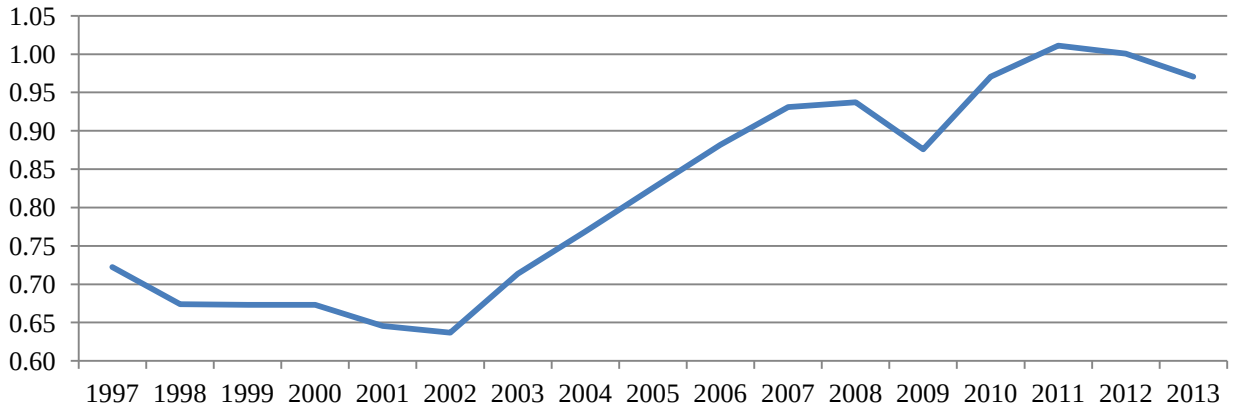
Harrison and Sharpe (2009:55) state that exchange rates can also exert an influence on productivity through their effect on output demand. If the Canadian dollar is depreciating relative to the U.S. dollar, then U.S. customers will find that Canadian products are becoming cheaper

[64] Despite a strong forest products sector, Quebec still imports certain forest products from other countries globally. With the changing economic environment and the appreciating dollar, Quebec's international export surplus declined from $10.5 billion to $6.1 billion, a drop of $4.4 billion. It could be suggested that the changing proceeds from exports reflect changing prices; however, the changes in the proceeds from exports can be due to changes in the volume of exports. Prices of major industry products were lower in 2013 than in 2000, but the volumes the provinces exported dropped considerably more, with the exception of other paper and paperboard and pulp exports from Quebec.

relative to other products, the forest products sector included, leading to an increase in export demand. When the Canadian dollar is appreciating relative to the U.S. dollar, then U.S. customers will find that Canadian products are becoming more expensive relative to other products, leading to a decrease in export demand. If firms respond to declining export demand by reducing hours worked faster than output is falling, productivity will increase, and vice versa.

Export (foreign) demand may offer a potential explanation for recent productivity trends in the Quebec forest products sector. In particular, the Canadian dollar was appreciating between 2000 and 2007; it depreciated during the financial crisis of 2009, but resumed its appreciation between 2010 and 2012 (Chart 46). Fortunately for the forest products sector, the Canadian dollar has begun to depreciate again in 2013 and 2014 with falling oil prices.

Chart 46: Canada-US Exchange Rate, 1997-2013



Source: CSLS calculations based on Statistics Canada data.

The appreciation of the dollar in the early- and mid-2000s would have reduced demand in the U.S. for Canadian forest products, and by definition, those in Quebec. Since approximately 80 per cent of Quebec's exports go to the United States, demand for Quebec's forest products declined. If firms in Quebec's forest products sector responded by reducing hours worked faster than they reduced output, productivity would have increased.

Harrison and Sharpe (2009:55) note that a trade-driven productivity increase cannot be permanent because demand conditions are not a long-run driver of productivity in the same sense as technological progress, capital intensification and skills development. While keeping this in mind, it is worth noting that the effect of the exchange rate changes on export demand is likely to have contributed to some of the productivity trends in the forest products sector in recent years.[65] Fortunately for the forest products sector in Quebec, the Canadian dollar is depreciating relative to the U.S. dollar, and as such, an increase in export demand can be expected in the coming years.

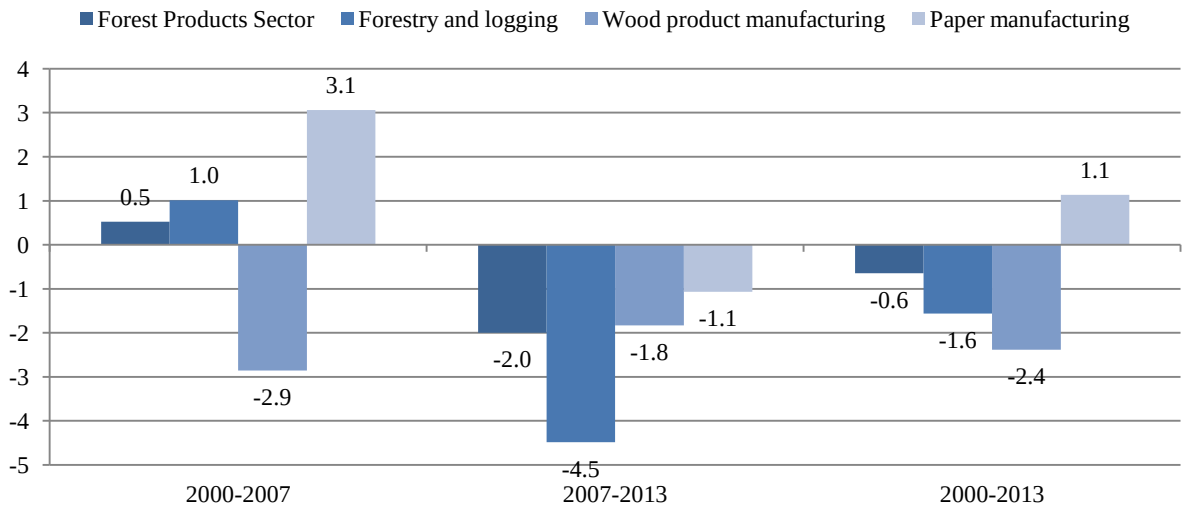
[65] When the Canadian dollar appreciated, demand fell, which drove firms in the forest products sector to restructure in order to survive. This restructuring meant shedding excess labour, which increased labour productivity as a by-product.

b. Unit Labour Costs and Energy Prices

A useful indicator of a sector's cost competitiveness is unit labour costs, defined here as the ratio between real GDP and nominal labour compensation. The change in unit labour costs (in U.S. dollars) can be decomposed into three components: 1) changes in the exchange rate, where an appreciation of the Canadian dollar leads to an increase in labour costs; 2) changes in hourly labour compensation (in national currency), where an increase in hourly labour compensation leads to an increase in unit labour costs; and 3) changes in labour productivity (in national currency), where an increase in labour productivity leads to a fall in unit labour costs.

Unit labour costs in the forest products sector in Canada increased between 2000 and 2013 at 4.5 per cent per year. The largest contributor to this increase was paper manufacturing, which saw unit labour costs increase 6.1 per cent per year between 2000 and 2013, followed by forestry and logging, which saw unit labour costs increase 5.0 per cent per year. In contrast, wood product manufacturing saw relatively tame increases in unit labour costs between 2000 and 2013 (1.5 per cent per year). Since forest products are sold internationally, the most useful information is obtained by examining how Quebec's unit labour costs perform relative to international competitors. Unfortunately, this comparison will not be undertaken in this report. However, unit labour costs comparisons will be made with the Canadian and U.S. manufacturing sectors, as these data are readily available from The Conference Board.

Chart 47: Unit Labour Costs, Forest Products Sector, Canadian Dollars, Quebec, 2000-2013

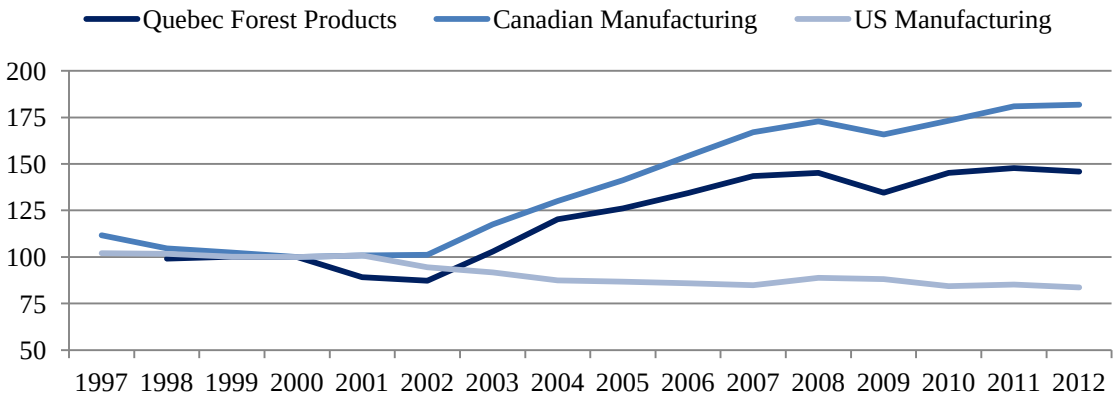


Source: CSLS calculations based on Statistics Canada data.

