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Procedures Used to Estimate Hardwood Lumber Consumption from 1963 to 2002

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Abstract

This paper presents an explanation for and procedures used to estimate hardwood lumber consumption by secondary hardwood processing industries from 1963 to 2002. This includes: classification of industry and industry groups, development of proxy prices used to estimate lumber consumption, assumptions used to convert dimension purchases to lumber consumption, estimation of material consumption by firms not reporting material consumption by kind, and estimation of lumber use in frame stock production. Also presented are the special procedures used to estimate lumber consumed by the hardwood flooring, kitchen cabinet, pallet, crosstie, and hardwood plywood industries.

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INTRODUCTION

Lumber is the most valuable product derived from eastern hardwood forests. However, the consumption of hardwood lumber has changed over the past several decades. Understanding theses changes in consumption is an important step in determining how markets influence the volume and type of timber harvested.

The periodic Census of Manufactures[1] is the only consistent source of information on hardwood lumber consumption over the past 40 years. This census was conducted in 1963 and again in 1967, 1972, 1977, 1982, 1987, 1992, 1997 and 2002. However, longitudinal comparisons and interpretation of this data from the Census is difficult because of changes in the industrial classification codes, incomplete data reporting, indirect lumber consumption through the purchase of hardwood dimension, and data inconsistencies. Because of these limitations, Census data must be interpreted through a logical chain of assumptions.

Our objective is to explain how we classified secondary hardwood manufacturers into industry groups and industries and to explain the assumptions used to develop estimates of hardwood lumber consumption despite changes in reporting procedures. The resulting estimates of hardwood lumber consumption are presented and analyzed in a companion paper, "Forty Years of Hardwood Lumber Consumption: 1963 to 2002" (Luppold and Bumgardner 2008).

In this publication we also present the development of proxy prices used to estimate quantity data from value data, the estimation of indirect lumber consumption through dimension and frame purchases, the estimation of material consumed by firms not reporting material consumption by kind, and several industry-specific assumptions.

[1]The corresponding data documents were called "Census of Manufactures Industry Series" until 1997, when they became "Economic Census Manufacturing Industry Series". We refer to these reports as "the Census" throughout this publication.

CLASSIFICATION OF INDUSTRY GROUPS AND INDUSTRIES

Between 1963 and 1992 the U.S. Department of Commerce, Bureau of the Census, combined, added, or deleted specific Standard Industrial Classifications (SIC) on several occasions. For instance, before 1972 kitchen cabinets (SIC 2434) were included in wood household furniture (SIC 2511) and pallets (SIC 2448) were classified under wood products not elsewhere classified, or NEC (SIC 2499).

In 1997 the North American Industry Classification System (NAICS) was implemented. Although SIC and NAICS classifications are similar in many respects, there are some major differences for specific industries. The most striking change is that millwork manufacturers (SIC 2431) were divided under three different NAICS classifications and one of these groups included flooring. In previous census years, flooring was combined with dimension (SIC 2426). By contrast, nailed wood boxes (SIC 2441), wirebound boxes (SIC 2442), pallets (SIC 2448) and wood containers NEC (2449) were combined under one code (NAICS 321114). The changes in SIC groups and transition to the NAICS system meant that different industries have to be combined over time to maintain data consistency. Furthermore, many hardwood processing firms are difficult to define because they can manufacture several different products. For example, a millwork producer also may produce specialty wood flooring or custom cabinetry. The change in industrial classification systems and the often difficult problem of classifying specific hardwood product manufacturers led to the decision to combine several SIC or NAICS codes into individual industries and to combine these industries into five broader industry groups (Table 1). These groups carry a better degree of accuracy because they contain a broader aggregate of similar industries.

Table 1.—Definition of industrial groups and industries by Census code and years covered.

