

Estimating the size of the hardwood sawmill industry in Pennsylvania

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Abstract

The size of the hardwood sawmill industry in Pennsylvania in 1999 is estimated at 1.311 BBF by 556 mills. Study results show an 11 percent higher estimate of the volume of hardwood lumber produced and a 60 percent greater number of Pennsylvania sawmills in 1999 as compared to the 1.186 BBF of hardwood lumber by 339 sawmills estimated by the USDC Census Bureau for the same year (USDC 2001). The difference between our estimates and those of the USDC Census Bureau is believed to be the result of the difficulty in defining and locating small sawmills. Compared with Census, our study found 73 percent more sawmills with less than 20 employees ($n = 473$ in this study vs. 273 in USDC) in 1999.

However, in 1993, the Census Bureau changed the estimation and sampling procedures used to determine hardwood lumber production, resulting in a 37 percent upward revision in estimated production (USDC 1995, 1996). Additional modifications in the sampling procedures employed by the Census Bureau in 1999 resulted in an additional 9 percent upward revision in hardwood lumber production (USDC 2000, 2001).

Pennsylvania contains the largest volume of hardwood sawtimber of any state in the United States, and, by all estimates, produces more hardwood lumber than any other state. The sawmill industry in Pennsylvania is also quite diverse in that it contains a large number of mills of virtually every size, with an unusually large number of small mills. This situation makes precise size calculations of the Pennsylvania sawmill industry quite difficult.

Much of the statistical information available on the U.S. hardwood sawmill industry has underestimated production (Cardillichio and Binkley 1984, Bush and Sinclair 1992, Luppold 1993) and contained inaccuracies (Luppold and Dempsey 1996). Evidence also suggests that the degree of underestimation in hardwood sawmills increased until the early 1990s (Luppold and Dempsey 1989, Luppold 1993, Luppold and

Dempsey 1994). A study of hardwood sawmills and planing mills in Ohio (Bratkovich and Passewitz 1991) reported substantially greater numbers of establishments (38% more) and employees (88% more) in 1987 as compared to the Census Bureau estimates for the same year. Further, Dempsey (1987) reported 1,892 sawmills and planing mills within Pennsylvania, Kentucky, and West Virginia in 1984, whereas the Census Bureau reported only 751 commercial sawmills and planing mills in these three states for the same year.

The Census Bureau now canvases all larger hardwood sawmills with a production of 2 MMBF per year and greater and estimates the production of smaller mills based on a sample. Accordingly, the Census Bureau estimated hardwood lumber production for Pennsylvania in 1999 at 1.186 BBF (USDC 2001) based on a survey of 195 mills of which 143 produced at least 2 MMBF annually (Jamski 2002). There were 339 mills recognized by the Census Bureau in 1999 (USDC 2001); however, it was reported that Pennsylvania had 578 sawmills in 1991 (Luppold 1996). The discrepancy between the number of mills surveyed by the Census in 1999 and the number of mills existing in Pennsylva-

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Table 1. — Estimated lumber production in Pennsylvania for all sawmills, those mills producing in excess of 2 MMBF, and the method for calculating total hardwood production volume in 1999.

	All mills		Mills producing > 2 MMBF	
	No. of sawmills	Production vol.	No. of sawmills	Production vol.
Usable survey respondents	172	542	72	496
		(MMBF)		(MMBF)
Non-responding large mills (information from various industry sources) ^a	8	148	8	148
Non-respondents listed in HLMAP Directory ^b (97-98) other than large mills discussed above	61	153	30	122
Other non-respondents with capacities < 2 MMBF (previous est. ^c × 1.64)	177	166	NA	NA
Other non-respondents with capacities > 2 MMBF (previous est. ^c × 1.62)	41	179	41	179
Other non-respondents listed in PA Bureau of Forestry (1995) directory but capacity not listed (assume 1.5 MMBF/mill)	52	78	unknown	unknown
Other non-respondents appearing to be sawmills (Assume 1 MMBF per mill) ^d	45	45	unknown	unknown
Totals	556	1,311	151	945

^a Volume based on information from the firm's internet pages or provided by industry experts (regional forest products utilization specialists).