Unit labour costs (in U.S. dollars) in Quebec's forest products sector experienced trends similar to Canada's manufacturing sector between 1997 and 2012 (Chart 48). In particular, unit labour costs in both sectors were stable from 1997 to 2001, after which they began rising. The bulk of the increase took place from 2002 to 2007, when the Canadian dollar experienced a great appreciation. By 2012, unit labour costs in Canadian manufacturing reached about 180 per cent of their level in 2001, while unit labour costs in Quebec`s forest products sector reached 145 per cent of their level in 2001. In contrast, unit labour costs in the U.S. manufacturing sector were

stable from 1997 to 2001, after which they began to fall steadily to 16.4 per cent below their level in 2001 in 2012.

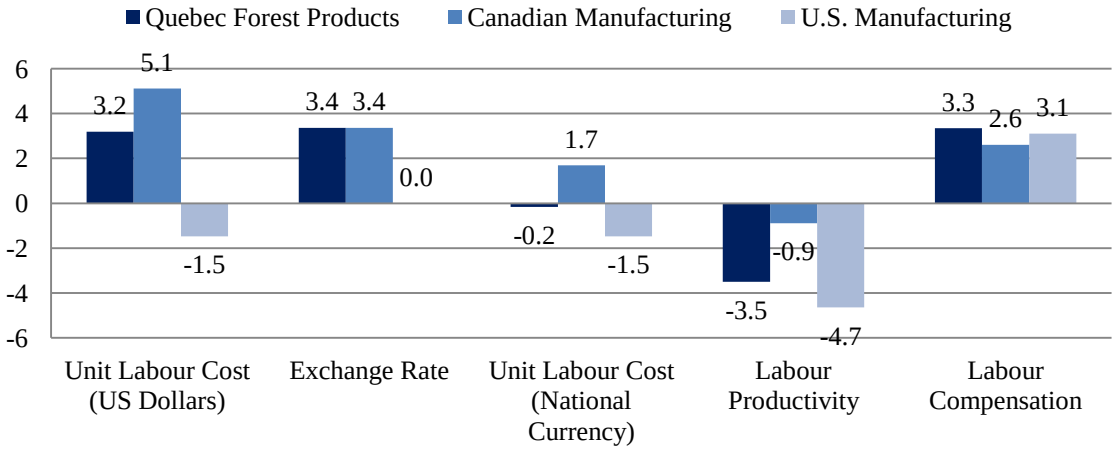
Chart 48: Unit Labour Costs, U.S. Dollars, 2000=100, 1997-2012



Source: CSLS calculations based on Statistics Canada data.

The massive increase in unit labour costs in Quebec's forest products sector between 2000 and 2012 (3.2 per cent per year) was primarily driven by an appreciation of the Canadian dollar (which contributed 3.4 per cent per year to the increase in unit labour costs) and low productivity growth (which completely offset the increase from the exchange rate) (Chart 49). In contrast, the United States experienced much stronger labour productivity growth from 2000 to 2012 (4.7 per cent per year), which drove the decrease in unit labour costs (-1.5 per cent per year). Surprisingly, the U.S. manufacturing sector and Quebec's forest products sector displayed comparable increases in hourly labour compensation between 2000 and 2012; this is unexpected considering the large drop in employment seen in the Quebec forest products sector.

Chart 49: Decomposition of Unit Labour Costs, Compound Average Annual Growth, 2000-2012



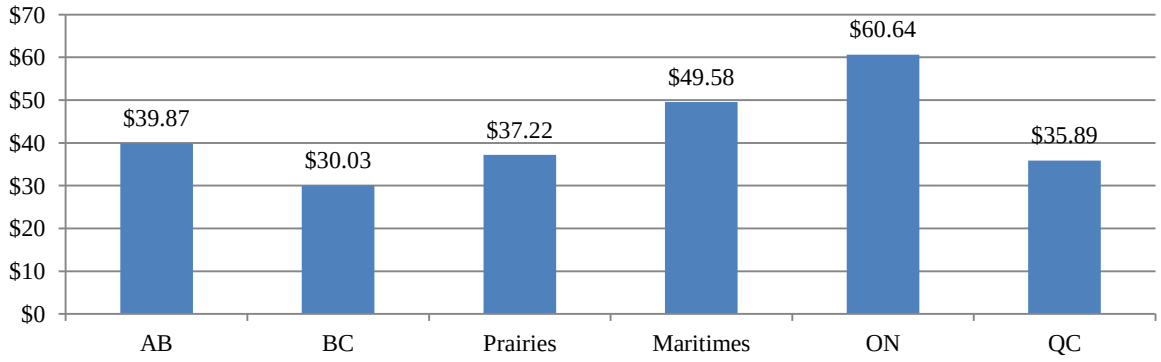
Source: CSLS calculations based on Statistics Canada data.

Out of the three provinces for which data are available – Ontario, Quebec and British Columbia – Quebec's unit labour costs increased less than Ontario's but more than British

Columbia's. This suggests that compared to both Ontario and British Columbia, Quebec's forest products sector was average in terms of competitiveness on the international market. This may help explain why exports dropped less sharply in Quebec as compared to Ontario, which had much higher increases in unit labour costs.

Another potential explanation for a declining competitiveness, which may be behind changing productivity, is increasing non-labour costs. The pulp and paper industry is highly energy intensive, and as such, high energy costs can deeply dampen competitiveness. Fortunately, energy prices in Quebec are about average in comparison to the rest of Canada, at approximately $35.89 per million kilowatt hours in pulp and paper mills. Hence, high energy costs are unlikely culprits for the recent decline in competitiveness, and thereby exports, in the pulp and paper industry. The likely explanation is the strong structural shift facing pulp and paper.

Chart 50: Pulp and Paper Mills, Energy Costs, Selected Canadian Provinces



Source: FisherSolve

c. Other Factors (Income and Structural Changes)

Domestic demand and foreign demand are both deeply affected by income and structural changes in preferences. As previously discussed, this section will focus on foreign demand.

When income in the importing country falls, demand will also fall. When foreign demand falls, real output will respond in the exporting country. In order for the firms in the exporting country to survive in the long-run, employment must decrease. If employment falls faster than real output falls, productivity will grow.

In 2008-2009, the financial crisis severely reduced disposable income in the domestic economy in Canada, as well as in importing countries. Hence, it is no surprise that real output fell in response in the forest products sector. As mentioned earlier in the report, firms wishing to survive the onslaught of reduced demand cut employment levels. A by-product of cutting employment was increased productivity.

Another important impact is structural changes in preferences. In the forest products sector, paper manufacturing is undergoing an interesting structural change: consumers are moving away from paper products toward electronic media. This is happening to both domestic and foreign demand. As consumers shifted away from products made in the paper manufacturing

industry group to products in electronics, real output fell. When this fall was paired with declining incomes and increasing exchange rates, the decline in real output was even harsher. Similar to the impact of reduced demand for other factors, structural changes away from paper products reduced real output and firms responded by cutting labour inputs. Since the labour input fell faster than real output (although in the case of paper manufacturing this was not always the case), labour productivity increased.

In short, as De Avillez (2014) notes, productivity exhibits procyclical behaviour, following closely trends in the macroeconomic environment: it increases during economic booms and decreases during recessions, following changes in both domestic and foreign demand.

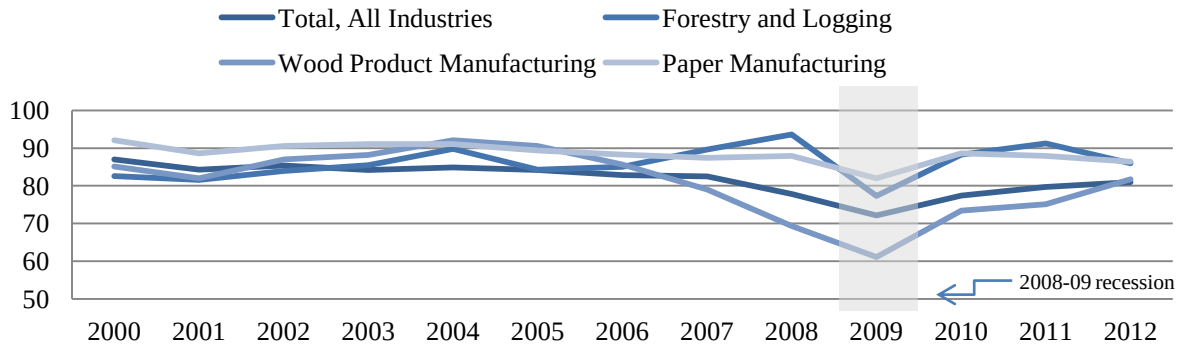
Given the factors discussed above, exchange rates, unit labour costs, income and structural changes, there are a variety of reasons why this correlation may appear. In particular, there are two explanations worth mentioning: capacity utilization and labour hoarding.