Industry group Industry	Census code	Description	Years covered
Furniture			
Wood furniture	SIC 2511	Wood household furniture	1963 - 1992
Wood furniture	SIC 2517	Wood TV and radio cabinets	1972 - 1992
Wood furniture	SIC 2519	Other household furniture	1992
Wood furniture	NAICS 337122	Non upholstered household furniture	1997 - 2002
Wood furniture	NAICS 337125	Other household furniture	1997 - 2002
Wood furniture	NAICS 337129	Wood TV, radio, and sewing cabinet	1997- 2002
Upholstered furn.	SIC 2512	Upholstered household furniture	1963 - 1992
Upholstered furn.	NAICS 337121	Upholstered household furniture	1997 - 2002
Commercial furn.	SIC 2521	Wood office furniture	1963 - 1992
Commercial furn.	SIC 2522	Metal office furniture	1963 - 1992
Commercial furn.	SIC 2531	Public building furniture	1963 - 1992
Commercial furn.	SIC 2541	Wood partition and fixtures	1963 - 1992
Commercial furn.	SIC 2542	Partition and fixtures other than wood	1963 - 1992
Commercial furn.	SIC 2599	Furniture and fixtures NEC	1963 - 1992
Commercial furn.	NAICS 337127	Institutional furniture	1997 - 2002
Commercial furn.	NAICS 337211	Wood office furniture	1997 - 2002
Commercial furn.	NAICS 337214	Office furniture except wood	1997 - 2002
Commercial furn.	NAICS 337215	Showcase, partition, and shelving	1997 - 2002
Industrial products			
Pallets/containers	SIC 2441	Nailed wood boxes and shook	1963 - 1992
Pallets/containers	SIC 2442	Wirebound boxes and crates	1963 - 1967
Pallets/containers	SIC 2499	Wood product NEC (pallets only)	1963 - 1967
Pallets/containers	SIC 2448	Wood pallets and skids	1972 - 1992
Pallets/containers	SIC 2449	Wood containers NEC	1972 - 1992
Pallets/containers	NAICS 321920	Wood containers and pallets	1997 - 2002
Crossties	SIC 2491	Wood preservation	1977 - 1992
Crossties	NAICS 321114	Wood preservation	1997 - 2002
Construction and Remodeling			
Flooring	SIC 2426	Dimension and flooring (the flooring component)	1963 - 1967
Flooring	NAICS 321918	Other millwork (the flooring component)	1997 - 2002
Kitchen cabinets	SIC 2511	Proportion of kitchen cabinets	1963 - 1967
Kitchen cabinets	SIC 2434	Kitchen cabinets	1972 - 1992
Kitchen cabinets	NAICS 337110	Kitchen cabinets	1997 - 2002
Millwork	SIC 2431	Millwork	1963 - 1992
Millwork	NAICS 321911	Wood window and doors	1997 - 2002
Millwork	NAICS 321918	Other millwork (flooring backed out)	1997 - 2002
Millwork	NAICS 337211	Custom architectural millwork	1997 - 2002

Continued

Table 1.—continued

Industry group Industry	Census code	Description	Years covered
Building products	SIC 2433	Prefabricated wood structures	1963 - 1967
Building products	SIC 2439	Structural wood members NEC	1972 - 1992
Building products	SIC 2452	Prefabricated wood building	1972 - 1992
Building products	NAICS 321214	Trusses	1997 - 2002
Building products	NAICS 321992	Prefabricated wood buildings	1997 - 2002
Miscellaneous			
Miscellaneous	SIC 2432	Veneer and plywood	1963 - 1967
Miscellaneous	SIC 2435	Hardwood veneer and plywood	1972 - 1992
Miscellaneous	SIC 2499	Wood product NEC (pallets backed out)	
Miscellaneous	SIC 2499	Wood product NEC	1972 - 1992
Miscellaneous	NAICS 321999	All other miscellaneous wood products	1997 - 2002

DEVELOPMENT OF PROXY PRICES

Census estimates of the volume of hardwood lumber consumed have declined over the past 40 years. In 1963, the Census provided volume information for logs, lumber, and dimension purchases for every SIC category consuming hardwood. By 2002, the only volume estimate reported by the Census was dressed lumber consumed by the pallet industry.

In cases where volume data were not reported in the Census (e.g., Table 7 - Material Consumed by Kind), volume was estimated by using a proxy price. These prices were developed through examination of imputed prices in years for which estimates of volume and value were provided, and from our knowledge of the grades and species of lumber consumed by the various secondary processing industries. Table 2 provides a list of proxy prices used to develop quantity information for specific industries, materials, and years, along with a brief description of the basis for development. All green (G) prices are based on early July listings for the Appalachian region as reported in the Hardwood Market Report (HMR) for 1963 to 2002. Kiln-dried (KD) prices were based on Anderson Tully price quotes (from early July) printed in the HMR for 1963 to 1987; price listings in the HMR from 1992 to 2002 were used thereafter as published KD data became available.