^b Volume for these firms was estimated by averaging the range of production listed in the directory for each sawmill.

^c Estimate is derived from 1992 capacity data in the Pennsylvania Bureau of Forestry (1995) directory.

^d Conservative estimate provided by regional forest products utilization specialists.

nonresponding Pennsylvania sawmills was estimated at 153 MMBF (Table 1).

Of the remaining non-responding firms, 217 had an estimated capacity listed in the Pennsylvania Bureau of Forestry (1995) directory.³ However, it was felt that production volumes had probably increased for these firms between 1992 and 1999. Therefore, a method was devised to estimate 1999 hardwood lumber production. The 217 firms were divided into two groups, smaller firms (with a reported capacity of < 2 MMBF; $n = 177$) and larger firms (> 2 MMBF; $n = 41$). Next, we compared the production volumes of the smaller firms who

responded to our questionnaire (and not belonging to the HLMAP) to their capacity, as reported in the Pennsylvania Bureau of Forestry (1995) directory. We found that, on average, their hardwood lumber production in 1999 was 1.64 times greater than their capacity as listed in the 1995 directory. A similar comparison of the actual 1999 production volume of the larger firms to their listed capacity in the 1995 directory resulted in a multiplier of 1.62 (Table 1).

Fifty-two non-responding firms listed in the Pennsylvania Bureau of Forestry Directory (1995) did not provide their estimated capacity. These firms were assumed to have an average production volume of 1.5 MMBF in 1999. An additional 45 non-responding sawmills in our database had no corroborating information in any of the aforementioned

sources. These firms were assumed to produce an average of 1 MMBF of hardwood lumber in 1999 based on conservative estimates from industry experts.⁴

Total Pennsylvania hardwood lumber production estimates

Table 1 shows a total of 556 sawmills in Pennsylvania, of which 151 produced > 2 MMBF in 1999. While the number of larger mills is similar to Census estimates (143 by Census), the number of total mills was 64 percent larger than the 339 reported by Census (USDC 2001). An estimated 122 MMBF was produced by the 30 non-responding mills listed in the HMA (1999) directory with a capacity > 2 MMBF and we estimated that 179 MMBF was produced by the 41 (of 218) non-HLMAP (2000) mills that reported capacities in the Pennsylvania Bureau of Forestry Directory (1995) and who produced > 2 MMBF in 1999 (Table 1).

The analysis in Table 1 illustrates that the types of mills that responded to our questionnaire were not representative of the total population of the Pennsylvania sawmilling industry. Of the 172 responding mills in our study, 72 firms (45%) produced > 2 MMBF of hardwood lumber in 1999 and accounted for more than 90 percent of the total production. However, for the total population, large firms (> 2 MMBF) represented only 27 percent ($n = 151$) of the total population and produced 72 percent (945 MMBF) of the hardwood lumber volume in Pennsylvania in 1999 (Table 1). This finding suggests that care should be exercised when determining the total volume of lumber produced within a state or region by using information from responding firms to estimate the volume produced by non-responding firms. For example, had we estimated total Pennsylvania hardwood lumber production based on the 172 responding mills out of either an unadjusted population of 921 or an adjusted population of 556, our estimate of hardwood lumber production in Pennsylvania would exceed 2.8 BBF or 1.75 BBF, respectively. Further, the average hardwood lumber production of the 172 responding mills was 3.15 MMBF, whereas the average size hardwood sawmill in Pennsylvania ($n = 556$) was estimated at 2.36 MMBF.

³ This listing had not been updated since at least 1992; therefore information is assumed to be 1992 data.

⁴ Regional forest products utilization specialists.

nia in 1991 may be of concern if these potentially uncounted mills have remained in business and if the collective production of these uncounted mills is significant.

