

# THE CHANGING HARDWOOD LUMBER MARKET<sup>1/</sup>

William G. Luppold<sup>2/</sup>

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Abstract.--During the last 15 years, tremendous change has occurred in the hardwood lumber market. Traditional hardwood lumber users, such as the wood flooring industry, have decreased hardwood lumber usage, while the pallet industry's demands and international demands for domestically produced hardwood lumber have shown considerable growth. Traditional pricing mechanisms for hardwood lumber have changed to reflect activity in the three major markets rather than activity in only the furniture market. Price cycles have also become more pronounced, especially in real terms. This paper discusses the changes that have occurred and the impact of these changes on the marketing and pricing of hardwood lumber.

Keywords: forest products, demand, price

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## INTRODUCTION

The hardwood lumber market seems to be a no-growth or declining market in which little change has occurred. But a close examination of this market reveals that dramatic changes have occurred over the last 15 years. However, these changes are obscured by the ambiguous data about the market.

### HOW MUCH HARDWOOD LUMBER IS USED?

In the development of the Hardwood Assessment Market Model, Cardellichio and Binkley (1984) found inconsistency between lumber usage figures derived from information published in the current industrial reports and lumber usage figures derived by examining lumber consumption by various industries (Table 1). An examination of the Census of Manufactures from 1963 to 1982 reveals still another data set.

The three sets of lumber usage data in Table 1 were developed in three different ways. The Census of Manufactures data set was derived from statistics published periodically in the Census of Manufactures (U.S. Department of Commerce 1963-1982a). In-house lumber production, as reported

in Table 1, is assumed to be lumber produced by firms for their own use and is based on log purchases by secondary processors. The Cardellichio and Binkley data set is based on use factors and the level of production of hardwood lumber end-using industries (furniture, pallet, railroad ties, etc.). Total lumber usage was calculated as the sum of the individual use factors times the level of production. Lumber produced by secondary processors was considered the same as lumber purchases from outside vendors in this data base. The Current Industrial Reports (U.S. Department of Commerce 1963-1982b) data set was derived by adding changes in millstocks and lumber imports to Commerce Department estimates of domestic lumber production.

An explanation of the differences between lumber consumption figures developed from Current Industrial Reports and consumption figures developed from end users can be found in work to be completed by Dempsey (1987). In his analysis of the sawmilling industry in West Virginia, Kentucky, and Pennsylvania, Dempsey found that in 1982 the Census Bureau counted 751 mills, while state sawmill directories listed 1,892 mills. Furthermore, the mills listed by the state sawmill directories had a combined capacity of 3.4 billion board feet (fbm) in 1982, while Census reported production was 938 million fbm. Although lumber production rarely matches capacity, these numbers indicate that a significant amount of hardwood lumber production is unreported. It is suspected that the small but numerous hardwood sawmills with annual production of under 1 million fbm per year are the major source of this unreported production.

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<sup>2/</sup> Economist, U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station, Forestry Sciences Laboratory, Princeton, WV.

Table 1.--Comparison of lumber demand data developed from the Census of Manufactures,<sup>1/</sup> Cardellichio and Binkley, and Current Industrial Reports (in million board feet).

Source	Year				
	1963	1967	1972	1977	1982
Census of Manufactures					
Purchased lumber <sup>2/</sup>	5,763	6,013	6,621	7,136	8,008 <sup>3/</sup>
In-house produced lumber	835	1,218	1,239	1,161	1,093
Total lumber	6,598	7,231	7,860	8,297	9,101 <sup>3/</sup>
Cardellichio and Binkley	7,020	7,520	8,070	8,520	7,160
Current Industrial Reports <sup>4/</sup>	7,548	7,610	7,234	7,127	5,317 <sup>5/</sup>

<sup>1/</sup> Estimates were made for missing quantity observations by the procedure outlined in Appendix 1 and lumber usage was adjusted to account for firms that provided no detailed material usage information by the procedure outlined in Appendix 2.