Table 2.—Proxy prices used to develop quantity information by year, Census code, product, and method used to estimate.

Year	Census code	Product	$/mbf	How developed
1967	2431	logs	66	price of logs for flooring
1967	2431	dressed lumber	245	price of KD FAS red oak
1967	2541	lumber	187	price of lumber for wood office
1967	2542	lumber	187	price of lumber for wood office
1967	2599	lumber	187	price of lumber for wood office
1972	2434	lumber	175	price of G 1C red oak
1972	2452	rough lumber	136	price of G 1C yellow-poplar
1977	2441	logs	100	price of grade 3 mixed sawlogs
1977	2448	logs	100	price of grade 3 mixed sawlogs
1977	2448	rough lumber	145	price of G 3A red oak lumber
1977	2541	lumber	432	price of lumber for wood office
1977	2542	lumber	432	price of lumber for wood office
1982	2431	dress lumber	865	price of KD FAS red oak
1982	2434	rough lumber	390	price of G 1C red oak
1982	2434	dress lumber	530	price of KD 1C red oak
1982	2441	rough lumber	180	price of G 2C red oak lumber
1982	2449	logs	125	price of grade 3 sawlogs
1982	2439	rough lumber	390	price of G 1C red oak
1982	2439	dress lumber	530	price of KD 1C red oak
1982	2499	logs	180	average of 1977 and 1987 prices
1982	2499	rough lumber	393	average of 1977 and 1987 prices
1982	2499	dressed lumber	332	average of 1977 and 1987 prices
1982	2511	lumber	390	price of G 1C red oak

Continued

Table 2.—continued

Year	Census code	Product	$/mbf	How developed
1982	2512	lumber	390	price of G 1C red oak
1982	2517	lumber	390	price of G 1C red oak
1982	2521	lumber	530	price of KD 1C red oak
1982	2522	lumber	530	price of KD 1C red oak
1982	2531	lumber	530	price of KD 1C red oak
1982	2541	lumber	530	price of KD 1C red oak
1982	2542	lumber	530	price of KD 1C red oak
1982	2599	lumber	530	price of KD 1C red oak
1987	2434	rough lumber	565	price of G 1C red oak
1987	2434	dress lumber	710	price of KD 1C red oak
1987	2439	rough lumber	565	price of G 1C red oak
1987	2439	dress lumber	710	price of KD 1C red oak
1987	2441	rough lumber	220	price of G 3A red oak
1987	2441	dressed lumber	250	3A red oak * 1.25
1987	2448	logs	125	price of grade 3 sawlogs
1987	2452	rough lumber	313	price of G 1C yellow-poplar
1987	2511	lumber	565	price of G 1C red oak
1987	2512	lumber	565	price of G 1C red oak
1987	2517	lumber	565	price of G 1C red oak
1987	2521	lumber	1050	price of KD 1C red oak
1987	2522	lumber	1050	price of KD 1C red oak
1987	2531	lumber	1050	price of KD 1C red oak
1987	2541	lumber	1050	price of KD 1C red oak
1987	2542	lumber	1050	price of KD 1C red oak
1987	2599	lumber	1050	price of KD 1C red oak
1992	2434	rough lumber	675	price of G 1C red oak
1992	2434	dress lumber	910	price of KD 1C red oak
1992	2439	rough lumber	675	price of G 1C red oak
1992	2439	dress lumber	910	price of KD 1C red oak
1992	2441	rough lumber	290	price of G 3A red oak
1992	2448	logs	125	price of grade 3 sawlogs
1992	2448	rough lumber	290	price of G 3A red oak
1992	2449	rough lumber	290	price of G 3A red oak
1992	2452	rough lumber	295	price of G 1C yellow-poplar
1992	2452	dressed lumber	440	price of KD1C yellow-poplar
1992	2499	logs	245	1987 price * 1.2
1992	2499	rough lumber	517	1987 price * 1.2
1992	2499	dressed lumber	457	1987 price * 1.2
1992	2511	lumber	675	price of G 1C red oak

