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An Analysis of Productivity Trends in the Forest Products Sector in Canada

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Executive Summary

Despite the great importance of the forestry products sector for the Canadian economy, our knowledge base on productivity trends and levels within the sector appears limited. The Forest Products Association of Canada (FPAC) contracted the Centre for the Study of Living Standards (CSLS) to produce both a review of the literature on productivity trends in Canada and other countries, which was completed in July 2002 (CSLS, 2002), and a report on current productivity trends in the sector in Canada, which is presented in this document. The objectives of this study are to provide a comprehensive overview of the productivity situation in the forest products sector at the national and provincial level in Canada, to compare this situation to that in other countries with important forestry product sectors, and to offer some explanation of the trends discovered.

The report covers seven major areas. The first provides a detailed examination of trends in output in the forest products sector, which includes three industries, logging and forestry, wood products, and paper products. The second discusses trends in employment and hours worked in the sector and the third trends in the capital stock. The fourth section provides estimates of labour (output per hour), capital productivity, and total factor productivity for the three forest product industries and the sector aggregate for Canada for the 1961-2000 period and cyclically neutral sub-periods. The fifth section compares labour, capital, and total factor productivity growth rates and levels in Canada, the United States and Finland over the 1975-99 period. The sixth section outlines 13 determinants of productivity growth and then uses these variables to shed light on productivity trends in the three forest products sectors in Canada.

The major findings of the study are highlighted below.

- labour productivity levels in forest products natural resource in 2000 was above the all industries average of \$27.98 (\$1992) in paper products (\$38.14) and in logging and forestry (\$32.50), but below average in wood products (\$21.35).
- from a long term perspective, the labour productivity performance of the forest products sector has in general been strong, exceeding the all industries average. From 1961 to 2000 output per hour advanced at a 1.80 per cent average annual rate at the level of the total economy. This rate was exceeded by all three forest products industries: logging and forestry (2.21 per cent), wood products (2.13 per cent), and paper products (2.12 per cent).
- The total factor productivity performance of two of three of the forest product industries over the last 40 years was also above the total economy annual average of 1.43 per cent: logging and forestry (2.35 per cent) and wood products (1.69 per cent). It was below average in paper products (1.07 per cent).
- This superior historical productivity performance of forest products industries is not surprising, given that the potential for productivity gains through mechanization is much greater in goods-producing industries than in many service-producing industries.

- From the shorter term perspective of the 1990s, the productivity performance of the forest products sector has been much poorer. Output per hour advanced at an average annual rate of 1.10 per cent from 1989 to 2000 for all industries. Only paper products exceeded this rate (3.27 per cent). The other two forest products industries experienced falling productivity levels, logging and forestry (-0.23 per cent per year) and wood products (-0.55 per cent), a possible matter for concern.
- The total factor productivity performance of the forest product industries in the 1990s was also weak except for paper products. The all industries average for total factor productivity growth was 1.02 per cent per year in 1989-2000. Total factor productivity growth in paper products registered a very strong 3.41 per cent, but logging and forestry advanced only 0.35 per cent and wood products fell 0.39 per cent.
- Thus logging and forestry experienced a labour productivity slowdown of 3.42 percentage points per year after 1989 compared to 1961-1989, with total factor productivity growth also falling off 2.79 points. Labour productivity growth in wood products fell 3.75 points per year after 1989, with total factor productivity falling 2.92 points. One possible explanation for this development may be the rise in the relative price of forest products in the 1990s, which led to the expansion of marginal operations, reducing productivity growth through a decomposition effect.
- In contrast to logging and forestry and wood products, labour productivity growth in paper products accelerated 1.6 points in the 1989-2000 period compared to 1961-1989, with total factor productivity growth up an even stronger 3.24 points. Again in contrast to the other two forest product sectors, the relative price of paper products fell after 1989, leading to the closing of marginal operations and increased productivity through a composition effect.
- One development to be noted in the 1990s has been the fall-off of investment in two of the forest product industries. While the total economy capital stock advanced at an average annual rate of 1.46 per cent from 1989 to 2000, capital stock growth has been negative in logging and forestry (-1.79 per cent), paper products (-1.69 per cent). It is interesting to note that despite this weak capital investment, the productivity performance in paper products has been very strong.

An Analysis of Productivity Trends in the Forest Products Sector in Canada

I Introduction

Despite the great importance of the forestry products sector for the Canadian economy, our knowledge base on productivity trends and levels within the sector appears limited. The Forest Products Association of Canada (FPAC) contracted the Centre for the Study of Living Standards (CSLS) to produce both a review of the literature on productivity trends in Canada and other countries, which was completed in July 2002 (CSLS, 2002), and a report on current productivity trends in the sector in Canada, which is represented by this document. The objectives of this study are to provide a comprehensive overview of the productivity situation in the forest products sector at the national and provincial level in Canada, to compare this situation to that in other countries with important forestry product sectors, and to offer some explanation of the trends discovered.

The report is divided into seven major parts. The first provides a detailed examination of trends in output in the forest products sector, which includes three industries, logging and forestry, wood products, and paper products. The second discusses trends in employment and hours worked in the sector and the third trends in the capital stock.

The fourth section provides estimates of labour (output per hour), capital productivity, and total factor productivity on the basis of the 1980 Standard Industrial Classification (SIC) for the three forest product industries and the sector aggregate for Canada for the 1961-2000 period and cyclically neutral sub-periods. Estimates by province are also provided for shorter periods. Where available, Statistics Canada has been the source of the data used. As no estimates of total factor productivity for these industries are currently available from Statistics Canada, the CSLS has produced these series.

The fifth section compares labour, capital, and total factor productivity growth rates and levels in Canada, the United States and Finland over the 1975-99 period. The sixth section outlines 13 determinants of productivity growth and then uses these variables to shed light on productivity trends in the three forest products sectors in Canada.

The study use a simple neoclassical growth accounting approach to decompose labour productivity growth into total factor productivity growth and increases in the capital intensity of production, or capital-labour ratio. Labour productivity is defined as the real output per unit of labour input. Capital productivity is defined as real output per unit of capital input. Total factor productivity growth is calculated as the difference between the growth rate of real output and that of total inputs where the growth of capital and labour and weighted by their respective income shares in value added to construct an index of total inputs. From the point of view of raising wages and living standards, labour productivity is the more relevant concept of productivity. From the point of view of efficiency in the use of resources, total factor productivity is more relevant.

II Trends in Real Output in the Forest Products Sector

Summary Table 1: Data Sources and Years of Availability for Real Output

National Level	National Accounts (NAICS-based)	National Accounts (SIC-based)	Aggregate Productivity Measures (SIC-Based)
Forestry and Logging Sector	1986-2001	1961-2000	1961-2000*
Wood Products Sector	1981-2001	1961-2000	1961-1997*
Paper Products Sector	1981-2001	1961-2000	1961-1997*
Provincial Level			
Three Forest Products Sectors	1984-2001	1984-1999*	N/A

* series chosen for analysis

A. Data Sources

Data for three series of real output in the forest products sector are provided with this report (Summary Table 1). The first series is from Statistics Canada Aggregate Productivity Measures (APM) data base and is based on real value added estimates in the Input-Output tables. It is based on the 1980 Standard Industrial Classification (SIC). Estimates for this series are only available at the national level, from 1961 to 1997 or 2000, depending on the sector (Table 1)¹. The second series is produced by the Industry Division of Statistics Canada and is part of Canadian National Accounts (Table 2). It is also based on the 1980 System of Industrial Classification (SIC). Estimates are available from 1961 to 2000 at the national level and from 1984 to 1999 at the provincial level. The third series is also from the Industry Division of the National Accounts, but it is based on the 1997 North American Industrial Classification System (NAICS), which was introduced in the late 1990s. Estimates are available from 1981 to 2001 at the national level (Table 3), and from 1984 onwards at the provincial level. A Laspeyres fixed weights price index was used by Statistics Canada to calculate output estimates in constant dollars for all series.

In order to minimize the amount of data presented in this paper, the discussion of output trends at the national level will focus on the Aggregate Productivity Measures series. The great advantage of this series is that Statistics Canada also produces estimates of employment, average hours, and output per hour on a consistent basis since 1961 as part of the APM program. Unfortunately, for wood products and paper products these series currently end in 1997. However, output growth rates from the Industry Division's National Accounts series for the 1997-2000 period have been used to update the APM series to 2000. Because APM series are not

¹ Tables, Charts, Appendix Tables and Charts are available upon request at csls@csls.ca and the complete list is at the end of this document, page 54.

available by province, the real output estimates produced by the Industry Division of Statistics Canada based on the 1997 NAICS will be used. These estimates are available for the 1984-01 period. Significant differences between growth rates from the APM output series and NAICS-based national accounts output series will be highlighted.

Summary Table 2: Differences in GDP (millions of 1992 dollars) Estimates between SIC and NAICS in 1998

	Forestry and Logging	Wood Products	Paper Products	Forest Products Sector Aggregate
SIC (S)	4,221	5,867	6,498	16,586
NAICS (N)	3,779	5,899	6,580	16,258
(N-S)	-442	32	82	-328
(N/S)*100	89.5%	100.6%	101.3%	98%
Per cent difference (N-S)/S*100	-10.5%	0.6%	1.3%	-1.97%

Source: Tables 1 and 80

It is important to note that the definitions of the three forest products industries differ between SIC and NAICS. A number of industries that were included in the SIC industry definition are not included in the NAICS definition and vice versa.

Four logging and forestry parts of support activities for forestry (reforestation, silviculture, forest firefighting) belong to SIC definition, but have been excluded from the NAICS definition. Alternately, part of other services included with agricultural crops (berries, wild rice and wild ginseng gathering) now belong to NAICS and were not in the SIC. The net effect of these classification changes was to reduce logging and forestry output by 10.5 per cent in 1998 (Summary Table 2).

For wood products, wood kitchen cabinet and counter top manufacturing were included in SIC, but not in NAICS, as were part of showcase, partition, shelving and locker manufacturing (prefabricated wood partitions); part of material handling equipment manufacturing (coffin lowering devices manufacturing); part of other miscellaneous manufacturing (coffin and casket manufacturing); and part of blind and shade manufacturing (window shades, wood slat manufacturing). Alternatively, both building board industries and mobile home industries are now included in the NAICS definition of the wood products, as are part of miscellaneous leather and allied products industries (wood boot and shoe heels and lasts manufacturing). The net effect of these changes on the output in the woods products industry has been very small. In 1998, real output defined on a NAICS basis was only 0.6 per cent greater than that defined on a SIC basis.

For paper products, parts of particle board and fibre mills (fibreboard manufacturing); asphalt shingle and coating material manufacturing (asphalt shingles and roll roofing manufacturing); part of all other miscellaneous chemical products manufacturing (blueprint and whiteprint sensitized paper manufacturing); and part of all other miscellaneous fabricated metal products manufacturing (containers made from purchased aluminium foil) that belonged in SIC do not belong in NAICS definition. Alternatively, part of other rubber products industries

(cellophane adhesive tape manufacturing); part of miscellaneous textile products industries (pressure sensitive cloth tape (e.g. duct tape) manufacturing); and part of hygiene products of textile materials (disposable sanitary products of textile materials manufacturing) now belong to NAICS definition of paper products, but were not in SIC. Again the effect of the industry reclassifications on the size of the paper products sector were largely offsetting in 1998, with the industry under the NAICS definition in 1998 only 1.3 per cent larger than under the SIC definition.

In terms of the net effect, the replacement of SIC by NAICS decreases the output of the overall forest products sector by 2.0 per cent in 1998. The fall in the size of the logging and forestry industry because of the removal of reforestation and silviculture activities was too large to be offset by the increased size of the woods products and paper products industries. The net effect over time depends on the output trends in the industries that are reclassified. Chart 1 shows that over 1986-2000 period, the share of forest products sector in total economy was always 0.6-0.7 percentage points greater based on the NAICS than on SIC.

Chart 1 shows the trends in the relative size of the output share of the forest products sector in Canada for the 1986-2001 period under NAICS and SIC definitions. Unlike in Summary Table 2 where estimates were adjusted to be in the same base year (1992), in this chart, SIC estimates are expressed in 1992 dollars and NAICS estimates in 1997 dollars. While the overall difference in the size of the forest products sector between NAICS and SIC estimates was found to be very small when the estimates were expressed in the same base year, this is not the case when the estimates are expressed in different base years. In 1998, the NAICS estimates show that the forest sector products accounted for 3.0 per cent of total output, while on a SIC basis, the sector accounted for only 2.5 per cent of total output.

This very large difference is explained by the increase in the relative price of forest products between 1992 and 1997, which increased the relative importance of the sector measured in nominal dollars. Between 1992 and 1997 the implicit price deflator for the forest sector products aggregate increased 61.2 per cent, compared to 9.2 per cent for the deflator for all industries (Table 91 and 92). Thus the relative price of the output of the sector increased 52 per cent, a major shift in relative prices.

B. Canada

i) Forestry and Logging Sector

Output in the forestry and logging sector rose 1.52 per cent a year on average during the 1961-2000 period, based on the APM series estimates (Table 1). The output growth in this sector was significantly slower than in the economy in general (Chart 2). The average annual growth rate for total economy during the same period was 3.69 per cent in comparison. The sector's share of total economy output fell from 1.35 per cent in 1961 to 0.59 per cent in 2000 as a consequence of the output growth rate gap (Chart 3).

In order to abstract from cyclical fluctuations, output growth rates are best measured on a cyclically-neutral peak to peak basis. As the years 1973, 1981, 1989, and 2000 were cyclical

output peaks, this report calculate and presents average annual growth rates for the 1961-73, 1973-1981, 1981-89, and 1989-2000 periods.

Output in the forestry and logging sector grew 3.05 per cent a year on average during the 1961-1973 period, while output in the economy in general grew 5.76 per cent a year on average. Output growth during the 1973-1981 period was zero. During the 1981-1989 period, the forestry and logging sector experienced its fastest output growth. The average annual growth rate for the period was 3.29 per cent, higher than the growth rate experienced in the overall economy. The 1990s were the worst period of the four cyclically neutral sub-periods since 1961. Output in the forestry and logging sector decreased -0.27 per cent a year on average between 1989 and 2000. Since 1998, however, there has been a strong rebound in output growth in the sector.

ii) Wood Products Sector

The wood products sector did much better than the forestry and logging sector in terms of output growth over the last forty years (Table 1 and Chart 2). Based on the APM estimates, the average annual growth rate of output was 3.67 per cent during the 1961-2000 period. Output growth was virtually identical to that of all industries (3.69 per cent). The wood products sector's share of total economy output has thus remained stable, at 0.93 per cent in 1961 and 0.92 per cent in 2000 (Chart 3).

During the 1961-1973 period, the wood products sector experienced rapid output growth, with an average annual growth rate of 5.14 per cent. Output grew much slower during the 1973-1981 period, 2.53 per cent a year on average, but picked up considerably during the 1981-1989 period, to 5.38 per cent, well above that of the overall economy. Output growth was slower at 1.69 per cent per year in the 1990s, but at least it was positive, unlike trends in the forestry and logging sector. Growth was especially rapid between 1995 and 2000 at 4.83 per cent per year, after a 0.85 per cent annual decrease between 1989 and 1995.

iii) Paper Products Sector

Output growth in the paper products sector has been more modest than it was in the wood products sector (Table 1 and Chart 2). Paper products output grew at a 2.06 per cent average annual rate over the 1961-2000 period compared to 3.69 per cent a year on average in the overall economy. The sector's share of total economy output was nearly cut in half, falling from 1.88 per cent in 1961 to 1.01 per cent in 2000 (Chart 3).