Capacity utilization can affect productivity results because during a recession, a significant part of the firms' capital stock is idle, which causes capital productivity to fall; while during an economic boom, capital can be over-utilized, causing productivity to rise. Labour hoarding can affect productivity results because during recessions, firms have a tendency to keep more workers than would be optimal for a given level of production, which drives down productivity.

Labour hoarding essentially measures the lack of synchronicity between output and inputs. However, labour hoarding is difficult to quantity, since it requires an estimation of the production function used by the forest products sector. Capacity utilization, on the other hand, is estimated by Statistics Canada for a variety of industrial activities. Unfortunately, the data is only available at the national level. However, like many of the other variables discussed in this report, national level data can provide insight into likely developments at the provincial level.

In general, De Avillez (2014) concludes that capacity utilization has had very small effects over cyclically neutral periods, but that these effects are quite large in shorter time frames, especially around the 2009 financial crisis. As such, when looking at the two subperiods, 2000-2007 and 2007-2013, it is likely that capacity utilization is affecting labour productivity growth. However, when looking at the overall period, between 2000 and 2013, it is unlikely that capacity utilization is affecting trend labour productivity growth significantly.

Chart 51: Capacity Utilization in Forest Products Subsectors in Canada, 2000-2012



Source: De Avillez (2014)

Similar to capacity utilization, labour hoarding impacts short-term productivity growth, but it has very little impact on medium-term and long-term productivity growth, since firms can fully adjust their labour input. Nevertheless, in the short-term, De Avillez (2014) found that labour hoarding significantly reduced labour productivity estimates in the forest products sector during the 2009 recession at the national level. As such, it is likely that labour productivity growth figures in the forest products sector in Quebec were slightly biased downwards in the period between 2007 and 2013, although labour productivity growth was still positive for all three subsectors even without accounting for labour hoarding.[66]

Interestingly, there was a positive relationship between output and productivity in the Quebec forest products sector between 2000 and 2013. As previously discussed, this reflects the slack in the system and the response it generated in terms of hours worked and employment. According to MacLeod (2014), the slack in the forest products sector was so bad that "despite its size and large portfolio of mills, it set a world standard for neglect of its mills: [pulp and paper executives] in Canada failed to demonstrated real competency in leadership, imagination and investment. Meanwhile, many new facilities were built in South America and Southeast Asia, which today lead the world." The forest products sector in Quebec was forced to shape up during the perfect storm and it may now be better set to compete on the world market.

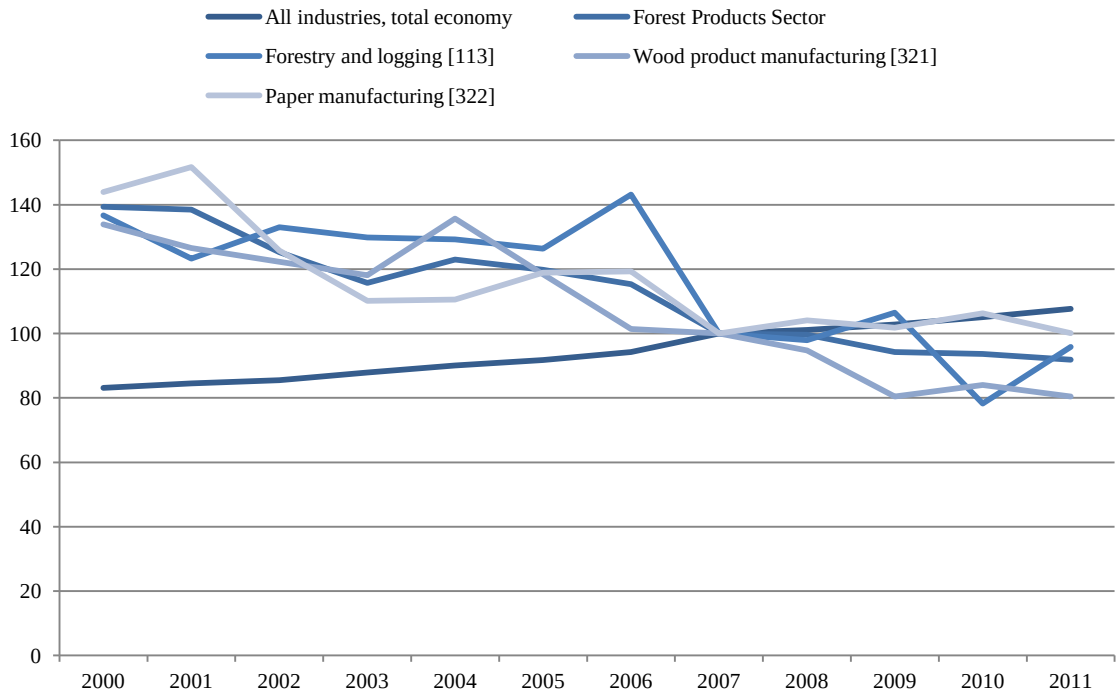
ii. Prices

Aside from domestic and foreign demand (analyzed through exports), productivity can also be affected by prices. In particular, Harrison and Sharpe (2009:53) note that output prices influence productivity by changing the average quality of the firms in the sector and of the resources used. Price increases bring into production establishments or productive resources that are of relatively lower productivity and would not have been profitable at lower prices. In contrast, falling prices force less productive establishments to close, leaving only more productive establishments operating, which tends to raise the average level of productivity of a subsector.

[66] Falls in capacity utilization do not necessarily follow from falls in output, since the net capital stock declined because of negative net investment.

Since implicit prices in the forest products sector have been declining in the forest products sector as a whole between 2000 and 2011 (Section II), this theory offers an explanation for productivity trends in the forest products sector. At the subsectoral level, this theory offers and explanation for all three industry groups between 2000 and 2011, but when broken down into two subperiods, the theory does little to explain productivity growth in paper manufacturing between 2007 and 2011 because prices actually increased between 2007 and 2011 in paper manufacturing at the same time that labour productivity increased by 1.7 per cent per year, contrary to economic theory.

Chart 52: Implicit Prices, Forest Products Sector, Quebec, 1997-2011



Source: CSLS calculations based on Statistics Canada data.

H. Microeconomic Environment

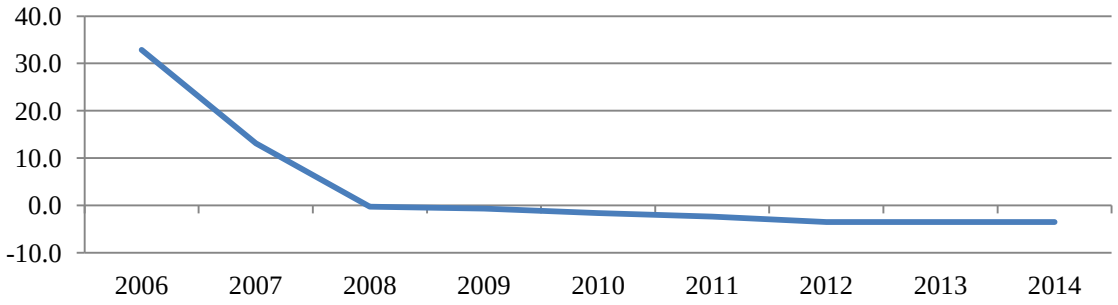
This subsection will examine how the microeconomic environment can influence behaviour at the firm level and subsequently affect productivity growth in the forest products sector as a whole. In this section, taxes, regulation, and economies of scale are examined.

i. Taxation

Harrison and Sharpe (2009:57) observe that taxation can influence productivity through investment decisions, which in turn affect capital intensity. Firms make investments to maximize profit by investing until the return from the last dollar invested equals the cost. Taxes on firms' profits reduce the return on investment, while tax allowances, like the allowance for capital consumption, reduce marginal costs.