Continued

Table 2.—continued

Year	Census code	Product	$/mbf	How developed
1992	2512	lumber	675	price of G 1C red oak
1992	2517	lumber	675	price of G 1C red oak
1992	2519	lumber	675	price of G 1C red oak
1992	2521	lumber	1350	price of KD 1C red oak
1992	2522	lumber	1350	price of KD 1C red oak
1992	2531	lumber	1350	price of KD 1C red oak
1992	2541	lumber	1350	price of KD 1C red oak
1992	2542	lumber	1350	price of KD 1C red oak
1992	2599	lumber	1350	price of KD 1C red oak
1997	321214	rough lumber	740	price of G 1C red oak
1997	321214	dressed lumber	1030	price of KD 1C red oak
1997	321992	rough lumber	435	price of G 1C yellow-poplar
1997	321992	dressed lumber	585	price of KD 1C yellow-poplar
1997	321911	rough lumber	1100	price of G FAS red oak
1997	321911	dressed lumber	1435	price of KD FAS red oak
1997	321918	logs	340	price grade 2 red oak log
1997	321918	rough lumber	740	price of G 1C red oak
1997	321918	dressed lumber	1030	price of KD 1C red oak
1997	327211	rough lumber	1100	price of G FAS red oak
1997	337110	lumber	773	price of AD 1C red oak/h maple
1997	321920	logs	130	price of grade 3 logs
1997	321920	rough lumber	275	price of pallet cants
1997	321999	logs	300	price of grade 2 logs
1997	321999	rough lumber	740	price of G 1C red oak
1997	321999	dressed lumber	1030	price of KD 1C red oak
1997	337121	lumber	740	price of G 1C red oak
1997	337122	lumber	740	price of G 1C red oak
1997	337125	lumber	740	price of G 1C red oak
1997	337129	lumber	740	price of G 1C red oak
1997	337127	lumber	1435	price of KD FAS red oak
1997	337211	lumber	1435	price of KD FAS red oak
1997	337214	lumber	1435	price of KD FAS red oak
1997	337215	lumber	1435	price of KD FAS red oak
1997	321992	dressed lumber	400	price of G 1C yellow-poplar
1997	321992	rough lumber	545	price of KD 1C yellow-poplar
2002	321214	rough lumber	850	price of AD 1C red oak/h maple
2002	321214	dressed lumber	1057	price of KD 1C red oak/h maple
2002	321992	rough lumber	400	price of G 1C yellow-poplar
2002	321992	dressed lumber	545	price of KD 1C yellow-poplar

Continued

Table 2.—continued

Year	Census code	Product	$/mbf	How developed
2002	321911	rough lumber	1282	price of AD FAS red oak/h maple
2002	321911	dressed lumber	1580	price of KD FAS red oak/h maple
2002	327211	rough lumber	1282	price of AD FAS red oak/h maple
2002	327211	dressed lumber	1580	price of KD FAS red oak/h maple
2002	321918	logs	268	price grade 2 red oak log
2002	321918	rough lumber	710	price of G 2A/1C red oak
2002	321918	dressed lumber	980	price of KD 2A/1C red oak
2002	337110	lumber	990	price of AD 1C h maple
2002	321920	logs	150	price of grade 3 logs
2002	321920	rough lumber	260	price of pallet cants
2002	321999	logs	400	price of grade 2 logs
2002	321999	rough lumber	850	price of AD 1C red oak/h maple
2002	321999	dressed lumber	1057	price of KD 1C red oak/h maple
2002	337121	lumber	850	price of AD 1C red oak/h maple
2002	337122	lumber	850	price of AD 1C red oak/h maple
2002	337125	lumber	850	price of AD 1C red oak/h maple
2002	337129	lumber	850	price of AD 1C red oak/h maple
2002	337127	lumber	1580	price of KD FAS red oak/h maple
2002	337211	lumber	1580	price of KD FAS red oak/h maple
2002	337214	lumber	1580	price of KD FAS red oak/h maple
2002	337215	lumber	1580	price of KD FAS red oak/h maple