Output in the paper products sector grew 3.77 per cent year on average during the 1961-1973 period, then fell to a very weak 0.37 per cent during the 1973-81 period. Output growth picked up to a 1.43 per cent average annual rate in 1981-89 and further accelerated to a 1.92 per cent annual rate in the 1989-2000 period. This growth pattern lies in contrast to the large falloff in output growth in the forestry and logging and woods products sectors in the 1990s. Even in the recessionary first fall of the decade output in paper products was advancing at a 1.81 per cent annual rate.

iv) Forest Products Sector Aggregate

The average annual growth rate of output in the forest products sector aggregate was 2.37 per cent over the last forty years (Table 1 and Chart 2). With overall output growth at 3.69 per cent, the sector's share of total economy output decreased from 4.16 per cent in 1961 to 2.52 per cent in 2000 (Chart 3).

The forest products sector aggregate grew the fastest during the 1961-1973 period, when its average annual growth rate was 3.87 per cent. Output growth slowed down considerably during the 1973-1981 period, averaging 0.86 per cent per year. The sector's average annual growth rate of output during that period was 0.7 per cent. It then picked up to 3.21 per cent during the 1981-89 period, the only period during which the sector's output growth exceeded that of the overall economy (2.88 per cent). Output growth was much slower during the 1989-2000 period, averaging 1.25 per cent per year. It was nearly zero (0.05 per cent) between 1989 and 1995, but picked up considerably in the second half of the decade (2.71 per cent).

C. Provinces

This section examines the provincial distribution, the relative provincial importance and provincial growth rates for output in logging and forestry, wood products, paper products, and overall forest products sector for the 1984-2001 period based on the 1997NAICS using real value added (1997\$) data produced by the Industry Division of Statistics Canada (Tables 4-7).

i) Forestry and Logging Sector

More than half (51.0 per cent) of the output of the Canadian forestry and logging industry was produced in British Columbia in 2001 (Table 4 and Chart 4). Quebec came in second with 18.4 per cent of the sector's output, followed by Ontario, New Brunswick and Alberta with respective shares of 14.1 per cent, 5.3 per cent, and 4.5 per cent. British Columbia saw its share remain constant between 1984 and 1999, while Ontario saw its share decline by 25 per cent.

Forestry and logging output as a share of the provincial GDP in 2001 was higher than the national average (0.60 per cent) in three provinces: Newfoundland, New Brunswick and British Columbia. The shares were 0.91 per cent, 1.76 per cent and 2.55 per cent respectively, based on the NA-NAICS estimates. The sector's importance in provincial GDP in 2001 were down in all provinces from their 1984 levels, with the exception of Alberta.

For the 1984-2001 period, Alberta experienced the fastest growth in output with a 7.07 per cent average annual growth rate, well above the national average of -0.62 per cent (Table 4). Saskatchewan, Quebec, and Nova Scotia also had positive average annual growth rates for the period (1.98 per cent, 1.01 per cent and 1.84 per cent respectively). However, New Brunswick, Manitoba, Ontario, and Prince Edward Island experienced significant decreases in output over the period. The respective average annual growth rates were -3.57 per cent, -3.03 per cent, -2.32 per cent and -2.16 per cent.

ii) Wood Products Sector

The British Columbia wood products sector had the largest share of the national wood products output, with 36.8 per cent in 2001. It was followed by Quebec, Ontario, Alberta and New Brunswick, with shares of 27.5 per cent, 17.0 per cent, 9.0 per cent and 4.6 per cent respectively (Table 5 and Chart 4). The other provinces all had shares below 3 per cent. The major structural shift over the period was the fall in British Columbia's share, down 51.1 per cent.

Output in the wood products industry remained stable as a share of total GDP in Canada over the 1984-01 period at around 1.1 per cent. It increased in Manitoba and Alberta, New Brunswick, Quebec and Ontario, but declined in the other provinces. In 2001, the three provinces where output of wood industries output, as a share of provincial GDP, was higher than the national average were British Columbia, New Brunswick and Quebec, with shares of 3.2 per cent, 2.6 per cent and 1.34 per cent respectively.

For the 1984-2001 period, the sector's output growth was positive in all provinces except Prince Edward Island, with Quebec having the most rapid growth at 3.47 per cent per year. It was closely followed by Ontario with an average annual growth rate of 3.44 per cent.

iii) Paper Products Sector

Quebec's paper products sector accounted for one third (36.8 per cent) of the output in the Canadian paper products sector in 2001 (Table 6 and Chart 4). It was followed by Ontario, British Columbia, New Brunswick and Alberta, with respective shares of 28.7 per cent, 15.1 per cent, 6.5 per cent and 4.9 per cent. The shares were up from their 1997 level in New Brunswick and British Columbia.

In terms of relative importance for the provincial economy, paper manufacturing was most crucial in New Brunswick (4.14 per cent of provincial GDP compared to the national average of 1.16 per cent). It was also of above average importance in Quebec, Nova Scotia, and British Columbia (2.00 per cent, 1.84 per cent, 1.45 per cent of provincial GDP respectively).

Over the 1997-2001 period, output growth rates were positive in all provinces for which data are available, except in Manitoba where it was slightly negative. New Brunswick outperformed the others with an average annual growth rate of 5.21 per cent.

iv) Forest Products Sector Aggregate

In 2001, more than 93 per cent of Canadian forest products was produced in five provinces (Table 7 and Chart 4). In order of importance, the five provinces with their respective output shares in brackets were: British Columbia (30.9 per cent), Quebec (29.4 per cent), Ontario (21.2 per cent), Alberta (6.3 per cent), and New Brunswick (5.5 per cent). The shares in Quebec and New Brunswick were up from their 1997 levels. However, output shares declined in Ontario and British Columbia.

Economic activity in the forest products sector is more important in some provinces than in others. In New Brunswick, British Columbia, , Quebec, and Nova Scotia, the forest products sector aggregate share of the provincial GDP is higher than the national average. In 2001, it was 8.5 per cent, 7.2 per cent, 3.9 per cent and 3.1 per cent of provincial GDP respectively, compared to the 2.8 per cent national average.

Over the 1997-2001 period, the growth rates of forest products sector output at the provincial level ranged from a low of –0.56 per cent per year in British Columbia to a high of 3.31 per cent in New Brunswick. Quebec and Alberta followed with 2.40 and 1.31 per cent a year respectively.

Summary Table 3: Data Sources and Years of Availability for Employment

National Level	Labour Force Survey (NAICS-based)	Survey of Employment, Payrolls and Hours (NAICS-based)	Labour Force Survey (SIC-based)	Aggregate Productivity Measures (SIC-based)
Forestry and Logging Sector	1987-2001	1991-2001	1976-1998	1961-2000*
Wood Products Sector	1987-2001	1991-2001	1976-1998	1961-1997*
Paper Products Sector	1987-2001	1991-2001	1976-1998	1961-1997*
Provincial Level				
Three Forest Products Sectors	1987-2001*	1991-2001	1984-1998	N/A

*series chosen for analysis

III Employment and Hours Worked Trends in the Forest Products Sector

A. Data Sources

Three sources for employment, average hours worked per week, and total hours (the product of employment and average hours) are provided with this report (Summary Table 3). The first source is the Aggregate Productivity Measures series, based on the 1980 SIC for 1961-2000 for logging and forestry and for 1961-97 for wood products and paper products (Tables 8, 16, and 24). Unfortunately, these estimates are only available at the national level. The second source is the Labour Force Survey (LFS). Estimates of employment and hours based on the SIC are available for the 1976-1998 period at the national level (Tables 9, 17 and 25 and for the 1984-1998 period at the provincial level and based on NAICS for the 1987-2001 period for both the national (Tables 10, 18 and 26) and provincial levels (Tables 12-15, 20-23, and 27-30). The third source is the Survey of Employment, Payrolls and Hours (SEPH). Employment and average hours estimates are available for the 1991-2001 period at both the national (Tables 11 and 19) and provincial level based on NAICS. The difference between the two surveys is that the LFS is a household survey covering all workers while the SEPH is an establishment surveys covering only employees.

In order to minimize the number of estimates of employment and average hours discussed, only the APM series, based on the SIC, will be presented for Canada. Employment and average hours trends from the LFS for the 1997-2000 period have been used to update the APM series to 2000 for wood products and paper products. For the provinces the LFS estimates based on NAICS will be presented because they are available to 2001, unlike the SIC estimates which end in 1998. Provincial NAICS employment estimates go back to 1987.

Summary Table 4: Difference in Employment (thousands of workers) Estimates between SIC and NAICS in 1998

	Forestry and Logging	Wood Products	Paper Products	Forest Products Sector Aggregate
SIC (S)	74.8	179.9	127	381.7
NAICS (N)	60.9	149.9	121.5	332.3
(N-S)	-13.9	-30	-5.5	-49.4
(N/S)*100	81.4%	83.3%	95.7%	87.1%
Per cent difference (N-S)/S*100	-18.6%	-16.7%	-4.3%	-12.4%

Source: Tables 12 and 14

The differences in SIC and NAICS definitions for the three forest products industries, summarized earlier, mean that employment levels vary depending of which industry definition is used. Summary Table 4 shows that employment in forestry and logging in 1998 was 18.6 per cent less under the NAICS definition, nearly double the difference registered for output. This implies that the activities that were dropped from this sector had productivity levels below the average for the sector or that activities that were added have above average productivity levels.

Equally, employment in woods products, measured on a NAICS basis, was 16.7 per cent

below the SIC estimate for 1998, even though the NAICS estimate of output in the sector was slightly above the SIC estimate. Again this implies large differences in productivity levels for the activities being reclassified into and out of the industry.

Employment in paper products on a NAICS basis in 1998 was 4.3 per cent less than on a SIC basis. In contrast, output was 1.3 per cent greater under NAICS.

Employment in the overall forest products sector was considerably smaller in 1998 on a NAICS basis than on a SIC basis: 332 thousand versus 382 thousand, a 12.9 per cent difference. Chart 1 shows that over the 1987-98 period the share of forest products sector employment in total economy employment was always 0.2-0.3 percentage points lower on a NAICS than a SIC basis.

Chart 1 shows the trends in the relative size of the employment share of the forest products sector in Canada for the 1986-2001 period under NAICS and SIC definitions. The SIC-based estimates are 0.3-0.4 percentage points of total employment larger than the NAICS estimates throughout the period.

A. Canada

i) Forestry and Logging Sector

Employment in the forestry and logging sector declined from 77.4 thousand in 1961 to 63.9 thousand in 2000, an average annual rate of -0.49%, based on APM data (Table 8 and Chart 5). On the other hand, employment in the total economy rose 2.21 per cent a year on average during the same period. Consequently, the sector's share of employment fell by two-thirds, going from 1.20 per cent in 1961 to 0.42 per cent in 2000 (Chart 6).

Employment in the forestry and logging sector was fairly stable over the 1961-1973 and then entered a period of continuous decline, falling 1.11 per cent a year in the 1973-81 period, 0.59 per cent in 1981-89, and 0.64 per cent in 1989-2000.²

Average weekly hours in logging and forestry followed a downward trend between 1961 and 1981, declining from 45.0 hours per week to 37.9 hours and then an upward trend between 1981 and 2000, increasing to 42.0 hours, based on the APM estimates (Table 16 and Chart 7). For the overall 1961-2000 period, the average annual growth rate was -0.18 per cent. The decrease was faster at the aggregate economy level, at -0.34 per cent per year. Average weekly hours in the forestry and logging sector were 113.8 per cent of the total economy average in 1961 and by 2000 had increased to 121.3 per cent. The decrease in average weekly hours was the

² NAICS employment data also show declining employment in the forestry and logging sector in the 1990s. Over the 1987-2001 period, employment declined slightly with an average annual growth rate of -0.14 per cent (Table 10) according to the LFS-NAICS estimates. The SEPH-NAICS data also shows a decline in employment with an average annual growth rate of -0.60 per cent for the 1991-2001 period (Table 11). Over the 1976-1998 period, employment in the forestry and logging seems to have remained fairly constant based on the LFS-SIC estimates with a small average annual growth rate of 0.15 per cent (Table 9).

fastest during the 1961-1973 period when its average annual growth rate was -0.99 per cent and continued at a -0.69 per cent annual rate during the 1973-1981 period. However, average weekly hour increased 0.48 per cent a year on average between 1981 and 1989, and 0.60 per cent a year on average between 1989 and 2000. Growth was very rapid between 1995 and 2000, as average weekly hours increased at a 1.73 per cent average annual rate.³

ii) Wood Products Sector

Based on the APM estimates, the wood products sector experienced a 1.56 per cent average annual growth rate in employment between 1961 and 2000, with employment rising from 92.1 thousand to 168.1 thousand (Table 8 and Chart 5). Since employment grew faster in the total economy (2.21 per cent per year), the sector's employment share fell from 1.42 per cent in 1961 to 1.11 per cent in 2000 (Chart 6).

Employment growth in woods products was especially fast during the 1961-1973 period at 2.65 per cent per year. Employment declined slightly over the 1973-1981 period (-0.13 per cent per year), rebounded to a 0.74 per cent average annual rate in the 1981-89 period, and then soared to a strong 2.20 per cent per year in the 1989-2000 period. This later growth rate was almost double that of the aggregate economy. Employment growth was particularly robust in the second half of the 1990s, advancing at a 5.44 per cent average annual rate.

Average weekly hours in the wood products sector have been relatively constant over the 1961-2000, contrary to what happened in the economy in general (Table 16 and Chart 7). Based on the APM estimates, the average annual growth rate for the period was -0.05 per cent, compared to -0.34 per cent for total economy. Consequently, average weekly hours as a proportion of total economy rose from 97.8 per cent in 1961 to 109.7 per cent in 2000. Average weekly hours decreased 0.22 per cent and 0.76 per cent a year on average during the 1961-1973 and 1973-1981 periods respectively. They then grew 0.80 per cent a year on average during the 1981-1989 period. Average weekly hours have been constant during the 1989-2000 period.⁴

iii) Paper Products Sector

Employment in the paper products sector grew very modestly during the 1961-2000 period, increasing only from 102.2 thousand to 107.5 thousand (Table 8 and Chart 5). The average annual growth rate of 0.12 per cent a year was well below that of aggregate employment

³ According to LFS-SIC estimates, average weekly hours in logging and forestry were fairly steady over the 1976-1998 period but there were some fluctuations from year to year (Table 17). Based on the LFS-NAICS estimates, average weekly hours have increased between 1987-2001 and have remained above the total economy average (Table 18). The upward trend is not present in the SEPH-NAICS estimates for 1991-2001 (Table 19).

⁴ Based on the LFS-NAICS estimates, average weekly hours in wood products remained fairly constant over the 1987-2001 period (Table 18). They remained above the average for total economy. The SEPH-NAICS estimates are slightly longer hours worked in the sector and some increase over the 1991-2001 period (Table 19).

(2.21 per cent), resulting in more than a 50 per cent drop in the sector's employment share from 1.58 per cent in 1961 to 0.71 per cent in 2000 (Chart 6).