The marginal effective tax rate, note Harrison and Sharpe (2009:58), is the most common measure of the total impact that taxes and allowances have on the return to marginal investments. The theoretical marginal effective tax rate (METR) on investment is the pre-tax return minus the post-tax return, divided by the pre-tax return and expressed as a percentage. All else constant, a firm should invest in jurisdictions and assets with low METRs. Taxes on capital lower the return that investors receive from capital investments, and in this way, taxes can reduce investment and result in lower capital intensity. As previously mentioned, lower capital intensity leads to lower labour productivity.

Chart 53: Marginal Effective Tax Rate on Capital, Forestry, Quebec, 2006-2014



Source: unpublished series from Mintz and Chen.

Since the financial crisis of 2008-2009, forestry in Quebec has faced negative METRs.[67] Despite extremely low METRs and a favourable exchange rate in terms of importing, wood product manufacturing firms in Quebec still demonstrated low investment levels.[68]

Hence, even with METRs that encourage high levels of investment, firms in the forest products sector in Quebec underinvested. Had METRs been higher, it is possible that the capital stock used by forest products sector firms would have deteriorated much more quickly. However, low investment despite low METRs rates is not surprising, since tax rates are only one factor affecting investment and they are much less important than the expected rate of return, which reflects prospects for sales and is dependent on macroeconomic conditions.

[67] The METR in Quebec decreased drastically between 2006 and 2008. According to Chen, this was driven by the introduction of the fast write-off for manufacturing and processing assets, class 43, in 2007, by the federal government. This class is used mainly by the manufacturing industry, which accounts for the biggest industrial capital share in Quebec. Hence, Quebec's fall in the METR. Quebec subsequently introduced its own investment tax credit for manufacturing and processing assets in 2008. In addition, the change in the class 43 accelerated depreciation rate from 30 per cent to 50 per cent had a massive impact on the aggregate METR in Quebec in 2008, somewhere in the range of a full 10 per cent. The investment tax credit of 5 per cent in Quebec, paired with the incremental drop in the corporate income tax rate, account for the full reduction. It is important to note that the provincial aggregate METR reflects the distribution of capital employment in the province. In the case of Quebec, there was a fairly generous increase to the accelerated depreciation of capital, which is heavily employed in the province's industry. If Quebec did not utilize this type of capital so heavily, the impact would not have been so dramatic.

[68] There are no data on investment in paper manufacturing and forestry and logging.

As Harrison and Sharpe (2009:60) note, even though Canadian tax policies may have been an impediment to productivity growth in the forest products sector in the past, the present analysis suggests this is no longer the case. In short, METRs do not explain firm behaviour in the forest products sector regarding investment and they do not explain falling levels of inward foreign direct investment, which are both considered drivers of productivity; as such, METRs in forestry do not explain the strong productivity growth that was seen over the past decade. Nevertheless, if METRs continue to remain at this level, a sustained increase in productivity may be the result, since firms may begin to invest more heavily in capital once low rates become the norm.

ii. Regulation

Harrison and Sharpe (2009:60) point out that government regulation can have both positive and negative effects on productivity growth. For example, government regulations that restrict certain types of logging practices for safety or environmental reasons or that require stringent controls on air and water emissions from paper plants can increase the operating and capital costs and thereby reduce labour, capital and multifactor productivity. Alternatively, government regulations can force firms to take actions they would not normally take. These actions may have unexpected positive consequences for productivity and competitiveness, particularly if other countries eventually adopt the same regulations, giving the early adopters an advantage. Of course, the evaluation of the effectiveness of government regulation must go beyond the impact of the regulations on productivity, and must also factor in the societal benefits of less pollution and other non-economic benefits.

De Avillez (2014:134) notes that regulation plays an important role in the Canadian forest products sector because around 93 per cent of forested land is publicly owned, mostly by provincial governments (FPAC, 2005:10). FPAC (2005) identifies three key areas of concern with respect to government regulation in the forest products sector. First, the *Competition Act* fails to recognize the global nature of the sector and unnecessarily obstructs consolidation. Second, the overlapping jurisdictions of the federal and provincial governments create confusion and redundancy in the forest products sector. Finally, specific policies tie access to resources to the maintenance of certain production facilities, presumably in an effort to prevent job losses among workers in the forest products sector.

Since Quebec is a key player in Canada's forest products sector, Quebec is likely not immune to the regulatory environment and the impacts of government-owned resources.

iii. Economies of Scale

Harrison and Sharpe (2009:61) note that one potential cause of lagging productivity in the forest products sector in Canada is the lack of large companies and large establishments, although establishment size is linked more closely with productivity levels than productivity growth. Large plants can offer economies of scale in the use of resources, leading to higher productivity. Not only is plant size a potential productivity driver, firm size can be as well. FPAC (2005) notes that credit ratings from Moody's and S&P demonstrate that larger firms, with higher capitalization, have better credit ratings.

According to the Forest Products Industry Competitiveness Task Force (2007), significant advantages enjoyed by large firms in the forest products sector include a lower cost of capital, greater scale economies in production and marketing, and more efficient risk management of innovation and major capital projects. Similarly, FPAC (2005:11) argues that consolidation in the sector could offer "critical competitive advantages" such as increased efficiency; asset, product or geographic diversification; and lower capital costs. The report also notes that diversification is desirable as it reduces cash flow volatility and improves market access. Large firms are also able to attract more capital for innovative investments.

With all of these advantages of scale (plant and firm size), it seems logical to exploit them wherever possible. Unfortunately, Harrison and Sharpe (2009:61) note that the Canadian forest products sector is not exploiting the advantages of scale. By global standards, Canadian forest products firms are generally small. Furthermore, Canadian plants tend to also be small by international standards. Since Quebec is a large player in the forest products sector in Canada, these observations also apply.

Statistics Canada's provides data on the number of establishments by industry. Establishment trends are quite peculiar. In particular, the number of establishments in the forest products sector is higher in 2010 than in 2004, and the decline since the recession of 2009 has been minimal.

Table 30: Number of Establishments, Quebec, 2004-2010

	Forest products sector	Forestry and logging	Wood product manufacturing	Paper manufacturing
2004	4,872	2,762	1,770	340
2005	5,977	4,128	1,522	327
2006	6,044	4,140	1,590	314
2007	6,007	4,123	1,575	309
2008	5,882	4,066	1,519	297
2009	5,640	3,857	1,492	291
2010	5,637	3,873	1,490	274

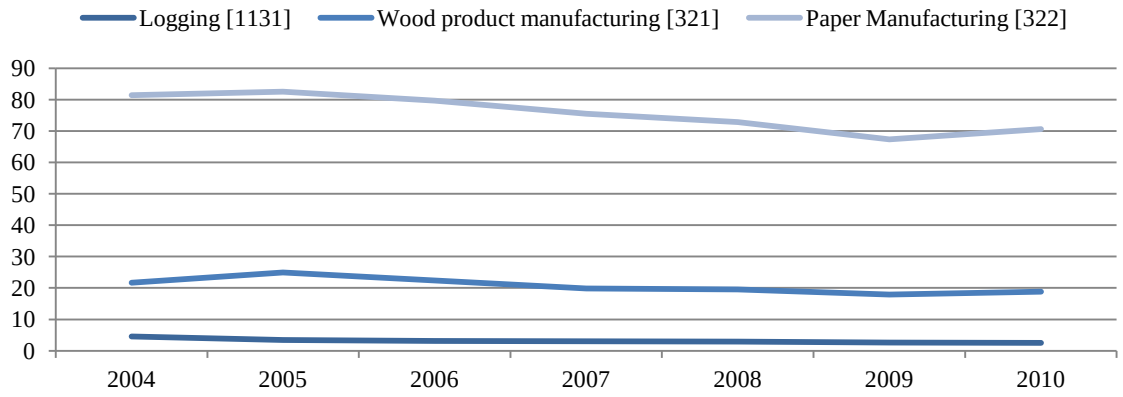
Source: Statistics Canada

When the number of establishments is combined with data on real value-added by industry, it is possible to assess how the average real value-added per establishment in the forest products sector has changed over time. Unfortunately, due to changing methodologies and terminated CANSIM series, the estimates must be interpreted with caution and they only extend up to 2010. The most consistent time series runs from 2004 to 2010.

In forestry and logging, the average establishment is very small. In 2010, real value added was $203 thousand with 2.5 employees per establishment (Chart 55). The average most certainly masks a significant number of larger establishments, but nevertheless, it suggests that the typical forestry and logging establishment in Quebec is very small. Relatively, wood product manufacturing demonstrates higher figures for the number of employees per establishment in 2010 (18.8) and real value added per establishment ($1,533 thousand).

In addition, paper manufacturing establishments in Quebec are larger than establishments in the other two industry groups. In 2010, there were 70.6 employees per establishment and real value-added per establishment was $11.2 million. Similar to wood product manufacturing, paper manufacturing's higher number of employees per establishment reflects more labour-intensive production processes.

