

Growth of secondary wood manufacturing in British Columbia, Canada

Brad Stennes

Bill Wilson

Sen Wang

Abstract

Comprehensive survey data collected on British Columbia's secondary manufacturing sector at the start and end of the 1990s was examined to develop estimates of sector growth. The measures of growth estimated include changes in the volume of wood processed and sector sales. Underlying explanatory data were examined to find strengths and constraints to future growth under the backdrop of international trade restrictions on lumber for two of British Columbia's three historically important export markets. In general, the public policy goal of increased secondary manufacturing activity was achieved through the 1990s, with strong growth in both average firm size and in the number of firms participating. Most of the sector growth was for export to the U.S. market, although both domestic and Asian market sales increased as well.

The forest sector in the Canadian province of British Columbia (BC) is a key economic driver, generating total sales of nearly \$16 billion (all dollar amounts in this article are Canadian dollars) in 2001, providing for 79 percent of provincial manufacturing shipments and 90,000 direct jobs. Maintaining this level of activity in "primary" forest products in the future is unlikely for a variety of reasons, including pressures to preserve native forests, the international emergence of low-cost plantation products and cumbersome trade restrictions with our largest export market, the United States. Maintaining economic and employment benefits from the forest sector requires a maximization of output value per unit of fiber cut. One strategy put forward to accomplish this goal is the expansion of secondary manufacturing in forest products.

Given the significance and potential of the BC forest sector, it is important that decision makers examining policy alternatives for secondary manufacturing expansion have accurate and timely information. Information is scarce for this sector in terms of either baseline data or sector growth for any region in Canada, including BC. The main objective of this study was to help fill this knowledge gap through an examination of sector change using data collected in two comprehensive surveys of the secondary manufacturing sector in BC. These surveys were conducted at the start and the finish of the 1990s, a turbulent decade for forestry in Canada, characterized by two different trade actions placed on lumber exports by Canada's largest trading partner, the United States. The study provides time series results including measures of growth, details on where growth has occurred, and changes in characteristics of the sector through the 1990s. One important result from this analysis is that sector growth occurred primarily through increased sales into the U.S. market.

Secondary manufacturing of wood products

Increased activity in downstream wood processing has been a policy goal in numerous jurisdictions. This is in response to pressures from members of forest-dependent communities for the purpose of maintaining jobs and from environmentalists who see it as a means to minimize timber harvest levels. Often referred to as value-added processing, in this study the term secondary manufacturing is used. The term value-added is avoided as it is applicable to any activity in the process of silviculture, harvesting, sorting, manufacture, and marketing. In addition, there are cases where further processing diminishes economic value. Secondary manufacturing refers to further processing of solid wood products past the primary stage (e.g., lumber). The definition utilized in this paper includes the following seven business types.¹

¹ The latest survey expanded the definition of secondary manufacturing to include shake and shingle manufacturers and panelboard producers. These two business types are not included in this analysis. Remanufacturers add further value to lumber inputs by making products such as fencing, cut stock, furniture stock, and finger-jointed lumber. Millwork includes windows and frames, doors, casing, and mouldings. Examples of Engineered Wood Products include pre-fabricated buildings, trusses, laminated veneer lumber and I-joists. The remaining business types are self-explanatory.

The authors are, respectively, Forest Economist, Research Director, and Forest Economist, Industry, Trade and Economics, Canadian Forest Serv., Victoria, BC (bstennes@pfc.cfs.nrcan.gc.ca; bwilson@pfc.cfs.nrcan.gc.ca; senwang@pfc.cfs.nrcan.gc.ca). This paper was received for publication in February 2004. Article No. 9841.

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Table 1. — Employment coefficients per 1000 m³ (RWE).^a

Business type	Jobs
Reman	0.41
MW	2.75
EWP	1.03
Cabs	23.29
Furn	6.19
P&C	0.64
OWP	0.41
Total forest sector ^b	1.1

^aSource is ITE 1999 Secondary Manufacturing Database, Canadian Forest Service, unless otherwise indicated.

^bSource is Delcourt and Wilson 1998.