The paper products sector exhibited positive employment growth up to 1981 and has since been shedding jobs. Employment grew at a 2.14 per cent average annual rate in the 1961-73 period and 0.26 per cent in 1973-1981. Employment then fell at a 1.07 average annual rate in 1981-89, accelerating to 1.27 per cent in 1989-2000. Employment continued to decline even in the second half of the 1990s, a period of strong economic growth.⁵

Average weekly hours decreased 0.20 per cent a year on average in the paper products sector from 39.1 hours in 1961 to 36.5 hours in 2000 (Table 16 and Chart 7). This was a slightly slower pace of decline than experienced at the aggregate economy level. Consequently, the sector's average weekly hours relative to that in the total economy increased from 98.8 per cent in 1961 to 105.4 per cent in 2000. Average weekly hours decreased 0.30 per cent a year on average during the 1961-1973 period and 0.81 per cent during the 1973-1981 period. Average weekly hours then rose 0.44 per cent a year on average during the 1981-1989 period. They have been relatively stable in the 1990s, down 0.04 per cent per year.⁶

iv) Forest Products Sector Aggregate

Employment in the forest products sector, which includes logging and forestry, wood products, and paper products, rose from 271.7 thousand in 1961 to 340.2 thousand in 2000, an average annual rate of increase of 0.58 per cent (Table 8 and Chart 5). This was slower than aggregate employment growth (2.21 per cent), with the result that the sector's employment share fell by nearly 50 per cent from 4.19 per cent in 1961 to 2.24 per cent in 2000 (Chart 6). Given the decline in employment in logging and forestry and the very weak employment growth in paper products over the period, wood products accounted for 111.0 per cent of the net employment gains.

Employment growth was strong during the 1961-1973, at an average annual growth rate of 1.80 per cent. It then fell at a 0.20 per cent annual rate in 1973-81 and 0.26 per cent in 1981-89. In the 1990s, employment growth turned positive, advancing 0.44 per cent per year from 1989 to 2000, with all the gains in the second half of the decade, reflecting the very strong employment growth in the woods product sector during this period.⁷

⁵ The decline in employment in paper products since 1981 is confirmed by other data sources. As was the case for forestry and logging and contrary to wood products industries, employment has been decreasing in the paper manufacturing sector since 1981 according to the LFS-SIC (Table 9), since 1987 according to LFS-NAICS (Table 10), and since 1991 according to SEPH-NAICS estimates (Table 11).

⁶ Average weekly hours in paper products have been stable over the 1987-2001 period according to LFS-NAICS (Table 18) as well as between 1991 and 2001 according to SEPH-NAICS (Table 19). SEPH shows that average hours worked in paper products in 2001 was 39.0 hours, above the estimate of 36.9 hours from the LFS.

⁷ Employment data from other sources show a similar pattern. Employment in the forest products sector grew during the 1987-2001 period at an average annual growth rate of 0.68% (Table 10), based on the LFS-NAICS estimates. Employment growth was stronger after 1997. The SEPH-NAICS estimates show similar trends, with a 0.52% average annual growth rate for the 1991-2001 period (Table 11). As was the case for output, the year 2001 was not

Average weekly hours in the forest products sector decreased -0.18 per cent a year on average between 1961 and 2000 (Table 16 and Chart 7). The fall in average weekly hours was slower than in the aggregate economy over the period, raising average weekly hours in the forest products sector from 102.8 per cent of the total economy average in 1961 to 109.3 per cent in 2000. Average weekly hours followed a downward trend from 1961 to 1981, falling 0.51 per cent per year in 1961-73 and 0.78 per cent in 1973-81. Average weekly hours then increased 0.59 per cent a year on average during the 1981-1989 period, and have been relatively stable in the 1990s (-0.04 per cent per year)⁸

C. Provinces

This section examines the provincial distribution, the relative provincial importance and provincial growth rates for employment and average hours in logging and forestry, wood products, paper products, and overall forest products sector for the 1987-2001 period based on the LFS using NAICS (Tables 12-15 and 20-23). Estimates for the 1984-98 based on SIC from the LFS show the same patterns and trends.

i) Forestry and Logging Sector

Quebec and British Columbia accounted for more than two-thirds of employment in Canada's forestry and logging sector in 2001, based on the LFS-NAICS estimates (Table 12 and Chart 8). Their respective shares were 36.0 per cent and 31.1 per cent. They were followed by Ontario, New Brunswick and Alberta, which respectively had 10.9 per cent, 7.0 per cent and 5.0 per cent of the Canadian forestry and logging sector employment.

In terms of contribution to provincial employment, the forestry and logging sector is most important in New Brunswick, accounting for 1.14 per cent of total employment in the province in 2001, compared to 0.36 per cent at the national level. Other provinces where forestry and logging makes an above average contribution to employment are Newfoundland (0.43 per cent), Nova Scotia (0.61 per cent), Quebec (0.56 per cent), and British Columbia (0.86 per cent).

Employment in the forestry and logging sector declined between 1987 and 2001 in Canada, but grew in certain provinces. Quebec and the Prairie provinces, Manitoba, Saskatchewan and Alberta, experienced positive average annual growth rates for the 1987-2001 period, which were 0.6 per cent, 2.9 per cent, 2.9 per cent and 2.2 per cent respectively. Newfoundland had the lowest average annual growth rate for the period at -3.6 per cent. All the decline in employment at the national level in 2001 came from a very large decline (25.7 per cent) in employment in British Columbia.

a good one since employment fell, from 343,000 to 328,900 according to LFS-NAICS and from 302,348 to 287,980 according to SEPH-NAICS.

⁸ Average weekly hours in the forest products sector aggregate did not experience any significant growth during the 1987-2001 period, based on the LFS-NAICS estimates (Table 18). The SEPH-NAICS estimates also show minimal growth for the 1991-2001 period (Table 19).

Average weekly hours worked in the forestry and logging sector were higher than the national average of 39.3 hours in Newfoundland, Saskatchewan and Alberta based on the LFS-NAICS estimates (Table 20). In all the other provinces, average weekly hours as a proportion of the Canadian sector ranged from 90 per cent to 100 per cent, with the exception of PEI, where average weekly hours were 81.3 per cent of the Canadian average. In all provinces, with again the exception of PEI, average weekly hours as a proportion of the average for the respective provincial total economies were above 100 per cent. In Saskatchewan, workers in the forestry and logging sector work 34 per cent longer hours per week than the provincial average.

Average weekly hours increased significantly between 1987 and 2001 in Newfoundland, Saskatchewan and Alberta at average annual rates of 1.21 per cent, 1.2 per cent and 0.68 per cent respectively. Average weekly hours did not decline in any provinces for which data is available.

ii) Wood Products Sector

Quebec and British Columbia again accounted for more than 60 per cent of employment in the Canadian wood products sector in 2001 (Table 13 and Chart 8). The five most important provinces for wood product employment (share of national total in brackets) in 2001 were Quebec (32.0 per cent), British Columbia (30.1 per cent), Ontario (20.0 per cent), Alberta (7.0 per cent), and New Brunswick (4.3 per cent). Quebec saw its share advance 8.3 percentage points between 1987 and 2001, while British Columbia's share declined 7.0 points.

Employment in the wood products sector as a share of the total provincial employment was above the national average (1.09 per cent) in 2001 in only three provinces: British Columbia (2.55 per cent), New Brunswick (2.09 per cent), and Quebec (1.51 per cent).. In 2001, the shares of wood products employment in total provincial employment were up from their 1987 level in all provinces except Prince Edward Island, New Brunswick and British Columbia.

Employment growth in the woods product sector was positive in all provinces over the 1987-2001 period. The highest average annual growth rate was achieved in Manitoba (5.8 per cent per year), followed by Saskatchewan (5.1 per cent), Quebec (4.4 per cent), Nova Scotia (3.7 per cent).

Average weekly hours in the woods products sector vary significantly by province, from a low of 35.7 hours in Quebec to a high of 44.0 in Prince Edward Island in 2001. Over the 1987-2001 period, the largest increase in average hours was in Prince Edward Island (0.68 per cent per year), followed by Saskatchewan (0.65 per cent), Alberta (0.40 per cent), and Manitoba (0.36 per cent).

iii) Paper Products Sector

Again two provinces dominate the paper products sector, but unlike the forestry and logging and wood products sectors where British Columbia and Quebec dominate, it is Ontario and Quebec that accounted for two-thirds of national employment in this sector in 2001 (Table 14 and Chart 8). The top five provinces, accounting for over 90 per cent of employment were

(per cent of national paper products employment in brackets) were Ontario (36.8 per cent), Quebec (30.4 per cent), British Columbia (13.6 per cent), New Brunswick (5.1 per cent), and Alberta (4.6 per cent). New Brunswick, Quebec and British Columbia saw their share decline between 1987 and 2001 while every other province saw their share rise during the same period.

The relative importance of the paper products sector for total employment was above the national average of 0.73 per cent in 2001 in five provinces: New Brunswick (1.67 per cent of provincial employment), Newfoundland (0.99 per cent), and Quebec (0.97 per cent), Nova Scotia (0.87 per cent), and British Columbia (0.77 per cent). Following the national trend, paper products sector employment as a proportion of total employment has been decreasing in all provinces during the 1987-2001 period except the Prairie provinces.

In absolute terms, employment in the paper manufacturing sector declined between 1987 and 2001 at the national level and in all provinces except the three Prairie provinces. Employment advanced at a 5.5 per cent average annual rate in Alberta, 3.6 per cent in Manitoba, and 3.4 per cent in Saskatchewan over the 1987-2001 period. The largest decline occurred in New Brunswick (2.3 per cent per year), followed by Quebec, Nova Scotia, and Newfoundland, all of which experienced a 1.8 per cent annual fall in employment.

Provincial average weekly hours in the paper products sector, as a proportion of national average for the sector of 36.9 hours in 2001, ranged from a low of 96.2 per cent in Newfoundland to 110.0 per cent in Saskatchewan (Table 22). Average weekly hours were also higher than total economy average hours in all provinces, as was the case in the other two forest products sectors. In Saskatchewan in 2001, paper products sector workers worked 16.8 per cent more hours per week than workers in the economy as a whole, while it was only 2.6 per cent in Newfoundland. Average weekly hours increased during the 1987-2001 in Nova Scotia and New Brunswick as well as in Saskatchewan, while they remained stable or declined in the other provinces.

iv) Forest Products Sector Aggregate

Quebec has the largest share of employment in the Canadian forest products sector aggregate, with 32.1 per cent in 2001, based on the LFS-NAICS estimates (Table 15 and Chart 8). In second place is British Columbia, (24.7 per cent), closely followed by Ontario (24.1 per cent), with Alberta (5.9 per cent) and New Brunswick (5.0 per cent) ranking fourth and fifth respectively. These five provinces account for 92 per cent of the sector's employment. During the 1987-2001 period, employment shares rose in Quebec and the Prairie provinces and declined in all other provinces. Employment in the forest products sector aggregate as a share of the provincial total economy rose only in the three Prairie provinces between 1987 and 2001.

Over the 1987-2001 period Manitoba enjoyed the largest increase in employment in the forest products sector (4.56 per cent per year), followed closely by Saskatchewan (3.95 per cent), Alberta (3.70 per cent), and Quebec (1.17 per cent). New Brunswick was the only province with a significant decline in employment, down 0.66 per cent a year.

Provincial average weekly hours worked in the forest products sector aggregate, as a proportion of the national average of 37.3 hours in 2001 ranged from 97.7 per cent in Quebec to 111.6 per cent in Saskatchewan (Table 23). Workers in forest products sector in all provinces worked more hours than the provincial average, ranging from 8.7 per cent more in Manitoba to 19.8 per cent in Saskatchewan.

Average weekly hours worked rose in all provinces for which we have data between 1987 and 2001, with the exception of Quebec. Saskatchewan experienced the fastest average annual growth rate during that period at 0.77 per cent, compared to the national growth rate of only 0.06 per cent.

IV Trends in Capital Stock in the Forest Products Sector

A. Data Sources

Two series on capital stock are available, both produced by the Capital Stock Division of Statistics Canada using the perpetual inventory method. The first, expressed in 1992 dollars, is based on the 1980 SIC and is available for the 1961-99 period at the national level (Table 31) and provincial level. The second, expressed in 1997 dollars, is based on NAICS and is available from 1961 to 2001 at the national (Table 32) and provincial level (Tables 33-36). Both series are based on end year net stock Laspeyres estimates, using a geometric depreciation assumption.

In order to minimize the number of estimates presented, at the national level only the SIC capital stock estimates will be discussed (Table 31). This series was chosen to ensure consistency with the APM estimates of output and labour input which are also based on the 1980 SIC. As the SIC capital stock time series only goes to 1999, the growth rate of the NAICS capital stock estimates for 2000 has been used to extend the SIC capital stock series to that year. At the provincial level the NAICS capital stock series has been used. Since there are no provincial APM series by province, there is no need to use the SIC capital stock series for consistency. A second reason for using the NAICS capital stock estimates by province is that it is available to 2001, compared to only 1999 for SIC capital stock estimates.

B. Canada

i) Forestry and Logging Sector

Based on SIC capital stock estimates, expressed in 1992 dollars, the net capital stock in forestry and logging in Canada fell at a 1.07 per cent average annual rate over the 1961-2000 period (Table 31 and Chart 9). The rate of growth of the capital stock in all industries was 2.95 per cent. This differential growth led to a massive decline in the relative importance of the capital stock of this sector in the total capital stock, from 0.55 per cent in 1961 to 0.12 per cent in 2000 (Chart 10).

The only cyclically neutral period when the capital stock in the forestry and logging sector grew was the 1961-73 period, when it advanced at an average annual 2.97 per cent. Since then it has shrunk in the three cyclically neutral periods: an average 0.86 per cent per year from 1973 to 1981, 6.08 per cent in 1981-89, and 1.79 per cent in 1989-2000. The value of the capital stock in 2000 was only half that in 1981.

ii) Wood Products Sector

In contrast to forestry and logging, capital stock growth in the wood products sector has been robust over the last 40 years (Table 31 and Chart 9). It has risen at a 3.42 per cent average annual rate, exceeding that for all industries (2.95 per cent). The sector's share of total economy capital stock has therefore risen from 0.43 per cent in 1961 to 0.51 per cent in 2000 (Chart 10).

Capital stock growth in the wood products sector was very fast during the 1961-1973 period, with an average annual growth rate of 8.07 per cent. It then fell off to 2.43 per cent in 1973-81, and 0.26 per cent in 1981-89, before picking up somewhat to 1.54 per cent in 1989-2000.

iii) Paper Products Sector

Capital stock in the paper products sector has also experienced strong growth over the 1961-2000 period, at 2.97 per cent per year (Table 31 and Chart 9), almost identical to that for all industries (2.95 per cent). The sector's share of the total economy capital stock has thus remained stable at 2.09-2.11 per cent (Chart 10).

The paper products sector experienced rapid capital stock growth during the 1961-1973 period, at 5.09 per cent per year. Capital stock growth fell to 2.41 per cent per year in the 1973-81 period, before rebounding to a strong 6.52 per cent in 1981-89. In the 1990s, the capital stock has declined at a 1.69 per cent average annual growth rate, with the fall, perhaps surprisingly given economic conditions, more rapid in the second half of the decade than the first (2.94 per cent per year in 1995-2000 versus 0.63 per cent in 1989-1995).

iv) Forest Products Sector Aggregate

In 1961, the paper products sector accounted for 68.0 per cent of the forest products sector total capital stock, forestry and logging 17.8 per cent, and wood products 14.0 per cent. With the absolute decline in the capital stock in forestry and logging, this sector's share of the total capital stock in the forest products sector plummeted to 4.3 per cent by 2000. The strong capital stock growth in wood products increased this sector's share to 18.7 per cent while the growth of the paper products raised this sector's share to 76.8 per cent.