Still, the inability to identify and count these small mills is understandable. The overall effort of developing a statistically representative research database of hardwood sawmills is very time consuming and expensive; therefore, studies of this nature are infrequently conducted. Commercial directories and other sources of operating establishments in the wood products industry typically list only a fraction of the sawmills in operation, making it impossible to obtain a complete list of sawmills in any state from a single source (Luppold and Dempsey 1994). Further, many directories are published infrequently (Luppold 1995, Luppold et al. 2000), thus making it difficult to use a single source. This is the case in Pennsylvania where the last sawmill directory was published in 1995 and, for the most part, contains data that were last updated in 1992.

Objectives

The first objective of this study was to calculate the number of Pennsylvania sawmills and the total volume of hardwood lumber produced in Pennsylvania through the use of secondary data from various mill directories and lists in combination with primary data obtained from a 1999 survey of the Pennsylvania sawmill industry. The second objective was to estimate the number of sawmills by employment size in Pennsylvania and compare and contrast this estimate with those developed by the Census Bureau.

Methods

Sample frame

In order to compile a complete database of all existing hardwood sawmills in Pennsylvania in 1999, the following sources were included:

- Pennsylvania Industrial Directory, 2000.
- Pennsylvania Industrial Directory, 1999.
- Hardwood Lumber Manufacturers Association of Pennsylvania (HLMAP) Directory, 2000.
- Hardwood Lumber Manufacturers Association of Pennsylvania (HLMAP) Directory, 1997 to 1998.
- Hardwood Manufacturers Association (HMA) Directory, 1999.
- Southern Lumberman, 2000.
- Import/Export Wood Purchasing News, 2000.
- Directory of the Forest Products Industry, 1998.
- Pennsylvania Bureau of Forestry, 1995.

From these nine sources, a comprehensive database of 921 potential sawmills was compiled to represent a preliminary sample frame of all hardwood sawmills in Pennsylvania. For the purposes of this study, a hardwood sawmill was defined as a mill in operation during 1999 that is primarily engaged in sawing rough lumber and timber from logs and bolts, or re-sawing cants and/or flitches into lumber.

Research instrument

Mail questionnaires, the most cost-effective means to collect data from a geographically dispersed population, were used for primary data collection (Blankenship and Breen 1992, Dillman 2000). The questionnaire was pre-tested for construction, content validity, wording, format, and question flow, through on-site, in-depth interviews with 17 Pennsylvania sawmills (similar to the population for this study), which satisfies the minimum number required according to Isaac and Michael (1995).

Response rates

To increase response rates, a modified version of Dillman's (2000) tailored design method was employed. A survey booklet and a cover letter explaining the purpose of the study and other instructions were mailed to a contact person in each of our 921 identified sawmills in the second week of October 2000. A reminder postcard was mailed 1 week after the first mailing. Three weeks following the initial mailing, a second questionnaire was mailed with a cover letter encouraging participation from the non-respondents. In addition, 3

weeks following the second mailing, follow-up phone calls were made to 55 non-respondents (about 10% of final population) randomly chosen from the population of non-respondents to increase the response rate, test for non-response bias, and validate the sample frame.

Of the original database of 921 prospective sawmills, the sample frame was reduced by 365 firms¹ resulting in an adjusted population size of 556 hardwood sawmills in Pennsylvania. An overall adjusted response rate of 31 percent ($n = 161$; representing 172 mills) was achieved, which compares favorably to response rates obtained in previous mail survey studies of a similar nature (Bratkovich and Passewitz 1991, Luppold et al. 2000, Bowe et al. 2001).

Responding and non-responding hardwood lumber production

Of the 921 questionnaires mailed, 161 usable forms were returned, representing 172² mills that had a combined production of 542 MMBF (Table 1). Of the total hardwood lumber volume produced by respondents, the larger firms (> 2 MMBF, $n = 72$) produced 496 MMBF or 92 percent of the total hardwood lumber volume in 1999. While responding firms represented a sizable portion of the sawmill industry in Pennsylvania, production for non-responding firms was sought in order to estimate the total size of Pennsylvania's hardwood sawmill industry.