- Remanufacturing (Reman)
- Millwork (MW)
- Engineered Wood Products (EWP)
- Cabinets (Cabs)
- Furniture (Furn)
- Pallets & Containers (P&C)
- Other Wood Products (OWP)

One of the often-stated benefits of value-added activities such as secondary manufacturing is the creation of employment in addition to existing jobs associated with tending, harvesting, and processing primary forest products.² Secondary manufacturing does provide added employment, and the different business types provide a range of employment intensity per unit of fiber input. Estimates of jobs per thousand m³ of roundwood equivalent (RWE)³ from the latest survey (1999), by business type, are shown in **Table 1**. In the majority of cases these are jobs in addition to those in primary processing as they utilize output from primary mills as their raw material.

Trade environment for BC wood products

The scale of forestry in BC is dependent on export markets, with foreign shipments representing a range of 76 to 86 percent (volume terms) of total lumber production through the 1990s (COFI 2000). The dominance of production for export underlies the importance of the trade environment for BC wood products as background to this analysis of sector performance. In the 1990s, two of the three important markets for BC wood products, the European Community (EC) and the United States, were encumbered with trade barriers limiting access for BC wood products.

The EC instituted a ban on imports of green lumber or timber to reduce the risk of introducing the pinewood nematode into European forests. Canada and the United States were initially excluded from this trade action, although the exclusion expired in October 1993. This resulted in the average annual shipments from BC to the EC falling from 930 million board feet (MMBF) for the 3 years prior to the ban to 240 MMBF for the 3 years following. This ban on green products does not affect all secondary manufactured wood products, as many are manufactured from kiln-dried lumber, or Western redce-

dar, both of which are excluded. However, other products such as most log home packages were effectively cut off from European markets.⁴

Access to the important U.S. market was also limited by trade restrictions for most of the 1990s. In March 1992, a 14.48 percent export duty was enacted by the United States; it was reduced to 6.51 percent in May of that year, and remained in place until August 1994. This was followed in April of 1996 by the Softwood Lumber Agreement (SLA), a negotiated agreement between Canada and the United States. The SLA featured a quota limiting (fee-free) access to the U.S. market by the major Canadian producing regions based on historic exports.⁵ Exports beyond the quota were subject to fees. The SLA remained in place until March 2001, and was replaced by combined countervail and antidumping duties, which amounted to a 27.2 percent *ad valorem* tariff.⁶ This level of tariff represents a much higher level of protection and is thus more disruptive than the level imposed under the SLA (Stennes and Wilson 2005).

The anticipated *aggregate* impacts of export quotas and *ad valorem* tariffs are shown in **Figure 1**. Included are the domestic supply (S) and demand (D) curves in the markets of the importer and the exporter. The excess supply curve (S_{XS}) in the trade market is quantity supplied less demand at each price in the export market and the excess demand curve (D_{XS}) is demand less supply at different prices in the domestic market of the importer. This three-panel diagram shows both the results of free trade equilibrium, and the perturbation due to the trade restriction, export quota, or tariff. Assuming a homogeneous commodity and zero transportation costs, the free trade equilibrium is represented by quantity traded Q at price P. This results in exports of d-a in the export region and imports of h-e.

Under the trade restriction, quantity traded is reduced from Q to Q¹ from either a quota set at Q¹ or a tariff that raises the excess supply curve from S_{XS} to S_{XS}¹. Likewise, exports fall from d-a to c-b in the exporting country and imports fall from h-e to g-f in the importing country. Domestic prices in the exporting country fall from P to P^X while domestic prices in the importing country rise from P to P^M. This creates a wedge between the prices in the two domestic markets, which did occur following the imposition of the SLA (Cintrafor 2002, Stennes and Wilson 2005).