Capital stock in the forest products sector aggregate grew at an average annual rate of 2.66 per cent over the 1961-2000 period, somewhat below the all industries growth rate of 2.95 per cent (Table 31 and Chart 9). The relative importance of the sector's capital stock to total economy capital stock thus fell from 3.07 per cent in 1961 to 2.75 per cent in 2000 (Chart 10).

Capital stock growth in the forest products sector was rapid during the 1961-1973 period, with an average annual growth rate was 5.46 per cent. It fell to 2.02 per cent in the 1973-81 period before rebounding to 4.50 per cent in 1981-89. In the 1990s, the capital stock has fallen at a 1.15 per cent average annual rate, compared to an increase of 1.46 per cent for all industries. These divergent growth rates lowered the forest products sector's share of the total economy capital stock from 3.66 per cent in 1989 to 2.75 per cent in 2000. It is important to note that capital accumulation deteriorated further in the second half of the 1990s relative to the already poor performance during the first half of the decade, from a fall of 0.10 per cent per year in 1989-95 to 2.40 per cent in 1995-2000. All the forest products industries experienced this fall in the rate of capital accumulation despite the strong economic growth.⁹

C. Provinces

This section examines the provincial distribution, the relative provincial importance and provincial growth rates for the capital stock in logging and forestry, wood products, paper products, and overall forest products sector for the 1984-2001 period based on NAICS (Tables 33-36). Unfortunately, capital stock data for certain provinces is not available because of confidentiality restrictions.

i) Forestry and Logging Sector

In 2001, British Columbia's forestry and logging sector capital stock accounted for 54.2 per cent of the national total for this sector (Table 33 and Chart 11). Quebec ranked second, with 18.4 per cent, followed by Ontario (9.8 per cent), Alberta (6.0 per cent), and New Brunswick (3.8 per cent). British Columbia's share of the national capital stock in forestry and logging in 2001 was down 10 percentage points from the 1984 level of 64.0 per cent.

The forestry and logging sector share of total economy capital stock declined over the 1984-2001 period in all provinces but Manitoba and Alberta. The fall was most important in Ontario and British Columbia, where the shares fell by more than half. It went from 0.13 per cent to 0.06 per cent in Ontario and 1.85 per cent to 0.91 per cent in British Columbia.

Since British Columbia's capital stock represents more than half of the national capital stock, the growth of the country's capital stock in this sector is strongly affected by developments in that province. Since 1984, capital stock growth has been negative in British Columbia, with an average annual growth rate of -1.8 per cent, by far the largest rate of decrease experienced by any of the provinces. Ontario and Newfoundland also had negative growth, -1.3 per cent per year and -0.6 per cent respectively. Manitoba and Alberta had relatively high average annual growth rates, 4.1 per cent and 6.5 per cent respectively, but due to the small size of their capital stock relative to that in British Columbia, this rapid growth was insufficient to compensate for the decline in British Columbia's capital stock.

⁹ The NAICS capital stocks estimates (Table 32) show overall a similar growth pattern to the SIC capital stock estimates over the 1961-2000 period and the four sub-periods. One difference is that capital stock growth for the forest products aggregate is positive (1.15 per cent per year), not negative in the 1990s.

ii) Wood Products Sector

The capital stock data for the wood products sector is incomplete for confidentiality reasons at the provincial level, but the data for the four most important provinces are available (Table 34 and Chart 11). The wood products sectors in British Columbia, Quebec, Alberta and Ontario were using 86.7 per cent of the Canadian wood products sector capital stock in 2001. Their respective capital stock share were 30.3 per cent, 26.0 per cent, 16.9 per cent and 14.1 per cent. Quebec's and Alberta's capital stock shares were up from their 1984 levels while Ontario's and British Columbia's shares were down from their 1984 levels.

During the same period, the wood products sector's share of provincial total economy capital stock rose in Quebec, going from 0.56 per cent to 0.85 per cent, and more than doubled in Alberta, going from 0.30 per cent to 0.64 per cent. But the share declined in the other two provinces, going from 0.33 per cent to 0.29 per cent in Ontario, and falling from 2.34 per cent to 1.64 per cent in British Columbia.

Capital stock growth in the four provinces for which data are available has been positive over the 1984-2001 period. Alberta had the fastest growth at 7.6 per cent per year, followed by Quebec (5.2 per cent), Ontario (2.2 per cent), and British Columbia (0.3 per cent).

iii) Paper Products Sector

In 2001, the paper products sectors in the four provinces for which capital stock data are available accounted for 83.8 per cent of the national paper products sector capital stock (Table 35 and Chart 11). Quebec had the largest share at 30.8 per cent of the total capital stock, followed by British Columbia (23.4 per cent), Ontario (22.9 per cent) and Alberta (6.7 per cent). Quebec's and Alberta's capital stock shares were larger in 2001 than in 1984 while British Columbia's and Ontario's 2001 shares were smaller.

The capital stock in the paper products sector was above the national average (2.03 per cent of the total capital stock) in 2001 in British Columbia (3.86 per cent) and Quebec (3.05 per cent). Between 1984 and 2001 the paper products share of the provincial total economy capital stock grew in Quebec, going from 2.61 per cent to 3.05 per cent, and in Alberta, where it tripled, from 0.25 per cent to 0.77 per cent. But the share declined in Ontario and British Columbia.

Capital stock growth was positive for all four provinces for which data are available for the 1984-2001 period. Average annual growth rates were above the 2.7 per cent national average in Quebec and Alberta, at 3.6 per cent and 10.1 per cent respectively, below national average in Ontario, at 2.4 per cent and well below national average in British Columbia, at 1.3 per cent.

iv) Forest Products Sector Aggregate

For confidentiality reasons, capital stock estimates in the wood and in the paper sector are only available for Quebec, Ontario, Alberta and British Columbia. The forest products sector aggregate estimates are therefore only available for those four provinces (Table 36 and Chart 11)

In 2001, Quebec had the largest share of the capital stock of the national forest products sector aggregate, with 28.8 per cent. British Columbia was a close second with 27.2 per cent, followed by Ontario (20.0 per cent) and Alberta (9.0 per cent). These four provincial sectors accounted for 85 per cent of Canadian capital stock in the forest products sector. Quebec's and Alberta's shares were up from their 1984 levels while Ontario's share was only slightly smaller than its 1984 share. British Columbia's share of the national capital stock of the forest products sector fell 10.7 percentage points between 1984 and 2001.

Capital stock in the forest products sector aggregate as a share of provincial capital stock declined in British Columbia, going from 8.8 per cent to 6.4 per cent, as well as in Ontario, going from 2.1 per cent to 1.8 per cent. But this share grew in Quebec, going from 3.5 per cent to 4.1 per cent, and in Alberta as it more than doubled from 0.6 per cent to 1.5 per cent.

The forest products capital stock grew faster than the national average of 2.5 per cent per year over the 1984-2001 in Quebec (3.7 per cent), and especially in Alberta (8.7 per cent). Growth was slightly under the national average in Ontario (2.2 per cent) and much below the average in British Columbia (0.5 per cent).

V Trends in Productivity in Forest Products Industries

Summary Table 5 on Data Sources and Years of Availability for Productivity Estimates

		Aggregate Productivity Measures (SIC based)	National Accounts-Labour Force Survey (SIC based)	National Accounts-Labour Force Survey (NAICS based)
Labour Productivity	Canada	1961- 1997/2000*	1976-1998	1987-2001
	Provinces	N/A	1984-1998*	1987-2001
Capital Productivity	Canada	N/A	1961-2000*	1981-2001
	Provinces	N/A	1984-98	1984-2001*
Total Factor Productivity	Canada	N/A	1961-2000*	1987-2001
	Provinces	N/A	1984-98	1987-2001*

*series chosen for analysis

Data Sources

Labour productivity estimates are calculated by dividing real value added (output) by the amount of labour input used in the production process, either total hours worked or employment. Because both cyclical and secular movements in average hours are not reflected in trends in output per person employed, productivity measured on an output per hour basis provides a more accurate representation of labour productivity trends. It will be the only labour productivity measure used in this report.

Labour productivity estimates are available from the Aggregate Productivity Measures (APM) series produced by Statistics Canada on an SIC basis from 1961 to 2000 at the one digit SIC level and from 1961 to 1997 at the two-digit level at the national level only (Table 37). The Centre for the Study of Living Standards (CSLS) maintains a productivity data base and has two labour productivity series. The first is based on real GDP estimates by industry from the National Accounts and labour input from the Labour Force Survey (LFS) measured on a SIC basis and runs from 1976 to 1998 at the national level (Table 38). The second uses the same real output data, but uses LFS labour input data measured on a NAICS basis. It runs from 1987 to 2001 at the national level (Table 39) as well as the provincial level (Tables 40-43).

In order to minimize the number of productivity estimates discussed, at the national level only the productivity trends based on APM series will be discussed in the main body of report. This series was chosen because of its long length and because it is the official productivity series produced by Statistics Canada. The CSLS has extended the series period for wood products and paper products to 2000 based on trends in output and labour input from other sources.

At the provincial level, the series based on LFS and national accounts output based on the 1997 NAICS will be used.

Capital productivity is defined as the amount of output produced per unit of capital used in the production process and is calculated by dividing real value added by capital stock. Two series on capital productivity are provided in this report. The first series is based on real output from the APM series, based on the 1980 SIC (Table 1) and capital stock on the 1980 SIC provided by the Capital Stock Division of Statistics Canada (Table 31). It is available at the national level only from 1961 to 2000 (Table 48). The second series is based on output (Table 3) and capital (Table 32) stock estimates prepared on a NAICS basis and runs from 1981 to 2001 at the national level (Table 49) and from 1987 to 2001 at the provincial level (Table 50-53).

For discussion of capital productivity trends at the national level, the first of the two series will be used because it represents the longest time series. For discussion of provincial capital stock trends, the second series will be used as the APM output estimates upon which the first series is based are not available on a provincial basis.

Total factor productivity (TFP) growth is the difference between output growth and a weighted average of input growth (labour and capital) where the weights are the cost shares of the inputs in value added. Two TFP series are provided in this report for Canada. The first is SIC-based and derived from the APM estimates of real output (Table 1) and total hours (Table 24), both on a SIC basis, and from estimates of the capital stock on a SIC basis produced by the Capital Stock Division of Statistics Canada (Table 31). The share of labour compensation in value added in the base year, 1992, is used to weight hours growth and unity minus the labour compensation share is used to weight capital stock growth. This series runs from 1961 to 2000 and is only available at the national level. The second series is NAICS-based and is derived from NAICS output estimates produced by the Industry Division of Statistics Canada, NAICS hours estimates from the Labour Force Survey, and NAICS capital stock estimates from the Capital Stock Division of Statistics Canada. The series runs from 1987 to 2001 at the national level (Tables 55 and 60 as well as the provincial level (Table 56-58 and 61-63).

For discussion of TFP productivity trends at the national level, the first of the two series derived largely from APM series will be used because it represents the longest time series. For discussion of provincial capital stock trends, the second series will be used as the APM output estimates upon which the first series is based are not available on a provincial basis.

B. Canada

i) Forestry and Logging Sector

Summary Table 6: Average Annual Growth Rates in the Forestry and Logging Sector

	Output	Hours	Capital Stock	Value Added per Hour	Capital Stock per Hour	Total Factor Productivity
1961-2000	1.52	-0.67	-1.07	2.21	-0.40	2.35
1961-1989	2.24	-0.92	-0.78	3.19	-0.78	3.14
1961-1973	3.05	-0.87	2.97	3.95	3.87	2.65
1973-1981	0.00	-1.79	-0.86	1.83	0.95	1.51
1981-1989	3.29	-0.11	-6.08	3.41	-5.97	5.54
1989-2000	-0.27	-0.05	-1.79	-0.23	-1.75	0.35
1989-1995	-1.36	0.68	0.39	-2.03	-0.29	-1.94
1995-2000	1.05	-0.91	-4.35	1.98	-3.47	3.18

Source: Tables 1, 24, 31, 37, 54, 70. Note: The labour and capital shares for Forestry and Logging are 0.67 and 0.33 respectively.

a) Labour Productivity

Labour productivity as measured by value added per hour worked grew 2.21 per cent a year on average in the forestry and logging sector between 1961 and 2000, based on the APM estimates produced by Statistics Canada (Table 37 and Chart 13). Growth was faster than in the aggregate economy, where labour productivity grew 1.80 per cent a year on average. Labour productivity in the forestry and logging sector, as a proportion of total economy productivity, therefore grew over the period, going from 99.2 per cent in 1961 to 116.2 per cent in 2000.

Labour productivity in forestry and logging has exhibited two different trends, an upward one from 1961 to 1989 and a downward one from 1989 to 2000. During the 1961-1973 period, labour productivity growth was rapid at 3.95 per cent a year on average, but only slightly above the average for the aggregate economy (3.42 per cent). Productivity growth decelerated to an average annual rate of increase of 1.83 per cent in the 1973-81 period and then picked up to a 3.41 per cent rate from 1981 to 1989. From 1989 to 2000, labour productivity fell -0.23 per cent a year on average, the first period during which aggregate economy productivity growth outstripped that in forestry and logging. The fall in productivity was concentrated in the first half of the decade (-0.23 per cent per year in 1989-95). The second half of the 1990s saw a very strong rebound in output per hour growth in forestry and logging (1.98 per cent per year from 1995 to 2000).

b) Capital productivity

In forestry and logging in 1961 one unit of capital stock, defined as \$1,000 worth of capital stock expressed in 1992 dollars, produced real output valued at \$2,297 (1992 dollars). By 2000, one unit of capital stock produced real output worth \$6,294, a 174 per cent increase (Table 48). Capital productivity in forestry and logging thus advanced at a rapid 2.62 per cent per year over the 1961-2000 period, compared to 0.72 per cent for all industries (Chart 14). Forestry and logging capital productivity, relative to that of total economy, thus increased from 244.3 per cent in 1961 to 506.4 per cent in 2000 (Chart 15).

c) Total Factor Productivity

Total factor productivity (TFP), based on total hours worked as labour input, has been quite strong in the forestry and logging industry over the 1961-2000 period, advancing at a 2.35 per cent average annual rate, well above the 1.43 per cent rate of the aggregate economy (Table 54 and Chart 16). In the three cyclically-neutral periods up to 1989, TFP growth was strong, with average annual rates of 2.65 per cent in 1961-73, 1.51 per cent in 1973-81, and a very robust 5.54 per cent in 1981-89. In this third period, a large increase in output growth combined with a plummeting capital stock produced a surge in TFP growth. TFP growth fell off sharply in the 1990s, increasing only 0.35 per cent between 1989 and 2000. The decline was concentrated in the first half of the decade (-1.94 per cent per year between 1989 and 1995), as TFP growth rebounded in the second half of the decade (3.18 per cent in 1995-2000).

ii) Wood Products Sector

Summary Table 7: Average Annual Growth Rates in the Wood Products Sector

	Output	Hours	Capital Stock	Value Added per Hour	Capital Stock per Hour	Total Factor Productivity
1961-2000	3.67	1.51	3.42	2.13	1.89	1.69
1961-1989	4.45	1.21	4.17	3.20	2.92	2.53
1961-1973	5.14	2.42	8.07	2.65	5.51	1.40
1973-1981	2.53	-0.89	2.43	3.45	3.36	2.68
1981-1989	5.38	1.54	0.26	3.78	-1.26	4.08
1989-2000	1.69	2.25	1.54	-0.55	-0.70	-0.39
1989-1995	-0.85	-0.51	2.63	-0.35	3.15	-1.05
1995-2000	4.83	5.67	0.25	-0.79	-5.13	0.41
Source: Tables 1, 24, 31, 37, 54, 70. Note: The labour and capital shares for wood products are 0.77 and 0.23 respectively.						

a) Labour Productivity

Based on the APM estimates, labour productivity in the wood products sector grew 2.13 per cent a year on average between 1961 and 2000 (Table 37 and Chart 12). Labour productivity growth in the aggregate economy was somewhat slower at 1.80 per cent per year on average over

the same period. Labour productivity in the wood product sector, as a proportion of total economy, thus increased from 67.2 per cent in 1961 to 76.3 per cent in 2000 (Chart 13).