<sup>2/</sup> Includes Cardellichio and Binkley's lumber usage estimates for railroad tie production and exports.

<sup>3/</sup> 1982 reported usage of lumber in millwork suspect because of unusually low price (\$150 per thousand fbm) of dressed hardwood lumber. Deducting for this factor places 1977 usage at similar level for 1982.

<sup>4/</sup> Adjusted for changes and inventories on international trade.

<sup>5/</sup> 1982 figure developed from a different sample frame than previous year figures.

One disturbing aspect is the divergence of lumber usage figure for 1982. While the data estimated from the Census of Manufactures showed an increase in hardwood lumber use between 1977 and 1982, both Cardellichio and Binkley's and Current Industrial Reports' data bases show a decrease. Since a major recession was taking place in 1982, a decrease in demand probably occurred. The increase in demand indicated by the Census data base probably resulted from better visibility of the hardwood lumber-using industries rather than an actual increase in hardwood lumber use.

Many major uses of hardwood lumber have been continually unaccounted for because of the numerous uses within close proximity of small hardwood sawmills. For instance, until recently, large but unmeasured volumes of hardwood lumber were used for sheathing, subflooring, and outbuilding construction in hardwood producing regions. Although building codes, labor costs, alternative markets for lower grade hardwood lumber (pallets), and more panel products have reduced the use of hardwood lumber in building construction, hardwood lumber is still used in outbuilding construction. The important concept here is that lumber used in building construction was used in close proximity to where it was produced and did not enter the market like lumber used in furniture production.

The notion that actual hardwood lumber usage has been continually higher than any published figure is supported by the periodic drain studies completed by the USDA Forest Service (1982). These studies usually indicate that between 10 and 11 billion fbm of hardwood sawtimber is harvested annually. Although it usually has been assumed that much of this timber is used for pulping and firewood, there is a strong possibility that much

of this material was converted into lumber by small unaccounted sawmills and consumed in a variety of measurable and immeasurable ways including local construction and industrial uses.

The above discussion points out that there are two separate hardwood markets--the visible market and the invisible or local market. In the visible market, lumber is sold more or less on a grade basis; price is reported by the various reporting services. In the invisible market, lumber is produced by small mills and sold ungraded for local uses. Some of the better grade lumber finds its way out of the local market via lumber wholesalers. In recent years, the visible market has grown while the invisible market has declined in importance.

Because the invisible lumber market is characterized by localized interactions of small traders and a dearth of market information, trading in the market probably exerts minimal influence on the visible hardwood market. Therefore, the remainder of this paper concentrates on the visible market.

#### TRENDS IN LUMBER USAGE

Although there is no clear picture of hardwood lumber usage, a further breakdown of Census of Manufactures will give a fair view of hardwood lumber consumed in the national hardwood lumber market (Table 2). Census of Manufactures data were used in this examination rather than the Cardellichio and Binkley data because the Census separates in-house produced lumber from purchased lumber and is probably more reflective of the visible hardwood lumber market.

Table 2.--Purchased lumber and in-house produced lumber demand by major industry group  
(in million board feet).

Industry groups	Year				
	1963	1967	1972	1977	1982
Outside lumber purchases:					
Furniture and cabinets	1,986	1,970	1,970	2,096	1,987
Dimension and flooring	1,446	1,146	1,030	1,071	921
Millwork	242	354	534	472	1,080
Plywood, structural members, prefab wood buildings and prefab buildings	113	147	399	478	440
Wooden boxes, pallets, containers, and wood products, NEC	1,255	1,582	1,601	1,779	2,389
Treated timber <sup>1/</sup> (rail ties)	500	650	850	1,000	834
Exports	131	164	237	240	357
Total outside lumber purchases	5,763	6,013	6,621	7,136	8,008
In-house lumber production:					
Dimension and flooring	344	357	422	313	228
Wooden boxes, pallets, containers, and wood products, NEC	491	861	817	848	865
Total in-house lumber production	835	1,218	1,239	1,161	1,093

<sup>1/</sup>Treated timber figures based on Cardellichio and Binkley's estimates.