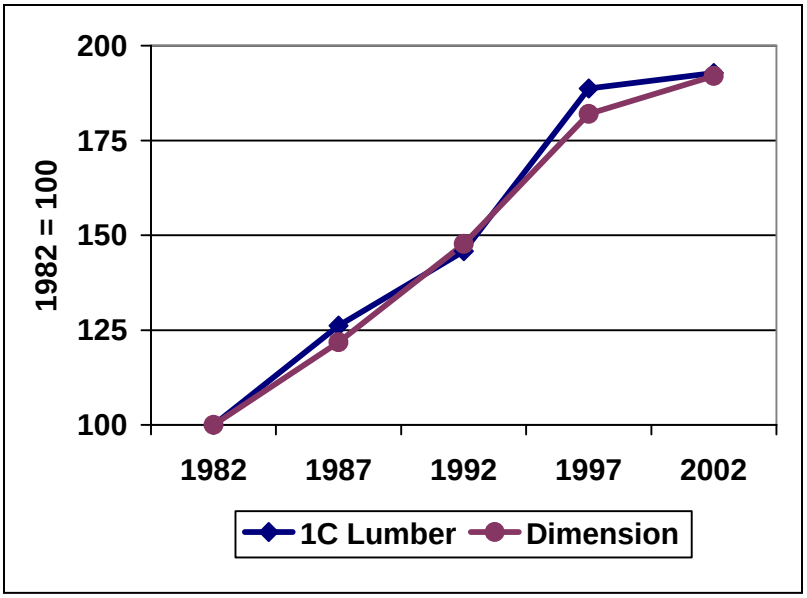

Figure 1.—Index of 1C lumber price and dimension price, 1982 to 2002.

CONVERSION OF DIMENSION PURCHASES TO LUMBER CONSUMPTION

For industries and years in which dimension volumes were reported, it was assumed that 2 board feet of lumber is required to produce 1 board foot of dimension. Proxy prices were used to determine volumes for years and industries that only reported value data. All but one of these proxy prices were based on inflating the price of dimension in 1972 or 1977 using a dimension price index (U.S. Bureau of Labor Statistics 2007). The difficulty with this procedure is that the Bureau of Labor Statistics (BLS) began reporting a dimension price index in 1981. Fortunately, an aggregate price series based on average annual price of grade 1 Common (1C) red oak (RO), white oak (WO), hard maple (HM), soft maple (SM), and yellow-poplar (YP) lumber we developed as a general price index is highly correlated with the BLS index of hardwood dimension price for census years 1982 to 2002 (Fig. 1). These weighting factors are roughly equivalent to the proportion consumption of grade hardwood species for the major hardwood species groups red oak, white oak, hard maple, soft maple, and yellow-poplar.

For census years 1977 through 1997, the formula for this index is:

Index = (.3∗1CRO)+(.2∗1CWO)+(.15∗1CHM)+(.15∗1CSM)+(.2∗1CYP)

For census year 2002 (reflects the emergence of HM as a dominant species), the index is:

Index = (.2∗1CRO)+(.15∗1CWO)+(.25∗1CHM)+(.2∗1CSM)+(.2∗1CYP)

The 1C series was re-indexed to 1972 = 100, and the resulting series index was used to inflate 1972 dimension prices for all series other than dimension used by producers of products NEC (SIC 2499, NAICS 32199). The last year an imputed dimension price was available for this industry was 1977 = 100 and the resulting series index was used to inflate 1977 dimension prices for these industries. Table 3 provides a list of proxy prices used to develop quantity information for specific industries and years.

Table 3.—Proxy prices used to develop quantity of dimension by year, Census code, and method used to estimate.