In the 1961-73 period, output per hour in wood products advanced at a 2.65 per cent average annual rate. This growth rate then accelerated to 3.45 per cent in 1973-81 and an even stronger 3.78 per cent in 1981-89. The situation changed markedly in the 1990s, with labour productivity falling at a 0.55 per cent average annual rate between 1989 and 2000. Unlike forestry and logging that experienced a rebound in productivity growth in the second half of the 1990s, the productivity growth performance of wood products actually deteriorated, from -0.35 per cent per year in 1989-95 to -0.79 per cent in 1995-2000.

The APM series provides indexes for output per hour growth for the 1961-97 period (Table 84) for five industries within the woods products sector (1997 shares of total hours worked in brackets): sawmill, planning mill, and shingle mill production industries (52 per cent); sash, door and other millwork industries (29 per cent); veneer and plywood industries (6 per cent); wooden box and coffin industries (3 per cent); and other wood industries (10 per cent). Output per hour growth was strongest in the most important wood products industry, sawmills, planning mills, and shingle mills at 3.13 per cent per year over the 1961-97 period, and relatively weak (0.99 per cent per year) in the second largest industry, namely sash, door and other millwork. The situation reversed itself in the 1990s (1989-97) when productivity growth fell 1.13 per cent per year in sawmills, planning mills, and shingle mills, but rose 1.89 per cent in sash, door and other millwork.

b) Capital Productivity

Capital productivity in the wood products sector rose at a very weak 0.13 per cent average annual rate over the 1961-2000 period (Table 48 and Chart 14), below that for all industries (0.62 per cent). Consequently, the relative capital productivity level of the sector fell from 197.1 per cent of the total economy average in 1961 to 162.9 per cent in 2000 (Chart 15).

c) Total Factor Productivity

The woods products sector experienced TFP growth of 1.69 per cent per year over the 1961-2000 period, above the all industries average of 1.43 per cent (Table 54 and Chart 16). As in forestry and logging, TFP growth was strong up to the 1990s, advancing 1.40 per cent per year in 1961-73, 2.68 per cent 1973-81, and 4.08 per cent in 1981-89. In contrast, TFP declined at a 0.39 per cent average annual rate in the 1990s, with all the fall taking place during the first half of the decade (-1.05 per cent per year in 1989-95 versus 0.41 per cent in 1995-2000).

iii) Paper Products Sector

Summary Table 8: Average Annual Growth Rates in the Paper Products Sector

	Output	Hours	Capital Stock	Value Added per Hour	Capital Stock per Hour	Total Factor Productivity
1961-2000	2.06	-0.05	2.97	2.12	3.03	1.07
1961-1989	2.12	0.44	4.87	1.67	4.41	0.17
1961-1973	3.77	1.84	5.43	1.90	3.52	0.63
1973-1981	0.37	-0.55	2.41	0.92	2.98	-0.10
1981-1989	1.43	-0.64	6.52	2.09	7.21	-0.34
1989-2000	1.92	-1.31	-1.69	3.27	-0.39	3.41
1989-1995	1.81	-2.16	-0.63	4.06	1.56	3.50
1995-2000	2.04	-0.27	-2.94	2.32	-2.68	3.29

Source: Tables 1, 24, 31, 37, 54, 70. Note: The labour and capital shares for paper products are 0.65 and 0.35 respectively.

a) Labour Productivity

Labour productivity grew 2.12 per cent a year on average between 1961 and 2000 in the paper products sector, based on the APM estimates (Table 37 and Chart 12). Growth was slightly faster than in the aggregate economy (1.80 per cent). Thus labour productivity in the paper products sector, as a proportion of total economy, grew from 120.6 per cent in 1961 to 136.3 per cent in 2000 (Chart 13). It is interesting to note that paper products has by far the highest productivity levels of the three industries that make up the forest products sector. In 2000, output per hour in this sector was 17 per cent higher than in forestry and logging and 79 per cent higher than in wood products.

Labour productivity in paper products advanced at a 1.90 per cent average annual rate between 1961 and 1973, then fell to 0.92 per cent in 1973-81, before picking up to a 2.09 per cent rate in 1981-89 and an even stronger 3.27 per cent in 1989-2000. The acceleration in the 1990s is in sharp contrast to the productivity growth accelerations that hit forestry and logging and wood products. It is particularly interesting to note that it was the first half of the 1990s, when demand conditions were weak that productivity growth in paper products was especially strong (4.06 per cent per year in 1989-95 versus 2.32 per cent in 1995-2000).

The APM series provides indexes for output per hour growth for the 1961-97 period (Table 85) for four industries within the paper products sector (1997 shares of total hours worked in brackets): sawmill, pulp and paper industries (63 per cent); paper box and bag industries (21 per cent); other converted paper products industries (15 per cent); and asphalt roofing industry (1 per cent). In the three largest industries which comprise 99 per cent of the sector's hours worked, output per hour growth was similar over the 1961-97 period in the 2.2-2.7 range. These three industries have also all enjoyed productivity accelerations in the 1990s, suggesting all three industries are affected by common productivity drivers.

b) Capital Productivity

Capital productivity in the paper products sector fell at a 0.89 per cent average annual rate over the 1961-2000 period (Table 48 and Chart 14), compared to an advance of 0.72 per cent for all industries. Consequently, the sector's relative capital productivity fell from 89.8 per cent of the total economy average in 1961 to 48.0 per cent in 2000 (Chart 15).

c) Total Factor Productivity

TFP in paper products grew at a 1.07 per cent average annual rate over the 1961-2000 period, again above the total economy average of 1.43 per cent (Table 54 and Chart 16). In stark contrast to forestry and logging and wood products, TFP growth in this sector was by far the strongest in the 1990s, advancing at a very robust 3.41 per cent average annual rate, above that experienced over the three previous business cycles (0.68 per cent in 1961-73, -0.10 per cent in 1973-81, and -0.34 per cent in 1981-89). TFP growth was strong during both the first half and the second half of the 1990s (3.50 per cent in 1989-95 and 3.29 per cent in 1995-2000).

iv) Forest Products Sector Aggregate

Summary Table 9: Average Annual Growth Rates in the Forest Products Sector Aggregate

	Output	Hours	Capital Stock	Value Added per Hour	Capital Stock per Hour	Total Factor Productivity
1961-2000	2.37	0.39	2.66	1.97	2.26	1.26
1961-1989	2.81	0.36	4.19	2.45	3.82	1.25
1961-1973	3.87	1.28	5.46	2.56	4.10	1.27
1973-1981	0.86	-0.97	2.02	1.85	3.02	0.90
1981-1989	3.21	0.32	4.50	2.87	4.16	1.57
1989-2000	1.25	0.48	-1.15	0.77	-1.63	1.29
1989-1995	0.05	-0.83	-0.10	0.88	0.73	0.65
1995-2000	2.71	2.07	-2.40	0.63	-4.38	2.05

Source: Tables 1, 24, 31, 37, 54, 70. Note: The labour and capital shares for the forest products aggregate are 0.69 and 0.31 respectively.

a) Labour Productivity

The level of labour productivity in the forest products sector is a weighted average of labour productivity levels in forestry and logging, wood products, and paper products where the weights are the total hours shares. Equally, the rate of growth of labour productivity in the forest products sector is the weighted average growth rate of the three components of the sector. Productivity levels and growth rates are affected by both within industry productivity trends and composition shifts in the relative importance of the three forest product industries.

Output per hour in the forest products sector increased at a 1.97 per cent average annual rate over the 1961-2000 period (Table 37 and Chart 12). As aggregate labour productivity grew

at a slightly slower pace (1.80 per cent), the sector's labour productivity, relative to that of the total economy, increased from 96.6 per cent in 1961 to 103.2 per cent in 2000 (Chart 13).

It is interesting to note that over the 1961-2000 period annual labour productivity growth in the forest products aggregate (1.97 per cent) was lower than in the three industries that make up the sector, logging and forestry (2.21 per cent), wood products (2.13 per cent), and paper products (2.12 per cent). This is explained by compositional shifts in employment shares. Employment in the low labour productivity level wood products sector increased from one third to one half of total forest products employment, putting downward pressure on the forest products sector's productivity level and productivity growth rate.

Labour productivity grew at an 2.56 per cent average annual rate in 1961-73, fell to 1.85 per cent in 1973-81, rebounded to 2.87 per cent in 1981-89, and fell off again in the 1990s to 0.77 per cent. The much slower growth in the 1990s reflected the negative productivity growth in logging and forestry and wood products, which more than offset the acceleration of productivity growth in paper products. Productivity growth was similar in the first and second halves of the decade (0.93 per cent per year in 1989-1995 and 0.63 per cent in 1995-2000).

b) Capital Productivity

The level of capital productivity in the forest products sector, like the level of labour productivity, is a weighted average of capital productivity levels in forestry and logging, wood products, and paper products where the weights are the capital stock shares. Equally, the rate of growth of capital productivity in the forest products sector is the weighted average growth rate of the three components of the sector. Productivity levels and growth rates are affected by both within industry productivity trends and composition shifts in the relative importance of the three forest product industries.

Capital productivity in the forest products sector fell at a 0.28 per cent average annual rate from 1961 to 2000 (Table 48 and Chart 14). Given the 0.72 per cent increase for the aggregate economy, the relative capital productivity of the sector fell from 135.4 per cent of the total economy average in 1961 to 91.8 per cent in 2000 (Chart 15). The decline in relative capital productivity in paper products largely drove this development.

c) Total Factor Productivity

The TFP growth rate in the forest products sector is a weighted average of TFP growth in forestry and logging, wood products, and paper products where the weights are the relative sizes of the sectors. TFP growth rates are affected by both within industry productivity trends and composition shifts in the relative importance of the three forest product industries.

TFP for the forest products aggregate increased at a 1.26 per cent average annual rate over the 1961-2000 period (Table 54), slightly below the rate of advance registered by the total economy (1.43 per cent). Because of composition shifts, this rate of increase was 0.4-0.8 percentage points slower the TPF growth recorded in the three industries that make up the forest products sector.

C. Provinces

i) Forestry and Logging Sector

a) Labour Productivity

The provincial levels of real value added per hour in the forestry and logging sector were very dispersed around the national average in 2001 (Table 40). Labour productivity as a proportion of the national average for the sector ranged from a low of 48.6 per cent in Nova Scotia or as high as 165.2 per cent in British Columbia. The Nova Scotia figure may reflect the small sample size of the LFS and should be treated with caution. During the 1987-2001 period, only Alberta experienced significant labour productivity growth in the forestry and logging sector, an average annual rate of increase of 3.04 per cent. In Manitoba, the labour productivity decline was drastic, more than 6 per cent per year.

b) Capital Productivity

Between 1984 and 2001, capital productivity in the forestry and logging sector as a proportion of the Canadian sector declined in every provinces but Quebec, Saskatchewan, and British Columbia (Table 50). In 2001, only three provincial sectors had higher capital productivity than the national average: Nova Scotia (140.8 per cent of the national average), New Brunswick (140.2 per cent of the national average), and Ontario (142.8 per cent).

Based on the NAICS estimates, only four provinces experienced capital productivity growth between 1984 and 2001: Saskatchewan (1.67 per cent per year), British Columbia (1.09 per cent), Quebec (0.8 per cent) and Alberta (0.58 per cent). All the other provinces had negative or close to null average annual growth rates, the largest being in Manitoba at -6.82 per cent. Forestry and logging capital productivity levels in all provinces represent more than double the level for total economy except in Manitoba. In 2001, New Brunswick's forestry and logging capital productivity level represented as much as 501.5 per cent of the provincial total economy capital productivity level.

c) Total Factor Productivity

At the provincial level, TFP has been rising between 1987 and 2001 in Newfoundland (3.59 per cent per year), (Table 48). TFP declined in all other provinces, and especially fast in Nova Scotia during the same period at 8.64 per cent a year.

ii) Wood Products Sector

a) Labour Productivity

Labour productivity in the wood products sector as a proportion of the national average of the sector varied greatly across provinces in 2001, ranging from 57.90 per cent in Nova Scotia to 125.4 per cent in British Columbia (Table 41). Furthermore, the provincial labour productivity

levels were above the national average for the sector only in Alberta and British Columbia the same year.

Value added per hour in wood products has been decreasing in all provinces except New Brunswick, Alberta, Ontario and Manitoba during the 1987-2001 period. The respective average annual labour productivity growth rates were 2.96 per cent, 2.08 per cent, 1.77 per cent and 0.60 per cent.. Saskatchewan and Nova Scotia, did especially poorly as their respective average annual growth rate were –4.97 per cent and –3.32 per cent. The poor labour productivity performance in wood products led to a decrease in the level of the sector's labour productivity, relative to the provincial aggregate labour productivity level, in all provinces, with the exception of New Brunswick, Alberta and Ontario.

b) Capital Productivity

Capital productivity in the wood products sector was above the national average in British Columbia, Ontario and Quebec in 2001 but lower in Alberta, at 53.48 per cent of the national average (Table 51). Capital productivity in the wood products sector is above the level of capital productivity in the provincial total economy in all provinces for which estimates are available. Since capital productivity estimates are scarce at the provincial level, we only know that capital productivity went up between 1984 and 2001 in Ontario and British Columbia, as the respective average annual, rates of growth were 1.24 per cent and 0.46 per cent.. Capital productivity went down in Quebec at an average annual rate of –1.62 per cent.

c) Total Factor Productivity

TFP indexes for the wood products sector are available at the provincial level, only for Quebec, Ontario, Alberta and British Columbia (Table 57). TFP declined in Quebec and British Columbia over the 1987-2001 period while it grew in Ontario and only slightly in Alberta. The average annual rates of TFP growth were –2.31 per cent and –1.41 per cent in Quebec and British Columbia and 1.24 per cent and 0.1 per cent in Ontario and Alberta respectively.

iii) Paper Products Sector

a) Labour Productivity

In 2001, labour productivity was highest in the paper products sector in New Brunswick at 124.9 per cent of the national average for the sector (Table 42), followed by Quebec (122.9 per cent), British Columbia (111.16 per cent), Saskatchewan (107.19 per cent), Alberta (103.83 per cent), Nova Scotia (100.1per cent), Ontario (77.91 per cent) and Manitoba (40.37 per cent).