The figures in Table 2 indicate that hardwood lumber usage by the furniture and cabinet industry (SIC's 2434, 2511, 2512, 2521, 2522, 2531, 2541, 2542, and 2599) has remained nearly constant. Lumber usage by the dimension and flooring industry (SIC 2426) has decreased considerably because of the decrease in hardwood strip flooring. The large increase in hardwood lumber usage by the millwork industry (SIC 2431) in 1982 is somewhat questionable because most of this resulted from an increase of dressed hardwood lumber purchases at an input price of \$150 per thousand fbm. This price is far below the price of most hardwood lumber except aspen studs and low-grade hardwood cants.

Whereas most of the higher value uses for hardwood lumber has shown a stagnant or declining market, hardwood lumber used for pallets, containers, and other industrial products (SIC's 2442, 2448, 2449, and 2499) and railroad ties (SIC 2491) has shown considerable growth since 1963. In Table 2, different industrial products are not separated because much of the pallet production that had occurred in the earlier Census years was included in categories other than SIC 2448. In fact, SIC 2448 was not even included until the 1972 Census even though pallets had been produced for nearly 30 years before that. Because of the problems in accurately measuring lumber use by the railroad tie industry, the railroad tie data presented in Table 2 correspond to Cardellichio and Binkley's usage figure.

In-house lumber production by the pallet, container, and other industrial products industries also has increased considerably. However, this internally produced lumber does not enter the hardwood lumber market per se but does indirectly affect hardwood lumber price.

Other domestic uses of hardwood lumber by miscellaneous industries such as hardwood plywood, structural member, and prefabricated buildings (SIC's 2432, 2433, 2439, and 2452) have shown some increase in hardwood lumber use. But these industries still remain minor users.

One other change in the hardwood lumber market has been an increase in exports. The volume of hardwood lumber that is exported is small relative to the amount of lumber going into other uses. However, much of the lumber being exported is high grade oak, ash, and cherry. Because of the quality of lumber being exported, exports impact the market for high-value lumber much more than the data in Table 2 indicate.

The changes in end uses and growth in exports have influenced the way hardwood lumber is priced and marketed. The remainder of this paper compares and contrasts the hardwood lumber market of the early 1960's to the hardwood lumber market of the 1980's.

#### THE HARDWOOD LUMBER MARKET OF THE 1960's

In 1960, the price for hardwood lumber was based on the amount of work it took to produce clearcuttings. In furniture manufacturing and millwork, larger and clearer boards took less time, labor, and machinery to mill than smaller boards with defects. The flooring industry also produced a defect-free end product. The only instances in which yield of clearcuttings was not strictly adhered to were in mixed hardwoods destined for upholstered furniture production, pallet and container lumber, and lumber for the local construction purposes. In these instances, if

grades were used, they were used as an indicator of structural integrity and strength.

Lumber grades based on clearcuttings were and are complex, and not every species was or is graded on the same criteria. However, for the sake of discussion, we can broadly define them as:

1. Firsts and Seconds (FAS) - Large boards that are either free or nearly free of defects.
2. No. 1 Common (1C) - Larger boards with some defects or smaller boards that are clear.
3. No. 2 Common (2C) - Boards with several defects that may yield 50-percent clear material with a moderate number of cuts.
4. No. 3 Common (3A) - Boards that can yield at least 33-percent clear material with unlimited cuts.

In 1960 lumber was usually sold as 1C and Better, or 2C and 3A. One Common and Better was normally purchased by wood furniture and millwork producers; 2C and 3A were purchased by flooring manufacturers. The price of a bundle of lumber was calculated by multiplying the proportion of each grade times the price of each grade and summing the products. Mixed-grade bundle pricing reduced sorting costs at the mills. This pricing procedure worked mainly because there were no large separate markets for either FAS or 3A lumber.