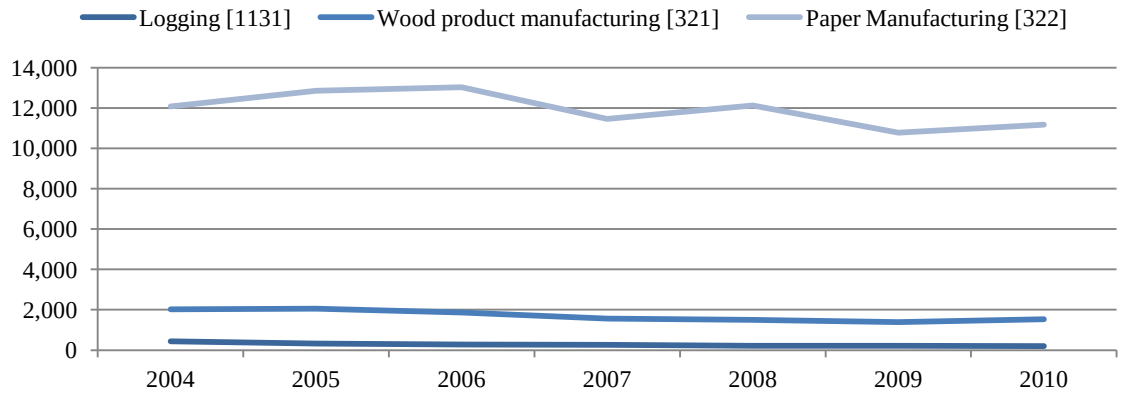
Chart 54: Number of Employees Per Establishment, Quebec, 2004-2010



Source: CSLS calculations based on Statistics Canada data.

In short, economies of scale can drive productivity growth. However, in Quebec, economies of scale do not explain the recently high growth rates of labour productivity. Especially since the number of employees per establishment and real-value added per establishment has been declining since 2004.[69]

Chart 55: Real Value Added Per Establishment, Quebec, 2004-2010



Source: CSLS calculations based on Statistics Canada data.

[69] Statistics Canada's time series for 1990 to 2003 also suggests that establishment size was decreasing in all three industry groups. The two time series, however, are not directly comparable.

I. Key Points

This section has focused on investigating the possible reasons behind the above-average labour productivity growth experienced by the forest products sector in Quebec between 2000 and 2013. A simple growth accounting exercise showed that it was multifactor productivity, not capital deepening, that accounted for the lion's share of labour productivity growth in the 2000s. By definition, multifactor productivity growth is a residual, representing output growth that is not accounted for by measured input growth. It is often seen as a proxy for disembodied technological change, but the reality is that it encompasses a variety of different factors, including improvements in technology and organization, capacity utilization, returns to scale, economies of scale, labour composition, and so on.

From a long term perspective, improvements in technology have played a major role in driving productivity growth in the Canadian forest products sector. Canada conducts state-of-the-art research in several areas related to forest products. Furthermore, Quebec has had high research and development intensity in the three industry groups in the forest products sector. However, there has been no obvious acceleration in technological change in the forest products sector since 2000, so it is very unlikely that a positive technological shock is responsible for the massive increase in productivity in the Quebec forest products sector.

Moreover, research and development intensity in the forest products sector and investment in physical capital (machinery and equipment, building construction and engineering construction) have been declining in recent years. This suggests that a number of firms in Quebec are using outdated capital assets that do not embody the latest technological innovations.

In addition, productivity in recent years seems to have been driven by the macroeconomic environment. These types of productivity drivers are not as long-term as productivity that results from technological or process innovation. More importantly, productivity growth in recent years was driven by the need to survive. The drop in demand meant firms in the forest products sector were up against a wall. They had to cut costs to survive. Given the low dollar in the late-1990s and early-2000s, inefficiencies developed: firms were insulated and became lazy (the "lazy manufacturing hypothesis"). The perfect storm starting in the mid-2000s wrenched these inefficiencies out of the system, with very negative consequences for the workforce. However, without such downsizing, employment levels may not have been maintained into the future at all, as firms would have had to close down operations entirely.

Paradoxically, the forest products sector experienced strong productivity growth, despite the fact that most factors were unfavourable to productivity growth: falls in research and development, negative net investment, low profits, and lack of foreign direct investment, among others. Going forward, focusing on ways to ensure that productivity growth is based on the long-term drivers is essential to guaranteeing the sustainability and competitiveness of Quebec's forest products sector on domestic and international markets.

V. Toward Better Productivity Performance in the Forest Products Sector

This section examines the future outlook for the forest products sector, focusing mainly on recent economic indicators and forecasts of future developments in the macro economy. In addition, the context for productivity improvements is examined. Essentially, public sector regulations and current innovations are briefly discussed, and their impacts on the forest products sector are analyzed. Finally, private sector actions and public policy for the forest products sector in the future are discussed. The section closes with a brief discussion of the recommendations from the CSLS for the forest products sector in Quebec. These recommendations may also have implications for other Canadian provinces and for the Canadian forest products sector as a whole.

A. Outlook for the Forest Products Sector

According to the Senate Standing Committee on Agriculture and Forestry (2009:9), the current problems in the forest system can be explained largely by the decreased demand for products made from Canadian wood, although the reasons for the reduction in demand vary from one product to another. Hence, the future path of the forest products sector in Canada and Quebec relies on the future demand for forest products, and the ability to adapt to these changing demand conditions.

Since the end of the financial crisis, there are signs that the confluence of negative factors is beginning to take a 180-degree turn and that the economic outlook for the Canadian and Quebec forest products sector is improving considerably, as illustrated by the following:

- Economic growth in the United States is quickly accelerating, spurred on by quantitative easing. In the third quarter of 2014, the economy grew at a 3.9 per cent annual rate, while it grew 4.6 per cent in the second quarter (BEA, 2014). According to the OECD's (2014) forecast, United States growth is projected to pick up from 2.2 per cent in 2014 to 3.1 per cent in 2015 and 3.0 per cent in 2016. Strong growth in the United States is promising from the point of demand for forest products, especially lumber.

- Housing starts in the United States grew in 2013, increasing demand for Canadian lumber and driving up lumber prices (Hasselback, 2014). According to the Conference Board's (2014) forecast for the U.S. economy, housing starts will pick up from 0.93 million units in 2013 to 1.01 million units in 2014 and 1.20 million units in 2015.

- The exchange rate has fallen significantly as the price of oil has begun declining. After hovering close to parity in the years immediately after the 2009 financial crisis, the value of the Canadian dollar had fallen to US$0.83 by January 2015.

- Energy prices, one of the largest costs faced by forest products sector firms, have started to fall.[70] Declining crude oil prices have reduced transportation costs for forest products.

- Forestry commodity prices have been abnormally high, given the state of the economic cycle. According to Ignjatovic (2014), lumber prices are expected to increase from $384 per metric ton in 2014 to $411 per metric ton in 2015 and $441 per metric ton in 2016. Similarly, newsprint prices are expected to increase from $605 per metric ton in 2014 to $610 per metric ton in 2015 and $614 per metric ton in 2016. In contrast, pulp prices are expected to decreased from $1,022 per metric ton in 2014 to $988 per metric ton in 2015 and $1,003 per metric ton in 2016.

- There has been a reduced dependency on United States exports in the forest products sector, especially in Quebec, and increased exports to emerging markets like India and China. These markets are expected to enjoy rapid economic growth. Ontario has not diversified away from the U.S. market as much as Quebec.[71]

- The forest products sector is highly cyclical. Since output growth has been weak since the trough in 2009, a cyclical rebound is overdue, if history is a guide to future developments.

- Employment continues to decline, reflecting the increased attention to costs. This result does not necessarily reflect poor economic conditions. This may simply reflect the increasing cost competitiveness and capitalization of the forest products sector in Canada. The restructuring induced by the financial crisis may have resulted in a more nimble, lean and efficient forest products sector.

Despite these signs of a positive turnaround, there are still a few less positive factors on the horizon, namely:

- The southern United States is starting to play an important role in lumber production, which adds a higher degree of competition to the international market, especially for provinces with forest products sectors that export mainly to the United States.

- Paper manufacturing may need to continue to downsize newsprint production, reflecting the continuing adoption and introduction of new electronic media and electronic devices. The outlook for other paper products may be positive.

B. Context for Productivity Improvement

The Canadian Council of Forest Ministers (CCFM) was established in 1985 to provide the federal, provincial, and territorial governments with an opportunity to work together to address forestry related matters. In their long-term strategic vision for sustainable forest management in Canada (*A Vision for Canada's Forests: 2008 and Beyond*), the CCFM identified

[70] This reflects mainly energy prices from natural gas and not energy from hydro.
[71] Given that the U.S economy is booming, this may not be a good trend, although diversity in export markets is generally a wise path.

forest sector transformation as a priority of national importance to maintain a prosperous forest sector. While diversification into new areas is important to maintain a strong forest sector, primary manufacturing will continue to play a major role within the sector.