Although the aggregate impacts on softwood lumber are the same under a quota and an equivalent tariff, there are different impacts on higher valued products from the two types of trade measures. Under a quota, there is an incentive to ship higher valued products to maximize value under the quantitative cap. This incentive to ship high valued products is not present under an *ad valorem* tariff. In addition, under the specifics of the SLA, there were options for the secondary manufacturing sector to further process lumber into products not subject to the quota (also true under the tariff). Further processing lumber into uncovered products, combined with a lower relative cost

² Although generally promoted as increasing employment in rural areas, many of these jobs are located near the final market rather than near the raw material supply.

³ All fiber inputs are converted back to thousand m³ of RWE, the equivalent volume of logs used.

⁴ This is an important result as log home production has been a very strong growth component of BC secondary manufacturing production (Wilson et al. 2002).

⁵ The fee-free exports allowed under the SLA quota for BC, Alberta, Ontario, and Quebec were approximately 93 percent of 1995 export volumes for those provinces.

⁶ This is the general tariff level, companies included in the AD determination by the U.S. Dept. of Commerce had firm-specific AD duties.

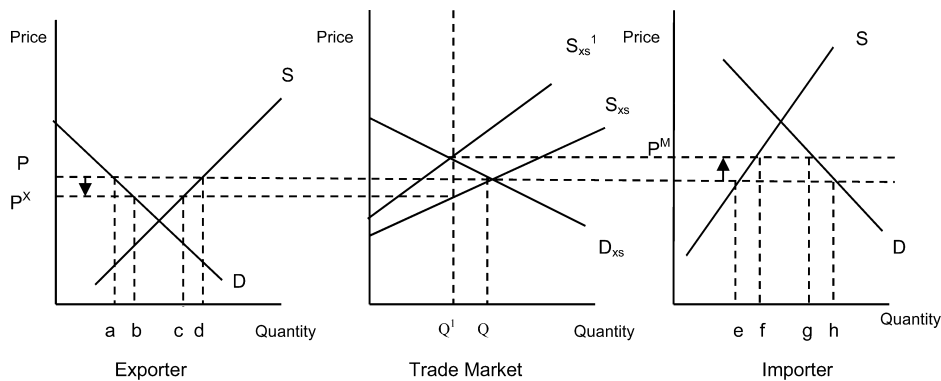


Figure 1. — Simple 2-region trade model with trade restriction.



Figure 2. — Exports of select secondary manufacturing wood products from Canada to the United States.

of lumber inputs in Canada as a result of the price wedge, are advantages for Canadian secondary manufacturing exporters. In general, the quota system as featured in the SLA had a number of features that were favorable for the export of secondary manufactured products into the United States. **Figure 2** shows the exports (value basis) for a number of such Canadian products that can be explicitly identified from U.S. trade (import) data covering our study period.

The information in **Figure 2** shows modest growth in Canadian secondary manufactured wood exports through the early 1990s, then a rapid acceleration in early 1996. This is when the quota under the SLA was instituted, indicating that producers did shift into higher unit value products with the imposition of the quota, as suggested by our simple trade model. Much of this growth was in builders joinery, but all of the listed products followed the same overall trend.

Surveys of secondary manufactured wood processing

The study first examines the results from two comprehensive surveys of secondary manufactured wood processing in BC. The survey representing the start of the decade (McWilliams 1993) took place in 1991, collecting financial and operational information covering the 1990 production year. A similar survey was conducted in 2000, collecting data on the

1999 production year (Wilson et al. 2001).⁷ The general survey methodology was the same for both surveys. First a comprehensive list of firms in BC was developed using published directories and the producer associations representing the different business types. Second, a pilot survey was developed and sent out to a small number of firms. After incorporating any changes resulting from the pilot survey, the final survey and detailed cover letter were mailed to all of the identified firms. A second mailing follows for nonparticipants after a few months, and finally an extensive phone survey finished the process. The firms in each business type, and the proportion responding to the two surveys, are shown in **Figure 3**.

In the 1990 survey, 579 secondary manufacturing firms were identified and 383 responded. For the 1999 survey, 356 firms responded out of 702 identified firms. For many of the formal tests used in this paper, respondents in the two surveys are stratified into four groups: Reman, MW, EWP, and Remainder (Remainder encompasses the four smaller business types: Cabs, Furn, P&C, and OWP).