The result of mixed-bundle pricing and end-use demands was a fairly well-defined set of price margins between grades (fig. 1). Oak lumber price is used in figure 1 and other figures in this paper for three reasons: (1) oak timber accounts for 40 percent of the available commercial sawtimber; (2) oak is the major species for furniture manufacturing and is the major species for the flooring, pallet, export, and rail tie markets; and (3) recent changes in the oak market may foreshadow changes in the overall hardwood market.

As shown in this figure, between 1960 and 1970, 1C, 2C, and 3A oak prices moved in a similar pattern. The price of FAS oak during this period was much less prone to change than the prices of the lower grades but still moved in a similar manner, especially during the mid-1960's.

#### AN ERA OF CHANGE

As indicated by the information in Table 2, several changes in lumber demand have occurred over the last 20 years. The most critical changes were the increase in pallet demand, the increase in exports, and the decrease in flooring demand. Another important but immeasurable change is the decrease in lumber for local construction purposes.

Export demand for hardwood lumber increased threefold between 1970 and 1980 (Luppold 1984). Although this represents only an increase of 250 million fbm, exports of hardwood lumber, and

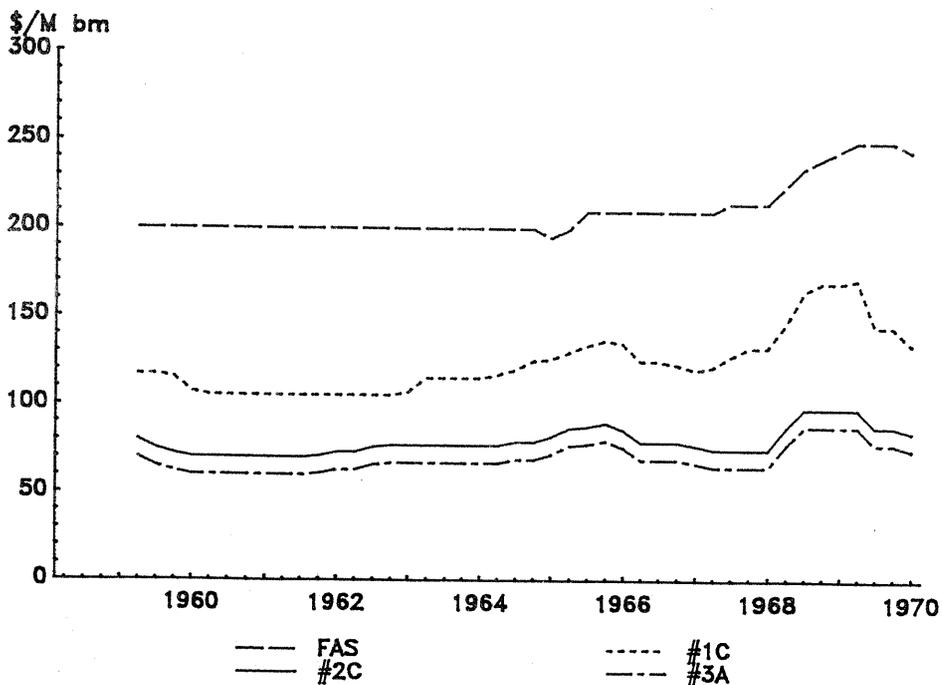


Figure 1.--Price of FAS, 1C, 2C, and 3A Appalachian red oak, 1960-1970.

especially oak lumber to Europe increased tremendously. Oak lumber exports to our four major European trading partners increased from 4 million fbm in 1973 to 104 million fbm in 1980 (Luppold 1984). The reason for this tremendous increase is complex but is attributable in part to: (1) the reduction of tropical timber supplies that resulted from third-world hardwood timber export policies, (2) an increase in traditional oak furniture demand in Europe, and (3) adoption of U.S. finishing practices that allow Europeans to use red oak as a substitute for European oak.