Year	Census code	$/mbf	How developed
1967	2499	240	Average of 1963 and 1977
1977	2511	618	Index (1972=100) * 72 price (1.55 * 398.5)
1977	2512	386	Index (1972=100) * 72 price (1.55 * 248.8)
1977	2517	869	Index (1972=100) * 72 price (1.55 * 560.5)
1982	2499	345	Index (1977=100) * 77 price (1.21 * 284.6)
1982	2511	749	Index (1972=100) * 72 price (1.88 * 398.5)
1982	2512	468	Index (1972=100) * 72 price (1.88 * 248.8)
1982	2517	1,054	Index (1972=100) * 72 price (1.88 * 560.5)
1987	2499	436	Index (1977=100) * 77 price (1.53 * 284.6)
1987	2511	948	Index (1972=100) * 72 price (2.38 * 398.5)
1987	2512	592	Index (1972=100) * 72 price (2.38 * 248.8)
1987	2517	1,334	Index (1972=100) * 72 price (2.38 * 560.5)
1992	2499	537	Index (1977=100) * 77 price (1.77 * 284.6)
1992	2511	1,092	Index (1972=100) * 72 price (2.74 * 398.5)
1992	2512	682	Index (1972=100) * 72 price (2.74 * 248.8)
1992	2517	1,535	Index (1972=100) * 72 price (2.74 * 560.5)
1992	2521	1,535	Index (1972=100) * 72 price (2.74 * 560.5)
1992	2599	1,535	Index (1972=100) * 72 price (2.74 * 560.5)
1997	321911	1,990	Index (1972=100) * 72 price (3.55 * 560.5)
1997	321999	653	Index (1977=100) * 77 price (2.29 * 284.6)
1997	337110	1,990	Index (1972=100) * 72 price (3.55 * 560.5)
1997	337211	1,990	Index (1972=100) * 72 price (3.55 * 560.5)
1997	337121	883	Index (1972=100) * 72 price (3.55 * 248.8)
1997	337122	1,415	Index (1972=100) * 72 price (3.55 * 398.5)
1997	337124	1,990	Index (1972=100) * 72 price (3.55 * 560.5)
1997	337127	1,990	Index (1972=100) * 72 price (3.55 * 560.5)
1997	337129	1,990	Index (1972=100) * 72 price (3.55 * 560.5)
1997	337211	1,990	Index (1972=100) * 72 price (3.55 * 560.5)
1997	337212	1,990	Index (1972=100) * 72 price (3.55 * 560.5)
1997	337214	1,990	Index (1972=100) * 72 price (3.55 * 560.5)
1997	337215	1,990	Index (1972=100) * 72 price (3.55 * 560.5)
2002	321911	2,035	Index (1972=100) * 72 price (3.63 * 560.5)
2002	321918	2,035	Index (1972=100) * 72 price (3.63 * 560.5)
2002	321999	667	Index (1977=100) * 77 price (2.34 * 284.6)
2002	337110	2,035	Index (1972=100) * 72 price (3.63 * 560.5)
2002	337121	903	Index (1972=100) * 72 price (3.63 * 248.8)
2002	337122	1,447	Index (1972=100) * 72 price (3.63 * 398.5)
2002	337127	2,035	Index (1972=100) * 72 price (3.63 * 560.5)
2002	337129	2,035	Index (1972=100) * 72 price (3.63 * 560.5)
2002	337211	2,035	Index (1972=100) * 72 price (3.63 * 560.5)
2002	337215	2,035	Index (1972=100) * 72 price (3.63 * 560.5)

CONVERSION OF FURNITURE FRAME PURCHASES TO LUMBER CONSUMPTION

Consumption of furniture frames is reported by the Census on a dollar value basis. To convert dollar value to lumber volume, we assumed that lumber cost was 50 percent of production cost and that delivered cost was twice the production costs. Therefore, lumber cost equals 25 percent of the cost of delivered frames. Volume of lumber was developed by dividing lumber cost by the price of grade 2 Common (2C) white or red oak lumber (whichever is lower during the particular year). Low-grade oak price was chosen because this is the lumber most commonly consumed by furniture frame manufacturers.

In 1997 the definition of furniture frames was changed and given the omnibus NAICS product code of 33721500. Upon investigation we determined that these products were finished furniture parts made by showcase, partition, and shelving manufacturers (NAICS 337215) and included 12 separate product groups made from metal, plastic, particleboard, medium density fiber board plywood, softwood lumber, and hardwood lumber. In 2002 these products accounted for 15 percent of all products shipped by NAICS 337215 firms (U.S. Bureau of the Census 2004 - EC02-311-337215 (RV)). Because of the relatively low volume of lumber consumed by NAICS 377215 firms (84 mmbf in 2002), the relatively small volume of total shipments (15 percent) and the lack of information about which of the 12 product groups went to what consuming industry, it was decided to assign lumber consumed by these firms to the commercial furniture group.