The CCFM identified several opportunities for forest sector transformation, including:

- The development of a bioeconomy;
- Increasing the production of value-added wood products; and
- Increasing the production of non-timber forest products.

The term bioeconomy describes an economy based on the manufacturing and trade of goods and services made from renewable resources. While the bioeconomy includes traditional wood products, the emerging bioeconomy uses resources from forests to develop new bioproducts (e.g. bioplastics, and biofuels, and biomass–generated energy). The developing bioeconomy is expected to increase the benefits derived from forests, help diversify the forest sector, and make it more resistant to economic downturns.

A promising aspect of bioeconomy is the use of forest biomass to generate energy. The pulp and paper sector has increased the use of forest biomass for energy. In 2007, 54 per cent of the energy used by the pulp and paper sector was derived from forest biomass.

The Quebec government in 2008 released a policy paper for the forestry sector entitled *Forests: Building a Future for Quebec*. Its objective was the introduction of a new forest regime that responds to the issues of adaptability and cost effectiveness within the industry that fully integrates the values of sustainable development and provides stimulating jobs for workers and brings renewed prosperity to communities and regions. The five specific objectives of the new forest regime were to:

- Establish a true industrial development strategy for timber and a new appreciation of timber as a material in Quebec;
- Enhance Quebec's forest heritage through integrated resource management and sustainable development;
- Give the regional authorities new responsibilities for managing public forests;
- Give companies access to a secure supply for some of their needs, and create a competitive market for wood from the public forests; and
- Ensure that forest management reflects the realities of climate change.

As documented in this report, since the mid-2000s the Quebec forest products sector has experienced a severe downturn. The Quebec government policy paper argues that the downturn has not been caused by economic factors alone. It identifies three factors, as highlighted below.

- The downturn is structural, because it is difficult for the forest industry to adapt to the changing economic context by investing in modernization and innovation. The industry has reacted by attempting to reduce costs, leading to mill closures and layoffs with severe consequences, especially in outlying regions.

- The downturn is organizational, because the rigidity of the current rules makes it difficult for new players to enter the market, forest yields in Quebec are low compared to other similar forests elsewhere in the world, the various users of the forest (wood products manufacturing, recreation and tourism, outdoor pursuits, etc.) find it difficult to agree on a shared vision for forestry practices, and the division of responsibilities between the Government, the industry, regional authorities and Aboriginal communities often leads to conflicts and lost opportunities.

- The downturn is social, because forest management is not perceived to be in keeping with the principles of sustainable development. Confidence in public forest management has been lost, and future workers are in short supply since fewer young people are attracted to work in the forest sector.

The crisis in the forest products sector in Quebec thus has diverse causes, and its roots stretch back into the past. As the Quebec government policy paper (2008) notes, all the partners in the sector recognize today that piecemeal change is no longer an option, and that new management approaches must be introduced as part of a new forest regime. Building on the stakeholder summit on the future of Quebec's forest sector held in 2007, the Quebec government forest policy document has set out a vision, objectives and orientation as the basis for a reform of Quebec's forest regime. The options considered, which include an ability to adapt to the needs and potential of each region, are to make it possible to manage Quebec's forests on the basis of their composition (hardwoods, softwoods or mixed) and their other ecological, economic and social characteristics. It is beyond the scope of this report to assess the effectiveness of this strategy to date.

C. Private Sector Actions

If the forest products sector in Canada and Quebec wants to maintain international competitiveness and domestic strength, private sector action is necessary. In its Vision 2020 Challenge, FPAC has set three goals for firms in the Canadian forest products sector in the next five years (FPAC, 2014):

- Generate an additional $20 billion in economic activity from new innovations and new markets;

- Deliver a further 35 per cent improvement in the sector's environmental footprint; and

- Renew the workforce with at least 60,000 new recruits, including women Aboriginals and new Canadians.

The forest products sector in Quebec will only be able to maintain strength in the Canadian forest products sector and internationally if firms in the forest products sector invest in capital equipment and human capital more heavily than they have been doing in the past ten to fifteen years. Current data suggest that forest products sector firms have been under-investing and that they are using out-of-date equipment. Returning to higher levels of investment is made easier by the recent low levels of marginal effective tax rates and the positive forecasts for demand. During the recent confluence of negative structural and cyclical factors, credit was extremely difficult to come by either from institutional lenders like banks or from private investors. A return to positive growth in the overall economy and a more positive outlook for the forest products sector as a whole will provide a much needed investment boost for the industry.

Furthermore, in order to stay competitive on the international market, the forest products sector in Quebec must rein in unit labour costs. Changes in the unit labour costs of a Canadian industry in international markets are a composite of changes in the exchange rate, changes in compensation per employee and changes in labour productivity. For instance, a slowdown in productivity gains would increase units labour costs over time, and this would gradually gnaw away at the international competitiveness of the forest products sector in Quebec. Fortunately, the forest products sector in Quebec has had such strong productivity gains in recent years that unit labour costs in domestic currency have not been a major concern. As the Canadian dollar depreciates, labour costs expressed in U.S. dollars will decrease, further boosting competitiveness.

In addition to minimizing increases in unit labour costs and investing in additional physical capital, forest products sector firms should continue to cut excess slack where possible.

Occasionally, industries that fall into this type of pattern are referred to as suffering from the lazy manufacturer hypothesis; manufacturing firms do not need to engage in cost minimizing decisions because the exchange rate is favourable enough to offset higher costs. With the confluence of negative factors in the early- to mid-2000s, especially the appreciating Canadian dollar, forest products firms in Quebec shaped up and chopped unnecessary labour.[72] In the short-term, this has caused many an outcry in rural Quebec, where forest products firms operate in "thin labour markets [with] limited employment opportunities in other sectors" (Standing Committee on Agriculture and Forestry, 2009:24).[73] Nevertheless, in the long-run, rural communities will benefit from these policies, since at least part of the forest products sector will still exist, where it may have slowly disappeared had these tough employment decisions not been made.

In summary, at the level of the firm, investing in research and development and physical capital, reining in unit labour costs and removing excess slack are crucial for maintaining a

[72] In the late-1990s and early-2000s, the low dollar encouraged the forest products sector's exports without encouraging cost containment strategies.

[73] For example, the Senate report states that some 300 communities in Canada are at least 50 per cent dependent on the forestry industry (Standing Committee on Agriculture and Forestry, 2009: 24).

sustainable, lean and mean forest products sector in Quebec that can compete both domestically and internationally, especially since "increasing energy costs add to the burden for forest companies struggling with the distance between the timber source and the processing location" (Standing Committee on Agriculture and Forestry, 2009).

D. Public Policy

As previously discussed, policies can have a substantial influence on decisions at the firm level. In Quebec, the public forest products sector is highly regulated. Ensuring that these regulations are providing the right incentives is important to ensuring that the forest products sector in Quebec recovers from the perfect storm and returns to full potential.

In a report by Roberts and Woodbridge (2008), the future opportunities for the forest products industry in New Brunswick are discussed in detail. Many of the opportunities available for New Brunswick are also relevant for Quebec, and hence, this paper deserves serious consideration. First, Roberts and Woodbridge (2008:4) note that "a competitive sawmilling segment should be seen as the cornerstone for a competitive forest products sector." It has been shown that "sawmilling typically provides the highest return-to-log, while generating by-products, upon which the province's pulp and paper, nonstructural panel and emerging bio-energy segments depend." Hence, public policy should encourage the maintenance of a healthy sawmilling industry, since there are positive externalities for the forest products sector as a whole from such endeavours.

Roberts and Woodbridge (2008) also note that bio-chemicals produced in bio-refineries are just around the corner and that a "bio-refinery can take advantage of the differences in biomass components and intermediates and maximize the value derived from the biomass feedstock by producing multiple products." Essentially, "a bio-refinery is a facility that integrates biomass conversion processes and equipment to produce fuels, power and chemicals from biomass. The bio-refinery concept is analogous to petroleum refineries, which produce multiple fuels and products from crude oil and natural gas. Instead, bio-refineries produce fuels, power and chemicals from biomass. In general, this is in addition to the more traditional forest products." They argue that "ideally, a bio-refinery might well be designed to produce one or several low-volume, but high-value, products, while generating electricity and processing heat for its own use and perhaps enough for capital costs," while the high-value products ensure economic sustainability, reduce unit costs, and avoid greenhouse gas emissions. [74] Thus, public policies that tap into and encourage these bio-refineries may give the forest products sector in Quebec a boost for both social and economic reasons.