Real value added per hour worked increased in British Columbia and during the 1997-2001 period at average annual rates of 10.27 per cent and 8.53 per cent respectively . In all other provinces for which data are available, the average growth rates were negative. Alberta suffered the fastest decline in labour productivity, at an average annual rate of –5.09 per cent. Labour productivity as a percentage of the provincial total economy level went up in Nova Scotia, New Brunswick, and British Columbia, while it went down in the other provinces. The strongest

decrease was again in Alberta, as labour productivity as a percentage of the provincial total economy average fell from 177.19 per cent in 1997 to 138.34 per cent in 2001.

b) Capital Productivity

Quebec, Ontario, Alberta and British Columbia are the only provinces for which we have capital productivity estimates for the paper products sector (Table 52). Capital productivity in Ontario and Quebec was above the national average, 125.03 and 119.57 per cent respectively, and was below the national average in Alberta and British Columbia, 72.14 and 64.35 per cent respectively. Capital productivity decreased in all provinces between 1997 and 2001 but with the exception of British Columbia which experienced an average annual growth rate of 4.52 per cent. The capital productivity average annual rates of growth in Ontario, Quebec and Alberta for the same period were -3.17 per cent, -0.40 per cent and -0.22 per cent respectively. Capital productivity for the four provinces for which estimates are available is well below the provincial average for all industries. In 2001, it ranged from 37.61 per cent in British Columbia to 65.65 per cent in Quebec, compared to 57.23 per cent at the national level.

c) Total Factor Productivity

TFP only grew in British Columbia between 1997 and 2001, at an average annual rate of 7.14 per cent. In the three other provinces for which data are available, TFP growth was negative. The average annual growth rates in Ontario, Alberta and Quebec were -2.85 per cent, -2.50 per cent and -0.29 per cent respectively.

iv) Forest Products Sector Aggregate

a) Labour Productivity

Only four provinces of the eight for which data are available in 2001 had labour productivity levels in the forest products sector above the national average for the sector, British Columbia at 126.7 per cent New Brunswick at 106.1 per cent, Saskatchewan at 103.3 per cent and Alberta at 115.7 per cent (Table 43). Only New Brunswick, Quebec, and British Columbia saw their labour productivity levels rise relative to the national average between 1997 and 2001.

Output per hour in the forest products sector decreased in all provinces during the 1997-2001 period, with the exception of New Brunswick, British Columbia and Quebec, where the average annual growth rates were 2.97 per cent, 1.54 per cent and 0.49 per cent respectively. The decline in labour productivity was most notable in Ontario (-2.46 per cent per year).

b) Capital Productivity

Capital Productivity grew at average annual rates of 2.41 per cent and 0.83 per cent in British Columbia and Alberta respectively between 1997 and 2001. It declined in Ontario -1.22 per cent a year on average during the same period while it remained unchanged in Quebec. All provinces for which data are available had higher capital productivity levels than the national average in the forest products sector in 2001, with the exception of Alberta.

c) Total Factor Productivity

There are no TFP indexes available at the provincial level because of the limited data on GDP and capital stock by province, especially in the paper products and wood products sectors. To be able to create a forest products sector aggregate series, we need the data for all three sectors, which are unavailable.

VI International Productivity Growth Rate Comparisons

Canadian forest products compete on international markets with those of a number of countries, including the United States and the Nordic countries. The cost competitiveness of the forest products sector is an important factor in determining Canada's share of the world forest products total and export market, and productivity growth is in turn a key driver of our cost competitiveness (the exchange rate is another). This section compares labour, capital, and total factor productivity growth rates and levels in the woods products and paper products sectors in Canada, the United States, and Finland. Data were not available for forestry and logging.

A. Wood Products Sector

i) Labour productivity

Labour productivity, defined as real value added per hour worked, grew much faster wood products in Finland than in North America during the 1975-99 period (Table 64). The average annual growth rate in Finland's wood products sector was 6.00 per cent while it was 2.19 per cent in Canada and 0.70 per cent in the United States. The 1990s have seen very poor labour productivity performance in wood products in both Canada and the United States, with negative growth in both countries over the 1989-1999 period. In contrast, Finland continued to enjoy very strong labour productivity growth at an average annual rate of 5.08 per cent.

A study by Industry Canada economists (Lee and Tang, 2000) found that in 1995 Canada's labour productivity in wood products was 104 per cent of that in the United States. A Finnish study (Maliranta, 2000) found that in 1990 Finnish labour productivity was 90 per cent of that in the United States. These benchmark estimates have been combined with the labour productivity growth rates to produce relative labour productivity levels for Canada and the United States, Finland and the United States, and Finland and Canada for the 1975-1999 period (Table 64 and Chart 17).

Over the 1975-99 period, Canada and Finland both greatly improved their labour productivity in the woods products sector relative to the United States. Canada's relative labour productivity level increased from 73.5 per cent of the US level in 1975 to 104.4 per cent in 1999, peaking at 106.9 per cent in 1997, while that of Finland went from 45.7 per cent to 156.4 per cent. During the same period, Finland caught up and surpassed Canada. The Canadian labour productivity level fell from 160.9 per cent of the Finnish level in 1975 to 66.8 per cent in 1999.

ii) Capital productivity

Capital productivity is defined as real value added per unit of real capital. In contrast to labour productivity, there was much less difference in growth rates between Canada, the United States, and Finland for this variable in wood products over the last quarter century (Table 65 and Chart 18). Canada experienced the fastest growth at 2.89 per cent per year over the 1975-99 period, followed by Finland (1.43 per cent), and the United States (1.42 per cent). In the 1990s, capital productivity growth has fallen off in both Canada and the United States, but has remained stable in Finland.

iii) Total factor productivity

Total factor productivity growth in the wood products sector was considerably faster in Finland than in the United States and Canada's wood products sectors over the 1975-99 period (Table 66). It grew 4.97 per cent a year on average in Finland while it grew 2.35 per cent in Canada and 0.42 per cent in the United States. In the 1990s, total factor productivity growth was near zero in Canada and the United States, but was still robust in Finland.

A study by Industry Canada economists (Lee and Tang, 2000) found that in 1995 Canada's labour productivity in wood products was 101 per cent of that in the United States. A Finnish study (Maliranta, 2000) found that in 1990 Finnish labour productivity was 75 per cent of that in the United States. These benchmark estimates have been combined with the total factor productivity growth rates to produce relative total factor productivity levels for Canada and the United States, Finland and the United States, and Finland and Canada for the 1975-99 period (Table 66 and Chart 18)

Over the 1975-99 period, Canada and Finland both greatly improved their total factor productivity in the woods products sector relative to the United States, as had been the case with labour productivity. Canada's relative labour productivity level increased from 72 per cent of the US level in 1975 to 114 per cent in 1999, while that of Finland went from 47 per cent to 137 per cent. During the same period, Finland caught up and surpassed Canada. The Canadian total factor productivity level fell from 153 per cent of the Finnish level in 1975 to 83 per cent in 1999.

B. Paper Products Sector

i) Labour Productivity

Labour productivity in the paper products sector grew much faster in Finland than in North America during the 1975-1999 period, as was the case for the wood products (Table 67). The average annual growth rate in Finland's wood products sector was 6.74 per cent while it was 3.07 per cent in Canada and 2.14 per cent in the United States. The superior Finnish performance also occurred in the three sub-periods (1975-81, 1981-89, and 1989-99).

A study by Industry Canada economists (Lee and Tang, 2000) found that in 1995 Canada's labour productivity in paper products was 71 per cent of that in the United States. A Finnish study (Maliranta, 2000) found that in 1990 Finnish labour productivity was 127 per cent of that in the United States. These benchmark estimates have been combined with the labour productivity growth rates to produce relative labour productivity levels for Canada and the United States, Finland and the United States, and Finland and Canada for the 1975-1999 period (Table 67 and Chart 20).

Over the 1975-99 period, Canada and Finland both improved their labour productivity in the paper products sector relative to the United States, although Finland's performance was much better. Canada's relative labour productivity level increased from 57.5 per cent of the US level in 1975 to 71.4 per cent in 1999, indicating that a 28.6 percentage point gap still existed between Canadian and US labour productivity levels in paper products. Finland's level went from 63.3 per cent to 182.0 per cent of the US level, an incredible increase. Canada's labour productivity level fell from 90.8 per cent of the Finnish level in 1975 to 39.2 per cent in 1999.

ii) Capital Productivity

In the paper products sector capital productivity growth was much faster in Finland than in North America (Table 65 and Chart 21)). It advanced at a 3.00 per cent average annual rate over the 1995-99 period, compared to an increase of 0.23 per cent in Canada and a decline of 0.38 per cent in the United States.

iii) Total Factor Productivity

Total factor productivity growth in the paper products sector, as in the wood products sector, was considerably faster in Finland than in the United States and Canada over the 1975-1999 period (Table 68). It grew 5.30 per cent a year on average in Finland while it increased 2.08 per cent in Canada and only 0.31 per cent in the United States.

A study by Industry Canada economists (Lee and Tang, 2000) found that in 1995 Canada's total factor productivity in paper products was 83 per cent of that in the United States. A Finnish study (Maliranta, 2000) found that in 1990 Finnish labour productivity was 98 per cent of that in the United States. These benchmark estimates have been combined with the total factor productivity growth rates to produce relative total factor productivity levels for Canada and the United States, Finland and the United States, and Finland and Canada for the 1975-1999 period (Table 68 and Chart 22)

Over the 1975-99 period, Canada and Finland both improved their total factor productivity in the paper products sector relative to the United States, as had been the case with labour productivity. Canada's relative total factor productivity level increased from 61 per cent of the US level in 1975 to 89 per cent in 1999, while that of Finland went from 48.3 per cent to 149.5 per cent. During the same period, the Canadian total factor productivity level fell from 126 per cent of the Finnish level in 1975 to 60 per cent in 1999.

VII An Analysis of Productivity Trends in the Forest Products Sector

A. Explanatory Variables

Productivity growth is determined by a large number of factors or drivers (Harris, 2002 and Sharpe, 2002). This section briefly outlines what appear to be the most relevant determinants of labour productivity growth in the forest products sector. The factors discussed are: the capital-labour ratio and relative factor prices; measurement problems; compositional shifts; educational attainment; innovation; output prices; capacity utilization; regulation; quality of resources; economies of scale and increasing returns; unionization; workplace safety; and foreign direct investment. Some of these factors will be used in the next section to explain productivity trends in the forest products industries.

i) Capital-Labour Ratio and Relative Factor Prices

The capital-labour ratio is a measure of capital intensity of the production process. As noted earlier in the study, the capital stock estimates are provided by the Capital Stock Division of Statistics Canada and are measured on a constant price, year-end, net basis based on a geometric depreciation pattern assumption. Labour can be measured on either a per worker or a per hour basis, with the latter measure the one chosen for this study.

In a neoclassical framework, total factor productivity growth is the difference between output growth and a weighted average of input (labour and capital) growth where the weights are the income shares. Thus labour productivity growth can be decomposed into the contribution from additional capital deepening (increases in the capital-labour ratio) and other factors, which fall under the concept of total factor productivity. Growth in total factor productivity is equal to labour productivity growth minus the rate of growth of the capital-labour ratio, weighted by the share of capital in total income. Thus if capital-labour growth is positive, labour factor productivity growth will exceed total factor productivity growth while if capital-labour growth is negative, total factor productivity growth will exceed labour productivity growth. Only if capital-labour ratio growth is zero will total factor productivity growth equal labour factor productivity growth

Trends in the capital-labour ratio are affected by trends in the relative price of the factors of production, labour and capital. An increase in the relative price of labour, everything else equal, will lead to substitution of capital for labour and an increase in the capital-labour ratio. Thus labour productivity growth may be affected by the rate at which labour compensation increases because of the latter's effect on capital-labour substitution. If wages tend to grow fast, there will be an incentive for plant managers to substitute machinery for labour, everything else being constant.

ii) Measurement Problems

The reliability of measured productivity trends are extremely dependent on the availability of high quality data, including the estimates on current dollar output, price deflators, capital stock, and hours worked. Needless to say, the measurement problems associated with

productivity estimates is well beyond the scope of this paper. More important, it appears that measurement problems are less severe in the forest products industries than in other sectors, such as services, in part because it is possible to obtain physical indicators of the different types of output produced by the sector. For this reason, this factor will not be discussed in the next section.

iii) Compositional Shifts

Labour productivity in the forest products sectors is a weighted average, using labour or hour shares, of labour productivity levels in each of the sector's sub-industries. If a below average sub-industry sees its share of labour or hour rise as a consequence of a higher employment or hour growth rate than in other sub-industries, the sector's labour productivity level and growth rate will be affected. The study of the compositional shift within a forest product sector is not possible for the forestry and logging sector since data for its sub-industries is not available.

iv) Educational Attainment

The skills of the workforce and its acquisition of new ones affect labour productivity levels and growth. Everything else constant, labour productivity will grow with skill acquisition. A proxy for skill level is educational attainment. It is available for the three forest products sectors and it is based on the LFS. Prior to 1990, the estimates are for the number of years completed, while in 1990 onwards, it is for the highest level completed. Differences in the growth rate of average years of schooling could also explain differences in labour productivity growth. The Centre for the Study of Living Standards (CSLS) has calculated average years of schooling estimates.

v) Innovation

Technological progress is the principal determinant of productivity growth over time but unfortunately, it is difficult to measure. It is still of interest to find out what are the types of innovation that take place in the forest products sector as well as the extend of the R&D activities, which are believed to contribute to technological progress. The tables and charts for this section come from Statistics Canada's publication *Innovation in the Forest Sector*, which is based on the 1999 Survey of Innovation. A few but important selected forest sector industries were surveyed about their innovation activities.

Of all the firms that say they do innovate, the firms in the forest sector seem to be more process innovators than product innovators (Chart 24). The best example of this is the logging sector, where 85 per cent of innovative firms were process innovators while 54 per cent of them were product innovators. The difference in frequency between the two types of innovative firms is present in the other selected forest sector industries but not as large. It is also noteworthy that in the manufacturing sector as a whole, there is relatively more product innovators than process innovators.

The four main objectives behind innovation in the selected forest sector industries are shown in Table 80. Improving product quality is important for a majority of innovative firms in all industries while reducing environmental damage is important for a majority of innovative firms only in the logging industry. After improving product quality, improving production flexibility is an objective of a majority of innovative firms in all industries but logging.

Table 82 shows that the forestry and logging industry uses capital goods produced by highly innovative industries, and that it could be a channel of transmission of innovation from these industries to the forestry and logging industry.