Eight of the non-responding firms were identified (by the authors) as very large mills (producing in excess of 5 MMBF) and three of these mills had recently changed ownership and were therefore not listed under their new names in the directories. Current production information on these eight mills was obtained from the firm's internet home pages or through other industry contacts, resulting in an additional 148 MMBF of hardwood lumber production in 1999 (Table 1).

Another 61 non-responding firms were listed in the 1997-1998 HLMAP directory. Production for these firms was estimated by averaging the range of production as listed in the directory for each sawmill. Accordingly, the total volume of lumber produced by these 61

¹ The sample frame was reduced due to returned (undeliverable) mail, bad or changed addresses, firms that were no longer in business, firms in other businesses (pallets, distribution/concentration yards, veneer and plywood mfrs., etc.), duplicate responses, follow-up phone call validation procedures, and insight from industry experts.

² Eight responding firms operated more than one sawmill as follows: six had two mill sites; one had three sites; and one had four sites.

Table 2. — Estimates of the number of Pennsylvania hardwood sawmills by number of employees in 1999.

Source	No. of employees			Total
	1 to 19	20 to 99	100 to 499	
Census Bureau ^a	273	60	6	339
Current study	473	74	9	556

^aUSDC 1999. Standard Industrial Classification (NAICS-321113 or SIC-2421).

Employee size classification

Overall, the Census Bureau (USDC 2001) found 339 hardwood sawmills in Pennsylvania in 1999, whereas our study found 556 sawmills to be in production that year. By size classification, our study identified a considerably larger number of sawmills in each employee size class in Pennsylvania in 1999 as compared to the Census Bureau (USDC 2001) estimates (Table 2). In the 1- to 19-employee size class, our study showed 73 percent more firms vs. the USDC (2001) ($n = 473$ vs. 273). And, as compared to the Census Bureau estimates, our study also indicated 23 percent more firms in the 20- to 99-employee size class and 50 percent more sawmills in the 100- to 499-employee size class (Table 2). However, the greater number of mills in the larger employment categories may be more the result of the way Census classifies the 4-digit SIC grouping within a mill than an actual undercounting of larger mills. For example, a sawmill with a small associated dimension operation will be classified under two different SIC numbers – parceling out the sawmill employees from the dimension workers – while our estimates of sawmill employees does not separate for two operations.

Conclusions

The size of the hardwood sawmill industry in Pennsylvania in 1999 is estimated at 1.311 BBF by 556 mills. Study results show an 11 percent higher estimate of the volume of hardwood lumber produced and a 60 percent greater number of Pennsylvania sawmills in 1999 as compared to the 1.186 BBF of hardwood lumber by 339 sawmills estimated by the Census Bureau for the same year (USDC 2001). However, it appears that the 217 mills missed by the Census Bureau had an average capacity of less than 600 MMBF that year.

Most economic and development studies for Pennsylvania are based on

Census Bureau estimates, and therefore, tend to underestimate the size of the industry, particularly the number of sawmills with < 20 employees. This may be a greater problem in Pennsylvania given the relatively large number of small sawmills as compared to most other hardwood producing states.

This study provides a caution to researchers and analysts who use the Census Bureau data as a benchmark for their studies. Care should also be exercised when extrapolating partial survey responses since this practice may lead to greatly overestimated production volumes and/or average sawmill size. Accurately measuring the total volume of hardwood lumber produced and the number of hardwood sawmills in operation has important implications not only for policymakers and industry analysts who calculate and forecast hardwood lumber supply and demand, but also for the entire hardwood value chain including timberland owners, loggers, lumber producers, and lumber buyers. Future research should focus on replicating this work in other U.S. hardwood-producing states and comparing results to official Census Bureau data.

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