However, it is important to note that there is a delicate balance between using wood to create energy as opposed to products. According to Roberts and Woodbridge (2008:4),

[74] They note that three different classes of chemicals can be produced through different conversion processes: organic acids (acetic acid, citric acid, fumaric acid, gluconic acid, itaconic acid, lactic acid, oxalic acid, levulinic acid, etc.); solvents (acetone, ethanol, n-butanol, isoproponal, MTHF, etc.); and others (butanediol, butyl butyrate, acetates, sorbitol, xylose, xylitol, etc.).

"governments should be careful how [they] encourage the bio-energy sector" because European data indicate that "a given volume of wood generates eight times more value-added and thirteen times more employment when used in the production of pulp and paper as opposed to energy." Hence, it is clearly important to stress the use of wood in pulp and paper and avoid encouraging the energy sector's use of wood if the forest products sector is to regain vigour in terms of both GDP and employment, but it may be equally important to encourage investment in bio-refineries as a way to diversify the production of forest products in Canada and boost demand for Canadian forest products.

In addition to all of the potential areas of public policy in the forest products sector discussed above, along with their caveats, it is important that the government encourage individuals to enter the trades and work for the forest products sector. This might be substantially more challenging than encouraging firms to invest and innovate. However, all three of these areas (human capital, physical capital and innovation) are important areas that the governments in Quebec and Canada need to properly incentivize if they want to ensure that the forest products sectors in Quebec and Canada remain healthy and competitive internationally.

An additional area of concern, as mentioned by FPAC (2005), is the *Competition Act*.[75] In the current international market, where increasingly low-cost rivals are becoming more prominent, it may be important to revise the application of the competition act. It may be in the interest of the province of Quebec and the government of Canada to allow larger firms in the forest products sector, especially given the potential for a lumber supercycle as China continues to industrialize, U.S. housing starts take off and India becomes a larger importer.

In summation, the Quebec Forest Industry Council (2010) summarizes the future of the forest products sector in Quebec quite succinctly. In the markets, wood products are distinctly tied to construction in the United States. Hence, as housing starts begin to trend upwards so will demand for Canadian wood products. However, there are other factors in wood product markets that need to be considered before believing that the success of wood products is secure when the United States is demonstrating strong growth. In particular, even though larger housing units (like six-storey apartments) are being constructed in wood in Canada, this trend has yet to take off in many other countries, where other products like steel and concrete are preferred. Moreover, firms in the southern United States are becoming fierce competitors on the international market.

In the paper and pulp market, the Quebec Forest Industry Council (2010) projects that newsprint production will continue to trend downwards as consumers shift to electronics and producers in emerging markets begin to compete. As this continues to unfold, plant closures in Quebec will continue to debilitate rural communities.

Similarly to the Standing Committee on Agriculture and Forestry (2009), the Quebec Forest Industry Council (2010) believes that bio-products and bio-energy will certainly provide new avenues of growth for the sector, but that these areas cannot be seen as a panacea. In particular, these new avenues may provide short-term sustenance for the industry, but they will

[75] This relates back to the economies of scale section discussed earlier.

not help encourage the structural changes that the industry needs if it wants to survive in the long term.[76]

Finally, the Quebec Forest Industry Council (2010) notes that many lenders and donors consider the risks associated with the forest sector to be extremely high, which intensifies the difficulty of accessing capital and thereby encouraging innovative growth. Hence, public policy might consider breaking down the barrier between the forest products sector and the supply of capital in order to generate much needed inflows of investment. However, the risk associated with the forest products sector reflects market assessments of the viability of the forest products sector in the future. Propping up the forest products sector could lead to worse outcomes in the future in terms of plant closures and unemployment on a grand scale. Thus, a delicate balance should be found between market mechanisms and public policy.

VI. Data Issues

This report relies extensively on Statistics Canada data. A number of concerns with data availability and reliability were encountered in producing this report. These issues are discussed below because the analysis provided in this report is contingent on the quality of the data made public by Statistics Canada.

One major concern is the lack of availability of certain data series, which derives from two main sources: confidentiality restraints mean that statistics occasionally remain unpublished; and low interest or lack of funding implies that Statistics Canada does not produce or release data.

The first major factor responsible for the lack of data availability is confidentiality restrictions. The *Statistics Act* in Canada has prevented Statistics Canada from releasing a large number of estimates. In addition, the application of the *Statistics Act* to data appears to have become even more stringent in recent years. Some time series provide estimates only until the mid-2000s, after which confidentiality restraints apply and data are not available. Concerns deriving from privacy are not applicable at the aggregate level because of the large sample size, but they are especially problematic at the provincial and industry level. Since this report deals with three-digit NAICS industries at the provincial level, there were a number of instances where data were suppressed. The most glaring case was investment and depreciation, where a number of three-digit NAICS industries were suppressed. In terms of the Quebec forest products sector, paper manufacturing and forestry and logging were suppressed.

The second reason for limited data is Statistics Canada's decision not to release available data, either because of perceived low interest on the part of users or lack of resources to produce the estimates on the part of the agency. In particular, Statistics Canada does not always publicly publish data on CANSIM at the provincial level concerning variables of interest. The most important examples are profits by three-digit NAICS industry by province and labour productivity by three-digit NAICS industry by province.[77]

[76] Given currently low oil prices, this venture has become even less attractive.

[77] Labour productivity estimates can be constructed manually using hours worked and real GDP estimates, which are available at the three-digit NAICS level by province, but at the two-digit NAICS level, these estimates are freely available and ready-made for provinces.

Another major concern is data reliability, which is driven by inconsistency, revisions, and small sample sizes. In particular, the termination of useful time series and lack of explicit linkages between the terminated series and the replacement series can cause severe reliability concerns. In this report, an example is the estimates on the number of establishments. This time series was terminated in 2010, but the table to which it belongs continues to be updated. The reason for this termination is unclear. The number of establishments is now made available in another time series, but this time series is not directly comparable with the previous time series, which limits analysis of long-term trends. In many cases, the replacement of a time series is necessary, to reflect new methodological or definitional information. However, Statistics Canada makes little effort to ensure comparability across these different time series. In cases where time series are not comparable, Statistics Canada should attempt to make data available for as many years in the past as possible, or provide direction to researchers on how to make the linkages between time series to allow for analysis over time.

Revisions are also an important source of data reliability issues. Statistics Canada often revises data, which is important, since the revised estimates will reflect the most up-to-date information and provide the most accurate statistical picture. Unfortunately, these revised estimates can often change findings quite dramatically.[78] Hence, it is important to be aware of the possibility of revision and to ensure that new estimates have not been made publicly available when reviewing an analysis.

Finally, data reliability is limited by the quality of estimates, which is heavily influenced by sample size. This issue rests mainly with the Labour Force Survey (LFS) in terms of this report.[79] The LFS survey provides the most up-to-date information on Canada's labour market, but unfortunately, the data that are made available are not always reliable at the detailed industry level because of small sample size.

In sum, Statistics Canada's data are vital: economic analysis would not be possible without the information that is provided by the institution. However, there are certain concerns that arise when researching any topic and these concerns should be addressed or at least acknowledged.

VII. Future Research

During this report's writing and editorial process, a number of future research topics were identified. Some of these research topics relate directly to this particular study, while other research topics branch off in a variety of interesting directions.

[78] An important example of the effect of revision to estimates relates to labour productivity growth in the Canadian forest products sector. Between 2000 and 2012, the CSLS reported that Canada's forest products sector saw labour productivity growth of 2.5 per cent (De Avillez, 2014). By adding an additional year and incorporating the revised data, this figure jumped to 3.0 per cent for the period between 2000 and 2013. The additional year alone cannot explain this jump.

[79] Note that the Labour Force Survey is not directly used for any analysis within the report, but estimates are provided in the dataset.

There are many future research possibilities relating to productivity in the forest products sector in Canada. First, this report could itself be updated to reflect new data for 2014 and any potential revisions to data by Statistics Canada. These updates could also be reflected at the national level (De Avillez, 2014) and at the provincial level for this report on Quebec and the report on Ontario (Capeluck and Thomas, 2015). Moreover, if and when data can be obtained for profits by three-digit NAICS industry at the provincial level, this information could be appropriately integrated into the section discussing productivity drivers.

Second, an analysis of productivity trends in the forest products sector could also be undertaken for British Columbia and other Canadian provinces. In addition to updating data and expanding the study to other provinces, a third future area of research would be the production of a number of comparative reports which examine differences between provinces in productivity trends and productivity drivers. An obvious example is a report that explains the very different labour productivity growth between the Quebec and Ontario forest products sectors since 2000.