Of all innovative firms in the selected forest sector industries, a majority of them are engaged in R&D activities, with the exception of the logging industry, where only 26% of innovative firms undertake R&D (Table 83). Of all those innovative firms that undertake R&D, a very large majority of them have a distinct R&D department to carry it out or contract it to other firms.

vi) Output Prices

Output prices can have an impact on productivity. As the price of an output goes up, it becomes profitable to use always less productive resources in order to produce more. Since marginal product is decreasing, average product will start to decrease at some point. As a consequence, a strong rise in the price of output can lead to a decrease in productivity of inputs used in the production of that output. Using the ratio of nominal output to real output per forest products sectors, CSLS has calculated implicit price indexes for output in those sectors.

vii) Capacity Utilization

The capacity utilization rate is the proportion of capital stock that is used in the production process. There is a positive relationship between capacity utilization and the business cycle. Capacity utilization falls as output falls because the amount of capital does not vary in the short term. As the capacity utilization rate falls, employment and output fall as well. If output falls proportionally more than employment, labour productivity will fall. If on the other hand employment falls proportionally more than output as a consequence of a decline in capacity utilization, labour productivity will rise.

viii) Regulation

Government regulations 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 operating and capital costs and thereby reduce labour, capital, and total factor productivity. Alternatively, government regulations can force firms to take actions then would not normally take. These actions may have unexpected positive consequence for productivity and competitiveness, particularly if other countries eventually adopt the same regulations, giving the early adopter an advantage. Of course, the evaluation of the effectiveness

of government regulation must go beyond the impact of the regulations on productivity, and factor in the societal benefits of less pollution and other non-economic benefits.

ix) Quality of Natural Resources

The quality of natural resources can have a major effect on productivity. Firms exploiting high quality, easily accessible natural resources that generate large economic rents will have higher productivity levels than firms exploiting poor quality resources. A depletion of natural resources over time, every else being equal, will lead to slower productivity growth or even falls in productivity levels. More inputs are needed to obtain a given output. The reliance on less accessible timber stocks, for example, can raise the cost in terms of labour and capital of producing a given quantity of wood, decreasing productivity. This tendency toward depletion and diminishing returns can, and often is, offset by technological advances or discovery of new resources.

x) Economies of Scale

Economies of scale and increasing returns as manifested by plant size may have an effect on labour productivity because of the possibility of increasing returns to scale. We therefore expect a positive relationship between average number of employees per plant and value added per employee. The data used in this section was taken from Statistics Canada's publication *Manufacturing Industries of Canada: National and Provincial Areas*, which includes only manufacturing industries. Data for the forestry and logging sector is therefore not available, which prevents the aggregation of a forest product sector by summation of the three forest products sectors.

xi) Unionization

Unionization can have various impacts on labour productivity. It reduces the flexibility with which managers can adapt the amount of labour they need or the wages they pay to the changing market conditions, and therefore reduces labour productivity growth. On the other hand, the presence of labour unions can lead to improved working conditions and higher job satisfaction which in turn lead to lower turnover and higher labour productivity growth. The source for data on unionization in the forest products sectors is from CALURA, which provides unionization estimates for the 1976-1995 period.¹⁰

xii) Workplace Safety

The relationship between labour productivity and workplace safety is ambiguous. Workplace safety regulations impose a constraint on labour use and so, a decline in workplace injuries could be associated with a decrease in labour productivity. But on the other hand, a safer work environment may limit absenteeism and therefore reduce production bottlenecks that reduce labour productivity, leading to labour productivity growth.

¹⁰ Union density estimates are available from the LFS for the 1997-2001 period

xiii) Foreign Direct Investment

It is believed that foreign direct investments can improve productivity because foreign firms will modernize the existing production facilities, and import new and better machinery or production methods. Statistics Canada has data on foreign direct investment in special industrial aggregates, and one of them aggregates the Wood and Paper sectors.

The total of foreign owned assets in the wood and paper aggregate sector rose steadily from 1988 to 2001 (Table 93). It grew faster on average during that period than in the economy as a whole. Foreign owned assets in the wood and paper sector grew 9.76 per cent a year on average compared, to 8.27 per cent a year on average in the economy as a whole. But during the 1995-2001 period, foreign owned assets grew faster in the total economy than in the wood and paper sector.

B. Forestry and Logging Sector

From 1961 to 1989, labour productivity growth in the forestry and logging sector was a strong 3.19 per cent per year. After 1989, however, it turned negative, falling at a 0.23 per cent average annual rate. Thus the key stylized facts to explain in terms of the labour productivity performance of the logging and forestry sector are the robust productivity growth in the 1960s, 1970s, and 1980s and the productivity slowdown in the 1990s.

In the 1961-89 period, the capital-labour ratio, measured on an hours basis, fell at a 0.40 per cent average annual rate, and total factor productivity a very strong 3.14 per cent. Thus increased capital intensity or capital deepening cannot account for the robust labour productivity growth as the capital intensity of production was actually declining over the period.

In the 1989-2000 period, the capital-labour ratio fell at an average annual rate of 1.75 per cent. This meant that total factor productivity growth was somewhat better than labour productivity growth, increasing 0.35 per cent per year. Thus some, but not much, of the poor labour productivity performance after 1989 can be explained by the falling capital intensity of production of the sector.

For the 1961-2000 period, the average annual growth rate of nominal compensation per hour in logging and forestry was 7.29 per cent compared to 6.48 per cent for total economy (Table 79). There was relatively more incentive to substitute capital for labour in this sector compared to the economy in general yet the capital-labour ratio fell. Real value added per hour increased during the same period and did at a faster pace than in the economy in general. During the more recent 1989-2000 period, nominal average hourly compensation grew much faster in the forestry and logging sector, 3.80 per cent a year on average, compared to 2.76 per cent in the economy in general. Yet the capital-labour ratio fell at an even greater rate. Moreover, the higher absolute level of hourly labour compensation in the sector, 134.2 per cent of the total economy in 2000 does represent an additional incentive to substitute capital for labour. Thus the falling capital-labour ratio cannot be explained by the falling price of labour

The rate of increase in the average years of educational attainment in forestry and logging (Table 73) was a dismal 0.03 per cent per year from 1976 to 1989 (data from the LFS are not available before 1976), well below the 0.53 per cent increase for all industries). The relative educational attainment of workers in this sector thus fell from 87.4 per cent of the all industries average in 1976 to 82.7 per cent in 1989. Despite this development, both labour and total factor productivity growth were well above economy-wide average over the period. Human capital accumulation was not a source of productivity growth in this sector.

Equally, the fall-off in labour and total factor productivity growth in forestry and logging after 1989 is not due to a slowdown in human capital accumulation. The rate of increase in the average years of educational attainment of workers in the sector actually picked up to 0.38 per cent per year between 1989 and 2000, although still slightly below the all industries average of 0.49 per cent.

It is unlikely that trends in unionization have had a major impact on productivity growth in logging and forestry as the changes in the unionization rate in the sector have been relatively small. The proportion of unionized workers in total employees fell from 46.8 per cent in 1976 (the first year for which data are available) to 42.6 per cent in 1989, then rising slightly to 43.1 per cent in 1995 (Table 90 and Chart 26).

It is equally unlikely that capacity utilization trends can shed light on productivity developments. Between 1962 and 1989 the rate of capacity utilization fell from 90.5 per cent to 84.8 per cent (Table 88 and Chart 25), yet this was the period when productivity growth was very strong. From 1989 to 1990 capacity utilization increased from 84.8 per cent to 86.3 per cent. This development, in principle, should foster productivity growth. Yet labour productivity growth over the period was negative.

The incidence of workplace injuries decreased a significant 48 per cent in the forestry and logging sector in Canada between 1984 and 1998, as it did in the economy as a whole, where the decrease was 41.5 per cent (Table 78 and Chart 23). The incidence of fatalities also fell. And yet, the number of injuries and fatalities as a percentage of all industries, which were 1.79 per cent and 4.44 per cent in 1998 (Appendix tables 51 and 55)), remained well above the sector's employment share (which was 0.52 per cent in 1998). This means there are relatively more injuries and fatalities in the forestry and logging industries than in the average industry. As the relative in injuries in the sector was relatively constant over the period, it is unlikely to account for the slowdown in productivity growth after 1989.

Between 1961 and 1989 the implicit price deflator for logging and forestry advanced at a 6.08 per cent average annual rate (Table 92), almost identical to that of all industries (6.05 per cent). In contrast to this relative price stability, in the 1989-97 period the relative price of logging and forestry output increased 4.78 per cent per year based on nominal increases on 6.62 per cent in logging and forestry and 1.84 per cent for all industries. This development may have led to the exploitation of higher cost, poor quality resources, with negative consequences for labour and total factor productivity.

Two variables for which data are not available, but which may account for the rapid growth in the 1961-89 period and the deceleration after 1989 are innovation and regulation. One hypothesis to explain the productivity pattern may be that the pace of technological change in the sector, particularly change that is not embodied in the capital stock, was very rapid in the 1960s, 1970s, and 1980s, fostering strong productivity growth. But it fell off after 1989, producing slower productivity growth. A detailed analysis of trends in technological innovation in the sector would be needed to prove or disprove this hypothesis.

A second hypothesis that 1961-89 was a period of minimal regulation in the logging and forestry sector, with little or no negative effects for productivity growth. The introduction of more regulations in the 1990s may then have impeded productivity growth. The measurement of the burden is difficult and controversial. More research is needed on this hypothesis before conclusions are drawn.

C. Wood Products Sector

As in logging and forestry, the key stylized fact to explain in terms of the productivity performance of the wood products sector is the deceleration in labour productivity growth after 1989. From 1961 to 1989 labour productivity advanced at a 3.20 average annual rate. From 1989 to 2000 it declined at a 0.55 per cent rate, a turnaround of 3.75 percentage points, even greater than the 3.42 point turnaround in logging and forestry.

In the 1961-89 period, the 3.20 per cent average annual rate of increase in labour productivity growth in wood products can be decomposed into a 2.92 per cent rise in the capital-labour ratio and a 2.53 per cent increase in total factor productivity, an above average performance for both variables. Capital deepening thus accounted for 21 per cent of labour productivity growth.

The 0.55 per cent average annual decline since 1989 in labour productivity growth can be decomposed into a 0.70 per cent decline in the capital-labour ratio and a 0.39 per cent fall in factor productivity growth. Thus of the 3.75 point slowdown 78 percent is due to the falloff in total factor productivity growth and 22 per cent to the decline in the rate of growth of the capital-labour ratio.

Compensation per hour worked in the wood products sector increased at a 8.21 per cent average annual rate over the 1961-89 period, almost identical to that for all industries. In 1989-97, there was also little difference in compensation trends: 3.13 per cent in wood products versus 2.76 per cent in all industries. These trends cannot account for the falloff in capital deepening after 1989.

In the wood products sector, there has been no compositional shift effect on labour productivity over the 1961-1997 period, according to the APM data (Table 84). The weighted sum using the 1961 weights and the weighted sum using the yearly hour shares are almost identical, as are the average annual growth rates. The hours shares show that there has been a compositional shift between 1961 and 1997, that is labour shares have changed over the period, but it did not have an effect on labour productivity. Labour productivity levels in the wood

products sector sub-industries have changed in such a way to cancel out the effect of the compositional shift.

The average educational attainment of workers in wood products increased at a 0.51 per cent average annual rate over the 1961-89 period (Table 74), almost identical to the economy-wide average (0.53 per cent). The average educational attainment in the sector remained stable at around 90 per cent of the all industries average. This trend is consistent with the rapid total factor productivity over the period.

The falloff in labour and total factor productivity growth in the 1990s does not appear to be linked to any deterioration in human capital accumulation. The average years of educational attainment continued to increase at 0.37 per cent per year, down only slightly from that experienced in the pre-1990 period.

According to cross section production statistics for Canada and the provinces, there is a positive relationship between average number of employees per establishment and average value added per employee. The positive relationship between the two variables is even clearer in summary table, as value added per employee rises with employment size range. These are signs that the size of employment has a positive effect on labour productivity in the wood products sector.

The capacity utilization trends in the wood products sector cannot account for the slowdown (Table 88 and Chart 25). Capacity utilization was 76.8 per cent in 1961 and 77.9 per cent in 1989, but rose to 86.3 per cent in 2000. Average capacity utilization was no lower in the 1989-2000 period than in 1961-1989.

Contrary to the forestry and logging sector, there was a definite downward trend in the wood products sector's unionization rate (Table 90 and Chart 26). It went from 51.5 per cent in 1976 to 24.6 per cent in 1995, but almost all the decline had taken place by 1989 (25.6 per cent). One hypothesis might be that the falling unionization spurred productivity growth in the pre-1989 period by the elimination of productivity-reducing workplace regulations embedded in collective agreements, and that the end of the decline after 1989 saw the erosion of this source of productivity growth. However, this development is unlikely to account for a significant proportion of the slowdown.

The implicit price deflator for wood products sector grew at a 5.23 per cent rate in the 1961-89 period, slightly below that of all industries (6.05 per cent). From 1989 to 1997, however, it has been a different story. The deflator increased at a 7.42 per cent average annual rate, compared to only 1.84 per cent for all industries, a massive increase in the relative price of wood products. This may have led to the expansion of low productivity firms, with a negative effect on productivity through a composition effect. The rate of growth of hours worked in the sector doubled between 1961-89 and 1989-2000.

D. Paper Products Sector

Unlike the logging and forestry and wood products sectors, there is no productivity slowdown to explain in the paper products sector. Output per hour growth actually picked by from 1.67 per cent per year in 1961-89 to 3.27 per cent in 1989-200, a 1.60 percentage point acceleration. The stylized fact to explain in this sector is the acceleration.

In the 1961-89 period, the 1.67 per cent average annual rate of labour productivity growth in the paper products sector can be decomposed into capital-labour growth of a very strong 4.41 per cent and total factor productivity growth of 0.17 per cent.

In 1989-2000, the labour productivity growth of 3.27 per cent per year can be decomposed into a 0.39 per cent per year decline in the capital-labour ratio and total factor growth of 3.31 per cent.

Thus the sources of growth were the opposite in the two periods. Total factor productivity was responsible for 11 per cent of labour productivity growth in the first period, but 104 per cent in the second, with the contribution of capital deepening falling from 89 per cent to -4 per cent. The acceleration in total factor productivity growth more than accounts for all the acceleration in labour productivity growth.

Of all three forest products sectors, the paper products sector always had the highest compensation per hour level (Table 79). In 1997, the sector compensation per hour level accounted for 162.5 per cent of the level for total economy. Hourly compensation grew at an average annual rate of 8.29 per cent over the 1961-89 period, and 4.27 per cent during the 1989-1997 period. The average annual growth rate for labour compensation for total economy was 7.97 per cent in 1961-89, not much different from paper products. But after 1989 the rate was 2.75 per cent, so there was an industry specific incentive for plant managers to substitute capital for labour. Yet it appears to have had no effect as the capital-labour ratio fell in the 1990s.

The compositional shift has had almost no effect on labour productivity in the paper products sector over the last forty years, according to APM data (Table 85). Labour productivity calculated using the 1961 hour shares was slightly more than a dollar per hour above labour productivity calculated using the yearly hour shares. The hour shares have changed but so did the sub-industries labour productivity levels. Although there was compositional shift, labour productivity at the wood products sector level was only slightly affected.

The average educational attainment of workers in paper products increased at a 0.59 per cent average annual rate over the 1961-89 period (Table 75), slightly above the economy-wide average (0.53 per cent). The average educational attainment in the sector went from 95.9 per cent in 1976 to 96.9 per cent in 1989 of the all industries average. This trend is consistent with the rapid labour and total factor productivity growth over the period.

The acceleration in labour and total factor productivity growth in paper products in the 1990s does not appear to be linked to any acceleration in human capital accumulation. In fact,

the average years of educational attainment increased by 0.54 per cent per year, down slightly from that experienced in the pre-1990 period.

Trends in the paper products sector's capacity utilization rate may account for some of the post-1989 acceleration in productivity growth. (Table 88 and Chart 25). The utilization rate was 88.0 per cent in 1962, a stable 87.9 per cent in 1989 and then rose to 92.7 per cent in 2000. These high rates of capacity utilization in the late 1990s may have given a cyclical boost to productivity growth.

The rate of unionization in paper products was relatively stable from 1976 to 1989, and then fell to 54.0 per cent in 1995. (Table 90 and Chart 26). It may be possible that the post-1989 decline in the unionization rate contributed to productivity growth but any effect would likely be small.

The paper products sector implicit price index grew at a slightly higher pace than the GDP implicit price index between 1981 and 1989: 6.73 per cent versus 6.05 per cent. (Table 92). From 1989 to 1997 the situation has been reversed. The deflator for paper products has advanced at only a 0.15 per cent average annual rate compared to 1.84 per cent for the output of all industries and 6.62 per cent for logging and forestry and 7.42 per cent for wood products. In contrast to the situation in the two other forest product industries where the relative price of their products was increasing, that of paper products was falling, occasioning different behaviour. Instead of expanding marginal operations and decreasing productivity through a composition effect, firms in the paper products have an incentive to cut less productive and profitable operations. This increases productivity through a decomposition effect.