ESTIMATION OF MATERIAL CONSUMED BY FIRMS NOT REPORTING MATERIAL CONSUMPTION BY KIND

Smaller firms are not required to provide detailed information on material consumed by kind, they report only total value of material consumed not specified by kind (nsk). To account for log, lumber, and dimension consumption by these firms, we assumed that reporting and nonreporting firms used similar proportions of these materials. We estimated the volume by all firms by inflating volume used by reporting firms by an nsk multiplier:
nsk multiplier = {(cost of all material)/(cost of all material-value reported nsk)}.

LUMBER CONSUMPTION BY THE KITCHEN CABINET INDUSTRY 1963, 1967, AND 1977

In the 1963 and 1967 censuses, kitchen cabinets were considered wood household furniture (SIC 2511) and only the value of cabinets shipped was reported. We assumed volume of lumber and dimensions used by this industry were proportional to value of shipments of cabinets relative to wood household furniture. Once estimated, this volume was subtracted from total lumber consumption by SIC 2511.

Data on material consumed by the kitchen cabinet industry in 1977 (SIC 2434) did not meet Census publication standards. Lumber volume for 1977 was estimated by using the 1972 estimate of lumber consumption multiplied by the change in value of shipment adjusted for inflation using the producer price index of all raw materials. Lumber consumption for years after 1977 was developed from Census volume or value estimates.

Industry-specific Assumptions

Estimating Lumber Consumed by the Flooring Industry
The Census historically has reported shipments of hardwood flooring by type. We assumed that 1.66 board feet of lumber are consumed for each board foot of strip flooring produced, and 2 board feet of lumber are consumed for each board foot of all other flooring products manufactured.

Estimating Lumber Consumption by the Pallet Industry 1963 and 1967

In 1963 and 1967, pallets were included by the census in the wood products NEC (SIC 2499) and the value of pallets shipped was reported. We estimated volume of lumber used by this industry by assuming each pallet cost $2 in 1963 and $3 in 1967 and each pallet required 15 board feet of lumber. Once volume was estimated, it

was deducted from total lumber consumption by SIC 2499 and added to lumber used by box (SIC 2441) and container (SIC 2449) industries. For years 1972 to present, we used volume or value estimates published by the Census.

Estimating Lumber Used by Wood Preserving Industry (railroad crossties)

In the 1960s, estimates of hardwood lumber consumption by the wood preserving industry as reported in the Census of Manufactures appeared to be lower than other reports of crosstie usage. Because of this apparent underreporting, estimates of hardwood lumber consumption for crossties developed by Cardellichio and Binkley (1984) were used for the 1963, 1967, and 1972 census periods.

Logs Consumed by Secondary Processors

We assumed logs and bolts consumed by pallet, box, and miscellaneous manufacturers was produced into lumber that was consumed in-house. We also assumed logs and bolts consumed by the hardwood plywood and wood containers NEC industry were made into veneer products.

Logs Used by Wood Products NEC 1963 and 1967

Volume of logs used by wood products NEC (SIC 2499) were reported in 1963 and 1967 were not separated on the basis of hardwood and softwood. We estimated volume of hardwood logs by multiplying the ratio of rough hardwood lumber to total rough lumber consumption by the volume of logs consumed.

Estimating Lumber Consumed by Veneer and Plywood Industries

Volume of hardwood lumber consumed in plywood production (SIC 2432 in 1963 and 1967 and SIC 2435 after 1972) is relatively small and highly variable. Although lumber can be used for core stock for plywood or composite panels or edgebanding, most lumber used in this application is most likely captured under wood household furniture manufacturers. Lumber also can be used in combination with veneer to make containers or to produce veneer. Therefore, lumber used by this industry is included with miscellaneous hardwood products.

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Luppold, William; Bumgardner, Matthew. 2008. **Procedures used to estimate hardwood lumber consumption from 1963 to 2002.** Gen. Tech. Rep. NRS-26. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 14 p.

This paper presents an explanation for and procedures used to estimate hardwood lumber consumption by secondary hardwood processing industries from 1963 to 2002. This includes: classification of industry and industry groups, development of proxy prices used to estimate lumber consumption, assumptions used to convert dimension purchases to lumber consumption, estimation of material consumption by firms not reporting material consumption by kind, and estimation of lumber use in frame stock production. Also presented are the special procedures used to estimate lumber consumed by the hardwood flooring, kitchen cabinet, pallet, crosstie, and hardwood plywood industries.

KEY WORDS: lumber demand, hardwood, secondary wood processors

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