In addition to the topics outlined above, there are some related issues that could be addressed in future reports. For example, there appears to be a compositional effect on productivity both within industry groups and at the level of the forest products sector as a whole. Investigating the importance of these composition effects on productivity may help identify more precisely where productivity gains are coming from and where productivity growth has been lagging.

There are also a number of additional topics whose explanation could shed light on productivity in the forest products sector in Quebec:

- It would be informative to investigate how patterns in firm data, provided by Statistics Canada, could be integrated into the analysis to shed more light into the drivers behind productivity and the responses made at the firm level.

- Insight could be gleaned from integrating information relating to the behaviour of the biggest players in the forest products sector (e.g. Resolute, Cascades, Tembac and Kruger) with the productivity patterns exhibited by Statistics Canada data. Information concerning market shares and layoffs by firm, as well as location, costs and profitability would need to be obtained.

- Examining how the relationship between logging and fibre use has been affected by the use of recycled fibre and to what degree productivity has been impacted by this shift would provide insight into future changes as people shift to more recycled products and continue to recycle at an increasing rate.

- Unpacking the impact of recycling on the location of mills and the subsequent effect of plant location on productivity.

Conclusion

Output per hour in the forest products sector in Quebec advanced at a very robust 3.7 per cent average annual rate in Quebec from 2000 to 2013. This rate was more than four times faster than that experienced in the Quebec business sector (0.8 per cent per year) and was the second fastest labour productivity growth rate among the twenty two-digit NAICS industries in Quebec. It was also the fastest rate of advance for the forest products sector among the four most important forest products producing provinces (i.e. British Columbia, Alberta, Ontario, and Quebec). Quebec also enjoyed the fastest provincial growth rates in each of the three industries of the forest products sector for which data are available, with output per hour advancing at 6.7 per cent per year in forestry and logging between 2000 and 2013, 4.8 per cent per year in wood (tied with British Columbia), and 1.8 per cent per year in paper. Overall an impressive performance.

Quebec's forest products sector productivity performance was particularly strong during the recent 2010-2013 period when output per hour advanced at a 6.0 per cent average annual rate. Productivity growth is often rapid in recoveries, but this does not explain productivity acceleration after 2010 as forest products output was basically unchanged between 2010 and 2013 (-0.1 per cent per year). Rather it was hours worked that plummeted (-5.8 per cent per year). The Quebec forest products sector was able to produce the same level of output in 2013 as in 2010 with around 16 per cent less labour input.

The main drivers of productivity advance are capital deepening (increased capital per worker), a more skilled labour force, and technological change. However, none of these factors can explain the post-2010 acceleration in labour productivity in Quebec's forest products sector or the overall robust performance since 2000. Rather it is has been the deep crisis in the sector that changed behavior and led to massive restructuring. This unfortunately involved large layoffs of forest products workers (employment in 2013 was down 32 per cent from 2000 levels), with the human costs such developments entail. However, without such changes, even more jobs would likely have been lost in the long run as many firms would not have survived. The very painful restructuring has laid the basis for a much more competitive Quebec forest products sector going forward.

Essentially, in a declining context, the forest products sector in Quebec was able to generate strong productivity growth, much higher than that of the business sector. There is concern that the gains in productivity have been made in an unsustainable fashion (hours worked falling faster than output). If this is true, as the forest products sector goes forward into a more positive growth environment, it is unlikely that the current pace of productivity advance based on falling labour input can be maintained long-term.

Table 31: Summary of Drivers, Impact and Reasoning

Driver	Impact on Productivity	Reasoning
Human capital	Negligible	The contribution of changes in labour composition to labour productivity growth is small at the national level. Hence, productivity increased due to human capital, but only marginally. It is unlikely that the story is different at the provincial level.
Innovation	Unlikely	Research and development expenditures and investment figures are decreasing, which suggests that productivity should have remained constant or decreased.
Profits	Plausible	The composition effect, the survival effect and the investment effect can be used to explain productivity trends for the forest products sector as a whole and for most of the subsectors.
Industrial and intersectoral shifts	Negligible	Industrial and intersectoral shifts explain only a small portion of productivity growth at the national level, so it is unlikely that they would explain a large portion at the provincial level.
Quality and size of natural resources	Unlikely	There has been no change or a reduction in the quality and size of the natural resources available. Hence, there should have been no change or a reduction in productivity, all else constant.
Macroeconomic environment	Plausible	Exports, influenced by exchange rates, unit labour costs, income and structural preferences, explain a decline in demand, which drove employers to reduce employment. Employment fell faster than output, thus increasing productivity.
Microeconomic environment	Unlikely	Taxation encouraged investment, but no investment was made. Regulation may have impacted productivity in the past, but it is unlikely that it has impacted current productivity trends. Theories of productivity related to economies of scale suggest that productivity should have decreased, not increased.

Source: CSLS

Quebec's Forest Products Sector Going Forward

Clearly, a perfect storm hit the forest products sector in Canada and Quebec in the mid-2000s: an appreciating exchange rate, high energy prices, the U.S. housing bust, and the financial crisis of 2009.[80] Paired with these macroeconomic trends is the structural shift toward electronic media away from paper products. All of these factors lead the forest products sector as a whole to be a subperformer. Since gross investment was not strong enough to offset depreciation, the average equipment age has deteriorated and the forest products sector in Quebec is using outdated equipment. The lack of investment in machinery and equipment reflects in part low profitability.

Fortunately, market conditions have improved and the fall in industry production has bottomed out. Firms are more profitable with cleaner balance sheets and stock markets have rewarded companies for improving prospects. Wood prices are even on the rise early in the cycle, which is promising. The industry could be on the verge of facing three winning conditions for a possible lumber supercycle, creating the background for a renaissance of Quebec's forest products sector:

- China industrializes quickly and uses more wood in construction;
- U.S. housing begins to boom again; and
- Wood prices begin rising.

These three conditions imply a return to significant profitability for the industry that will enable it to further pursue the transformation it needs to undertake to resume its growth and gain back the market share it lost over the last decade.

To maintain competitiveness, the industry must begin by investing in state-of-the-art equipment to improve productivity even further and in a more sustainable fashion. If the forest products sector in Quebec revitalizes its capital stock, it will be able to continue to operate in a market with low cost competitors. Furthermore, the industry needs to articulate clearly to government where policy changes are needed. The forest products sector should also understand precisely which niche each country or province fits into the international market to ensure that business plans are accordingly developed, especially since new competition has entered the international market in recent years and will likely continue to present itself in the future. Successfully entering new markets, like India, will also help diversify Quebec's forest products sector. Finally, and likely most importantly, the forest products sector in Quebec (and Canada as a whole) should leverage the development of new products, especially those surrounding wood pulp, like cosmetics, adult diapers and textiles.

Importantly, the Bank of Canada (2014:25) has noted that in manufacturing industries output can be expected to grow, but that it is unlikely that output will quickly reach previous levels

[80] In comparison to other provinces, energy prices in Quebec were actually quite reasonable and may have been contributing to the state of affairs in the forest products sector.

because of reduced capacity. This inability to regain previous output levels stems from underinvestment in plant and equipment in Canada, often because firms decided to invest in more favourable locations abroad. This is particularly true in the forest products sector, resulting in a number of operations becoming obsolete because of insufficient investment.

In summary, the industry has demonstrated high productivity growth, and in recent years it has undergone a significant transformation. Excess slack has been shed, leaving behind an industry that is leaner and smaller than in the past.[81] Furthermore, the industry is starting to become more profitable. It remains to be seen whether the forest products sector in Quebec can remain competitive by using the renewed profitability and enhanced productivity to deploy a smart business strategy for the future.

The sector will likely never return to what it used to be, but the forest products sector in Quebec will also not disappear. Instead of representing approximately 4 per cent of nominal output, like it did in 1997, the industry will represent closer to 1-2 per cent. Despite the smaller size, the forest products sector in Quebec will continue to have the potential to serve as a crucial component to the overall economic fabric of the province (and the country as a whole), providing highly paid employment in many rural regions. Indeed, the forest products sector will continue to be a significant part of the Canadian and Quebec economy; it will just not be as important as it used to be.[82]

Hence, going forward, strong, sustainable labour productivity growth will be essential for the health of the Quebec forest products sector.

[81] It is important to recognize the human costs of layoffs, particularly when there are thin labour markets and no other employment opportunities. This is particularly a problem in Northern Ontario, not so much in Quebec, where many forest products sector firms are in Southern Quebec with other employment opportunities nearby. Fortunately, the unemployment rate has remained relatively low despite falling employment levels in the forest products sector.

[82] The forest products sector is important in that exported materials bring income into the country and generate crucial tax revenues.

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