E. Forest Products Sector Aggregate

The productivity performance of the forest products sector is of course a weighted average of the three industries that comprise it and the forest products sector capital-labour ratio is a weighted average of the three sectors capital-labour ratios. From that perspective, the above discussion on productivity trends in the three industries that make up the forest products sector serves to explain the overall productivity trends in the sector.

F. Further Research

As is always the case, this study has identified number of areas for additional research. The payoff in terms of an increased understanding of productivity trends in the forest products sector would appear to be particularly high in the following areas:

- further investigation and modeling of the factors behind total factor productivity, including economies of scale, technical efficiencies;
- examination of the factors behind what appears to be the excellent productivity performance in the forestry products sector of the Nordic countries; and
- more analysis of provincial differences in productivity levels and growth rates.

The types of new and improved data that would assist productivity analysis of the forest products sector include the following:

- data on intermediate goods, including energy, raw materials, and purchased services;
- data on the average characteristics of the forest resource stock that affect the resources needed to harvest the stock (e.g. size of timber, accessibility); and
- data in the number of regulations that affect the forest products sector and the compliance costs.

VIII Conclusion

This study has provided a comprehensive examination of trends in output, employment and hours, the capital stock, and labour, capital, and total factor productivity in the three forest products industries in Canada. The main finding is that over the last 40 years all three industries have outperformed the all industries average in terms of both labour productivity and total factor productivity. In the 1990s, however, both logging and forestry and wood products have experienced significant slowdowns in both labour and total factor productivity growth. Paper products, in contrast, has seen an acceleration in labour and total factor productivity growth. A key driver in these productivity developments appears to be changes in relative prices. In logging and forestry and wood products the relative price of output increased in the 1990s, drawing marginal resources into the sector and decreasing productivity through a composition effect. Conversely, the opposite happened in paper products, resulting in laying off of marginal operations with positive effects for productivity. This explanation should be treated as preliminary and may be modified with future research.

References

Centre for the Study of Living Standards (2002) Literature Survey, report prepared for the Forest Products Association of Canada, July

Forest Products Association of Canada (2002) Accelerating Forest Sector Renewal: Forest Sector Innovation Response, Consultation Draft, August 7.

Harris, Richard G. (2002) “Determinants of Canadian Productivity Growth: Issues and Prospects,” in Someshwar Rao and Andrew Sharpe (eds.) *Productivity Issues in Canada* (Calgary: University of Calgary Press).

Lee, Frank and Jianmin Tang (2000) “An Assessment of Competitiveness and Productivity Levels: Canadian and U.S. Manufacturing Industries,” paper presented at the Canada-US Manufacturing Productivity Gap Conference, Ottawa, Ontario, organized by the Centre for the Study of Living Standards, revised version, February.

Maliranta, Mika (2000) “Technology, Productivity and Restructuring,” PhD thesis, University of Helsinki, Finland.

Sharpe, Andrew (2002) “Productivity Issues, Concepts and Prospects: An Overview,” in Andrew Sharpe, France St-Hilaire and Keith Banting (eds.) *Review of Economic Performance and Social Progress: Linkages Between Productivity and Social Progress* (Ottawa: Centre for the Study of Living Standards and Montreal: Institute for Research on Public Policy).

Parry, Ian W.H. (1999) “Productivity Trends in the Natural Resource Industries: A Cross-Cutting Analysis,” in David Simpson (ed.) *Productivity in Natural Resource Industries: Improvement through Innovation* (Washington, DC: Resources for the Future).

Sedjo, Roger (1999) “Land Use Change and Innovation in U.S. Forestry,” in David Simpson (ed.) *Productivity in Natural Resource Industries: Improvement through Innovation* (Washington, DC: Resources for the Future).

Appendix 1: A Comparison on Forest Products Industries under NAICS and the 1980 SIC

Under NAICS, forest products industries are classified in a similar way than under SIC, but as the comparative table shows, there are some differences in employment levels, which can be explained by classifications differences. To show these differences, the following table opposes the industries that were included in the forest products sectors under the SIC but that are not under the NAICS, with the industries that are included in the NAICS but were not under SIC. Gross loss in employment and other variables from going from the SIC to the NAICS classification is associated with the industries on the left side of the table while gross gain is associated with industries on the right side of the table.

Belonging to the SIC logging & forestry division (C00) but not to the NAICS logging & forestry division (113).	Belonging to the NAICS logging & forestry division (113) but not to the SIC logging & forestry division (C00).
115310* Support activities for forestry (Reforestation, silviculture, forest firefighting)	A0229* Other services included to agricultural crops (Berries, wild rice and wild ginseng gathering)

Belonging to the SIC wood division (E25) but not to the NAICS wood division (321).	Belonging to the NAICS wood division (321) but not to the SIC wood division (E25).
337110 Wood Kitchen cabinet and counter top manufacturing 337215* Showcase, Partition, shelving and locker manufacturing (Prefabricated wood partitions) 333920* Material handling equipment manufacturing (Coffin lowering devices manufacturing)) 339990* All other miscellaneous manufacturing (Coffin and caskets manufacturing) 337920* Blind and shade manufacturing (Window shades, wood slat manufacturing)	E2717 Building board industries E3244 Mobile home industries E1719* Miscellaneous leather and allied products industries (Wood boot and shoe heels and lasts manufacturing)

Belonging to the SIC pulp & paper division (E27) but not to the NAICS pulp & paper division (322).	Belonging to the NAICS pulp & paper division (322) but not to the SIC pulp and paper division (E27).
321216* Particle board and fibreboard mills (Fibreboard manufacturing) 324122* Asphalt shingle and coating material manufacturing (Asphalt shingles and roll roofing manufacturing) 325999* All other miscellaneous chemical products manufacturing (Blueprint and whiteprint sensitized paper, manufacturing) 314990* All other textile products mills (Paper twine manufacturing) 332999* All other miscellaneous fabricated metal products manufacturing (Containers made from purchased aluminium foil)	E1599* Other rubber products industries (Cellophane adhesive tape manufacturing) E1999* Miscellaneous textile products industries (Pressure sensitive cloth tape (e.g. duct tape) manufacturing) E1994* Hygiene products of textile materials (Disposable sanitary products of textile materials manufacturing)

* Indicates that only the part of the industry between brackets is included.

C0411 Logging Industry	113311 Logging (except Contract)	
C0412 Logging Contractors	113312 Contract Logging	
C0511 Forestry Services Industry	113110 Timber Tract Operations	
	113210 * Forest Nurseries and Gathering of Forest Products	Forest nursery services; forest products (e.g. gums, barks, seeds), gathering
	115310 * Support Activities for Forestry	Reforestation; silviculture; forest firefighting, ground

Wood Industries [25]

E2511 Shingle and Shake Industry	321112 Shingle and Shake Mills	Purchased lumber, planing Cooperage stock, manufacturing
E2512 Sawmill & Planing Mill Products Industry	321111 Sawmills (except Shingle and Shake Mills) 321919 * Other Millwork 321920 * Wood Container and Pallet Manufacturing 321999 * All Other Miscellaneous Wood Product Manufacturing 321211 Hardwood Veneer and Plywood Mills 321212 Softwood Veneer and Plywood Mills 321992 Prefabricated Wood Building Manufacturing 337110 Wood Kitchen Cabinet and Counter Top Manufacturing 321911 Wood Window and Door Manufacturing 321215 Structural Wood Product Manufacturing 321919 * Other Millwork	
E2521 Hardwood Veneer and Plywood Industry		Millwork, n.e.c. (e.g. mouldings, trim, ornamental woodwork), manufacturing Prefabricated wood partitions, manufacturing
E2522 Softwood Veneer and Plywood Industry		
E2541 Prefabricated Wooden Buildings Industry		All except cooperage stock and products, manufacturing Coffin lowering devices, manufacturing Coffins and caskets, manufacturing
E2542 Kitchen Cabinet and Bathroom Vanity Ind.		
E2543 Wooden Door and Window Industry		Particle board, manufacturing
E2549 Other Millwork Industries		
E2561 Wooden Box and Pallet Industry	337215 * Showcase, Partition, Shelving and Locker Manufacturing 321920 * Wood Container and Pallet Manufacturing	
E2581 Coffin and Casket Industry	333920 * Material Handling Equipment Manufacturing 339990 * All Other Miscellaneous Manufacturing 321114 Wood Preservation 321216 * Particle Board and Fibreboard Mills 321217 Waferboard Mills 321919 * Other Millwork	
E2591 Wood Preservation Industry		
E2592 Particle Board Industry		
E2593 Wafer Board Industry		
E2599 Other Wood Industries n.e.c.		

	321920 * Wood Container and Pallet Manufacturing 321999 * All Other Miscellaneous Wood Product Manufacturing 337920 * Blind and Shade Manufacturing	Wood turnings, manufacturing Cooperage products, manufacturing Wood products, n.e.c., manufacturing Window shades, wood slat, manufacturing
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Note: An asterisk means that only the portion of the second column industry, portion that is described in the last column, is included in the industry in the first column.

Paper and Allied Products Industries [27]

E2711 Pulp Industry	322111 Mechanical Pulp Mills 322112 Chemical Pulp Mills 322121 * Paper (except Newsprint) Mills	Integrated pulp and paper mills
E2712 Newsprint Industry	322122 Newsprint Mills 322121 * Paper (except Newsprint) Mills	Building paper, manufacturing
E2713 Paperboard Industry	322130 * Paperboard Mills	All except building paper, manufacturing
E2714 Building Board Industry	322126 * Particle Board and Fibreboard Mills	Fibre board, manufacturing
E2719 Other Paper Industries	322121 * Paper (except Newsprint) Mills	Fine, specialty and sanitary paper, manufacturing
E2721 Asphalt Roofing Industry	324122 * Asphalt Shingle and Coating Material Manufacturing	Asphalt shingles and roll roofing, manufacturing
E2731 Folding Carton and Set-up Box Industry	322211 * Corrugated and Solid Fibre Box Manufacturing 322212 Folding Paperboard Box Manufacturing 322219 * Other Paperboard Container Manufacturing 322299 * All Other Converted Paper Product Manufacturing	Solid fibre boxes, manufacturing
E2732 Corrugated Box Industry	322211 * Corrugated and Solid Fibre Box Manufacturing	All except sanitary food containers of paper, manufacturing Egg cartons, fillers and flats, die-cut, manufacturing
E2733 Paper Bag Industry	322121 * Paper (except Newsprint) Mills 322220 * Paper Bag and Coated and Treated Paper Manufacturing 322130 * Paperboard Mills	Corrugated boxes, manufacturing
E2791 Coated and Treated Paper Industry	322220 * Paper Bag and Coated and Treated Paper Manufacturing 325999 * All Other Miscellaneous Chemical Product Manufacturing	Bags, made in paper mills
E2792 Stationery Paper Products Industry	322121 * Paper (except Newsprint) Mills 322230 Stationery Product Manufacturing	Bags, made from purchased paper
E2793 Paper Consumer Products Industry	322121 * Paper (except Newsprint) Mills	Coated paperboard, made in paperboard mills Coated, treated or laminated paper, manufacturing
		Blueprint and whiteprint sensitized paper, manufacturing
		Stationery paper products, made in paper mills

Appendix 3: List and Description of Industries included in the Forest Products Sector under 1997 NAICS and their 1980SIC Equivalent

113110 Timber Tract Operations 113210 Forest Nurseries and Gathering of Forest Products	C0511* Forestry Services Industry A0229* Other Services Inc to Agricultural Crops C0511* Forestry Services Industry	Timber tract operations Berries, wild rice and wild ginseng, gathering Forest nursery services; forest products(e.g. gums, barks, seeds), gathering
113311 Logging (except Contract) 113312 Contract Logging	C0411 Logging Industry C0412 Logging Contractors	

321111 Sawmills (except Shingle and Shake Mills)	E2512* Sawmill & Planing Mill Products Industry	Manufacturing lumber from logs
321112 Shingle and Shake Mills	E2511 Shingle and Shake Industry	
321114 Wood Preservation	E2591 Wood Preservation Industry	
321211 Hardwood Veneer and Plywood Mills	E2521 Hardwood Veneer and Plywood Industry	
321212 Softwood Veneer and Plywood Mills	E2522 Softwood Veneer and Plywood Industry	
321215 Structural Wood Product Manufacturing	E2549* Other Millwork Industries	
321216 Particle Board and Fibreboard Mills	E2592 Particle Board Industry	Purchased lumber, planing
321217 Waferboard Mills	E2714 Building Board Industry	
321911 Wood Window and Door Manufacturing	E2593 Wafer Board Industry	
321919 Other Millwork	E2543 Wooden Door and Window Industry	

321920 Wood Container and Pallet Manufacturing 321991 Manufactured (Mobile) Home Manufacturing 321992 Prefabricated Wood Building Manufacturing 321999 All Other Miscellaneous Wood Product Manufacturing	E2512* Sawmill & Planing Mill Products Industry E2549* Other Millwork Industries E2599* Other Wood Industries n.e.c. E2512* Sawmill & Planing Mill Products Industry E2561 Wooden Box and Pallet Industry E2599* Other Wood Industries n.e.c. E3244 Mobile Home Industry E2541 Prefabricated Wooden Buildings Industry E1719* Misc. Leather and Allied Products Inds. E2512* Sawmill & Planing Mill Products Industry E2599* Other Wood Industries n.e.c.	Millwork, n.e.c. (e.g. mouldings, trim, ornamental woodwork), manufacturing Wood turnings, manufacturing Cooperage stock, manufacturing Cooperage products, manufacturing Wood boot and shoe heels and lasts, manufacturing Lumber, kiln drying Wood products, n.e.c., manufacturing
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Note: An asterisk means that only the portion of the second column industry, portion that is described in the last column, is included in the industry in the first column.

Paper Manufacturing [322]

322111 Mechanical Pulp Mills 322112 Chemical Pulp Mills 322121 Paper (except Newsprint) Mills 322122 Newsprint Mills 322130 Paperboard Mills 322211 Corrugated and Solid Fibre Box Manufacturing 322212 Folding Paperboard Box Manufacturing 322219 Other Paperboard Container Manufacturing	E2711* Pulp Industry E2711* Pulp Industry E2711* Pulp Industry E2713* Paperboard Industry E2719 Other Paper Industries E2733* Paper Bag Industry E2792* Stationery Paper Products Industry E2793* Paper Consumer Products Industry E2712 Newsprint Industry E2713* Paperboard Industry E2791* Coated and Treated Paper Industry E2731* Folding Carton and Set-up Box Industry E2732 Corrugated Box Industry E2731* Folding Carton and Set-up Box Industry E2731* Folding Carton and Set-up Box Industry	Mechanical and semi-chemical pulp manufacturing, not integrated with paper-making Chemical pulp manufacturing, not integrated with paper-making Integrated pulp and paper mills Building paper, manufacturing Bags, made in paper mills Stationery paper products, made in paper mills Sanitary products made in paper mills All except building paper, manufacturing Coated paperboard, made in paperboard mills Solid fibre boxes, manufacturing Folding paperboard boxes, manufacturing All except solid fibre boxes; folding paperboard boxes; die-cut egg cartons, fillers and flats,
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