A decade of growth through the 1990s?

Although information was collected on a number of variables that can be used to test for sector growth, this analysis examines two: 1) the volume of fiber inputs; and 2) volume of sales. Fiber use data facilitate simple t-tests of means between the two surveys as respondents provide the actual volume through an open-ended question, while sales data are provided as an interval or data range. **Table 2** lists the results of testing for an increase in the mean level of fiber use in total and stratified by business type from 1990 to 1999.

The results in **Table 2** show growth in the mean size of firms has occurred through the decade of the 1990s. Mean fiber use increased from 23,507 m³ in 1990 to 41,855 m³ in 1999. Examining the stratified results, mean fiber use increased in all four cases from 1990 to 1999, although the null hypothesis of means being equal for the EWP group is not rejected, even at the most relaxed 10 percent level of significance. Combining these results on means, with overall growth in the population of secondary manufacturing firms from 576 to 702 firms, indicates overall sector growth of over 100 percent in terms of total fiber use over the decade.

Using sales to measure sector growth is problematic because the underlying data are interval rather than numeric

⁷ For a more detailed analysis of the information collected in the two surveys, the reader is referred to McWilliams (1990) and Wilson et al. (2001).

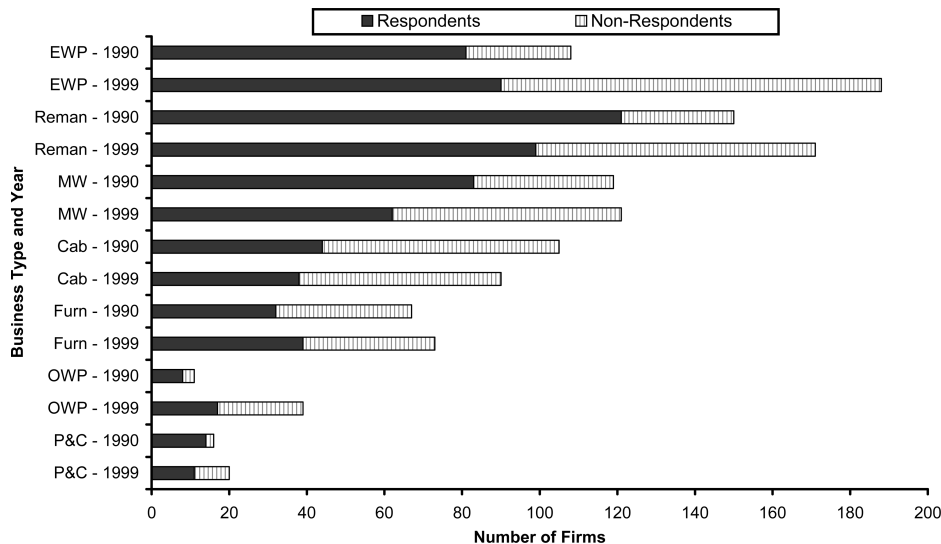


Figure 3. — Surveyed firms and respondents by business type 1990 and 1999 production years.

Table 2. — Summary statistics on fiber use by secondary manufacturing firms in 1990 and 1999.

Stratification	Respondents		Mean fiber use		Reject H ₀ ^a
	1990	1999	1990	1999	
			------(m ³)-----		
All firms	334	280	23,507	41,855	Yes***
Reman	114	88	52,688	98,120	Yes***
MW	72	49	1,950	6,828	Yes**
EWP	65	75	18,678	25,967	No
Remainder	83	68	5,912	11,807	Yes*

^aTests of means were performed using the t-test, *** indicates $\alpha = 0.01$, ** indicates $\alpha = 0.05$, * indicates $\alpha = 0.10$. H₀: Mean(1999) – Mean(1990) = 0; H_A: Mean(1999) – Mean(1990) > 0.

data. An examination of the distribution of firms across intervals does indicate growth in the mean level of sales from 1990 to 1999. Proportionally fewer firms are in the smallest sales category in 1999 (37%) than in 1990 (45%), and more are in each of the larger categories, indicating that mean firm sales level has increased. Assuming that interval midpoints for each sales category represent mean sales for that interval, the mean and median firm sales for the two surveys are estimated. The summary statistics using interval midpoints are given in **Table 3**.

Mean firm sales are higher in each case in 1999 than they are in 1990. This is especially true for Reman firms whose mean firm sales increased by 65 percent in nominal terms (inflation over the period is approximately 11%). Estimating population sales from these statistics to account for nonrespondents is done in two ways: the usual method of simple extrapolation, and a more conservative approach that uses median value to represent nonrespondent sales. The summations use the stratified statistics as shown in **Table 3**. Following an adjustment for inflation to real 1999 dollars, this yields a range of sector sales estimates of \$1.7 to \$2.1 billion for 1990, and \$2.9 to \$3.7 billion for 1999.

It is clear that growth in sector sales did occur in the secondary manufacturing of solid wood in BC through the 1990s, both in terms of mean firm size and the aggregate sector. The

following sections go into detail about where the growth occurred and what constituted the major constraints to continued sector growth.

Market focus

There has been a fundamental shift in the overall markets for BC lumber in the past decade, with export growth concentrated in the U.S. market. Asian exports have seen modest growth and there has been a contraction in export sales to Europe. Our survey data on secondary manufactured wood exports in 1990 and 1999 show that the U.S. market is also the key focus for this sector. Sales into the United States have experienced a large increase, with the percentage approximately doubling between 1990 and 1999 (**Table 4**).

Likewise, on a percentage basis, Asian sales have seen a small increase and the proportions of both domestic and European sales have fallen.

Combining these estimates of percentage sales to different markets with overall sales growth of 75 to 80 percent, it is clear that sales increased through the 1990s in both domestic and most export markets. The only market in which there was no growth over the decade was Europe, although sales volume of secondary manufactured wood products to Europe fell less than did lumber exports. The majority of the increased sales by the BC secondary manufacturing sector were clearly a result of increased U.S. exports, which now account for approximately 50 percent of sales from BC secondary manufacturing firms.

Constraints to expansion in secondary manufacturing

In the 1999 survey questionnaire, respondents were asked to rank constraints to firm expansion. There were four choices provided and respondents were asked to order the factors from 1 to 4 with 1 being the most constraining (ordinal ranking). To analyze the results from this procedure, pairwise comparisons were made between the different factors to order them from most to least constraining. A factor is considered more constraining if greater than 50 percent of the respondents chose it as more constraining (a lower number). To fully rank the constraints requires six such pairwise comparisons.

Each of the comparisons results in a statistic representing the proportion of respondents who chose it as more constraining. Formally, in a pairwise comparison of two variables *A* and *B*, in which the respondent must choose one as more constraining:

$$C = \text{count}(A - B > 0)$$

and our statistic of interest is:

$$X = C/N$$

where *N* = total number of respondents.

To make inferences based on these statistics requires non-parametric techniques; in this case, bootstrapping (Mooney

Table 3. — Sales statistics in 1990 and 1999 secondary manufacturing surveys.

	Mean	Median	Respondents	Population
	-----(\$'000)-----			
1990 survey				
Reman	5,300	2,050	124	161
MW	2,100	500	79	122
EWP	3,600	2,050	78	108
Remainder	2,050	500	95	188
1999 survey				
Reman	11,100	6,050	95	171
MW	2,400	2,050	53	121
EWP	5,400	2,050	84	188
Remainder	2,210	2,050	91	222

Table 4. — Percentage sales into domestic and export markets.

Destination	Simple avg. ^a		Reject H ₀ simple avg. ^b	Sales weighted avg. ^c	
	1990	1999		1990	1999
Domestic	70.8	55.7	Yes**	53.0	32.0
United States	14.2	28.8**	Yes**	27.7	49.7
Asia	9.2	12.0	No	11.4	13.6
Europe	5.2	3.0*	Yes*	7.4	3.7
Otherr	0.3	0.6	No	0.6	1.1

^aThis is an averaging of percentage sales to markets used across all firms with no weighting for the size (level of overall sales) of the firm.

^bTests of means were performed using the t-test. ** indicates $\alpha = 0.05$, * indicates $\alpha = 0.10$. H₀: Mean(1999) – Mean(1990) = 0; H_A: Mean(1999) – Mean(1990) < or > 0 (two-sided).

^cThis average includes a weighting for firm sales volume, and thus gives a better indication of overall sector sales into markets. No formal tests are run on this variable as it includes the midpoint of an interval multiplied by the percentage sales to markets.

and Duval 1993). Using the bootstrapping technique, sampling distributions are generated for the statistic, allowing for hypothesis testing:

$$H_0: X = 0.05, \text{ versus}$$

$$H_A: X \neq 0.50$$

Rejection of the null hypothesis (referred to as the factor indifference hypothesis) would indicate that one of the factors *A* or *B* is considered more constraining. The results of the pairwise comparisons are given in **Table 5**.

These results show that markets are considered the most serious constraint to expansion. We can reject the null hypothesis, $H_0: X = 0.50$ ($\alpha = 0.05$) when comparing markets individually to the other three factors. The ranking for the remaining three factors as constraints to expansion is wood supply > labor > finance, although we cannot reject H_0 in the comparisons for these factors.

More detailed questions were also asked about the most serious constraint to expansion within each of the major categories in **Table 5**. Only the constraints related to markets are further examined here (**Table 6**).

The more detailed examination of market factors that constrain expansion indicates that the ranking in terms of most

Table 5. — Overall constraints to expansion in BC secondary wood manufacturing.

Factor <i>A</i>	Factor <i>B</i>	$X = C/N$ for ($A - B > 0$) ^a
Markets	Wood supply	0.40**
Markets	Labour	0.36**
Markets	Finance	0.34**
Wood supply	Labour	0.48
Wood supply	Finance	0.46
Labour	Finance	0.51

^aA smaller number indicates that *A* is more constraining than *B* ($X < 0.50$), and a larger number indicates that *A* is less constraining ($X > 0.50$). ** indicates H₀ is rejected with $\alpha = 0.05$.

Table 6. — Market related constraints to expansion.

Factor <i>A</i>	Factor <i>B</i>	$X = C/N$ for ($A - B > 0$) ^a
Markets		
Quota	Product diversity	0.61**
Quota	Market diversity	0.62**
Quota	Market/product research	0.55
Product diversity	Market diversity	0.53
Product diversity	Market/product research	0.37**
Market diversity	Market/product research	0.32**

^aA smaller number indicates that *A* is more constraining than *B* ($X < 0.50$), a larger number indicates that *A* is less constraining ($X > 0.50$). * indicates H₀ is rejected, $\alpha = 0.10$; ** indicates H₀ is rejected, $\alpha = 0.05$.

constraining is 1) market diversity; 2) product diversity; 3) market/product research; and 4) the SLA quota. We can only reject the factor indifference hypothesis when comparing one of either market or product diversity to one of either quota or market/product research. The former pair is found to be a more limiting constraint than the latter pair.

Summary and conclusions

The public policy goal of increased secondary manufacturing activity in the solid wood sector was clearly achieved between 1990 and 1999 for BC. Although growth occurred in all of the major markets except Europe, the most important destination for this added production was the United States. The proportion of sales into the United States doubled between 1990 and 1999, and exports to that market now represent 50 percent of BC's overall secondary manufacturing sector production. Secondary trade data at the national level indicate that export growth to the United States accelerated at the end of the decade while under the quota system of the SLA. This result is consistent with economic theory, as exporters move up the value chain when faced with a volume-based quota, or further process lumber into finished products not covered by the quota.

For the latest (1999) survey, firms identified "markets" as the most serious constraint to further expansion. This is not a surprising result as virtually all of the sector growth was in export markets. The low ranking of the quota as a constraint to expansion for secondary manufacturing firms underlines the result that this sector performed well under the SLA. It must be stressed that these results are based on data collected prior to the U.S. imposition of the 27.2 percent *ad valorem* tariff.

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