A more recent event in lumber export demand has been the development of the Pacific Rim market. The major players in this market are Japan and Taiwan. Japan imports significant quantities of U.S. 1C and FAS oak but seems to be most interested in West Coast alder. Taiwan, on the other hand, imports large quantities of red oak but very little FAS and significant amounts of 2C. Furthermore, Taiwan is less reluctant to use red oak grown in southern regions of the United States whereas European demanders have a strong preference for Northern and Appalachian oak.

Pallet demand increased 316 percent between 1960 and 1980 as U.S. manufacturers and distributors automated their material handling processes (National Wooden Pallet and Container Association 1986). The prime factor behind this automation process was to reduce labor costs associated with transporting goods and materials.

During the same period that pallet demand was increasing, the demand for hardwood flooring decreased. Between 1960 and 1980, hardwood flooring production dropped from 915 million fbm to 270 million board feet (U.S. Department of Commerce, Bureau of the Census 1963, 1984). If we assume that it takes 2 fbm of 2C lumber to produce 1fbm of flooring, lumber usage by the flooring industry dropped by 1.2 billion fbm in a 20 year period. The primary reason for this decrease was the introduction and acceptance of wall-to-wall carpeting. Carpeting was not only a popular consumer good that seemed to require less maintenance than wood floors but also required less labor during installation.

Hardwood lumber usage for local building construction during the early 1960's is quite apparent when looking at barns and outbuildings in Appalachia and other hardwood producing regions. Large quantities of hardwood lumber also were used in siding, roofing, and subflooring construction in these regions. Examination of homes built in the 1940's, 1950's, and 1960's reveals mixed grades of oak and poplar lumber. In recent years, building codes and the increase in plywood and composite product availability have greatly reduced the use of hardwood lumber for building construction.

The effects of the changing end markets for hardwood lumber are evident when looking at hardwood lumber price and the way hardwood lumber is sold. As stated earlier in this paper, hardwood lumber was sold in mixed-grade lots with the higher grades (1C and Better) going to furniture and millwork plants. Today, many of the less marketable hardwood species are still sold in this manner; however, separate markets for clear or nearly clear lumber now exist for red and white oak, cherry, and ash and seem to be developing for basswood, beech, and hard maple. These separate markets for clear lumber are directly attributable to the increase in European and Pacific Rim demand for U.S. hardwood lumber.

The clear material that is exported is primarily FAS and clear 1C lumber. Defect-free lumber is preferred by European furniture manufacturers because of the distance the material must be transported and the less labor-intensive furniture production process. However, during peak demand periods, significant amounts of 1C lumber with defects were exported to Europe.

The most apparent result of the increase in export demand is the incorporation of a premium for bundles containing only grade FAS lumber (fig. 2). As evident in figure 2, the practice of an FAS premium started in the oak market at about the same time European demand started to increase. The movement of the premium over and above the mixed-bundle FAS price since 1975 is directly related to domestic supply and international demand forces.

Even though mixed-bundle FAS prices are still being published, the difference between mixed-bundle price and FAS-only price encourages grade separation. The premium, which has been as high as \$250 per thousand fbm, usually exceeds the cost of sorting FAS from the lower grades. Although FAS oak was the first product to command a premium, premiums are now being paid for FAS cherry, ash, basswood, hard maple, and beech.

One other effect of international trade activity is an increase in the magnitude of price cycles. Price cycles have increased rather than diminished with international trade because European and U.S. economies are interdependent. When the European market is strong, so is the U.S. market. Similarly, when the U.S. market is in a recession, so is the European market. This causes oak price to go up during growth periods and to fall precipitously during recessions.

Since lower grade oak is the primary material in hardwood flooring manufacturing, and since oak and other dense hardwoods are still preferred as pallet material, the shift in oak demand from flooring to pallets should not have had any great impact on the hardwood market in general or the oak market in particular. However, other hardwood species can be used in place of oak in pallet

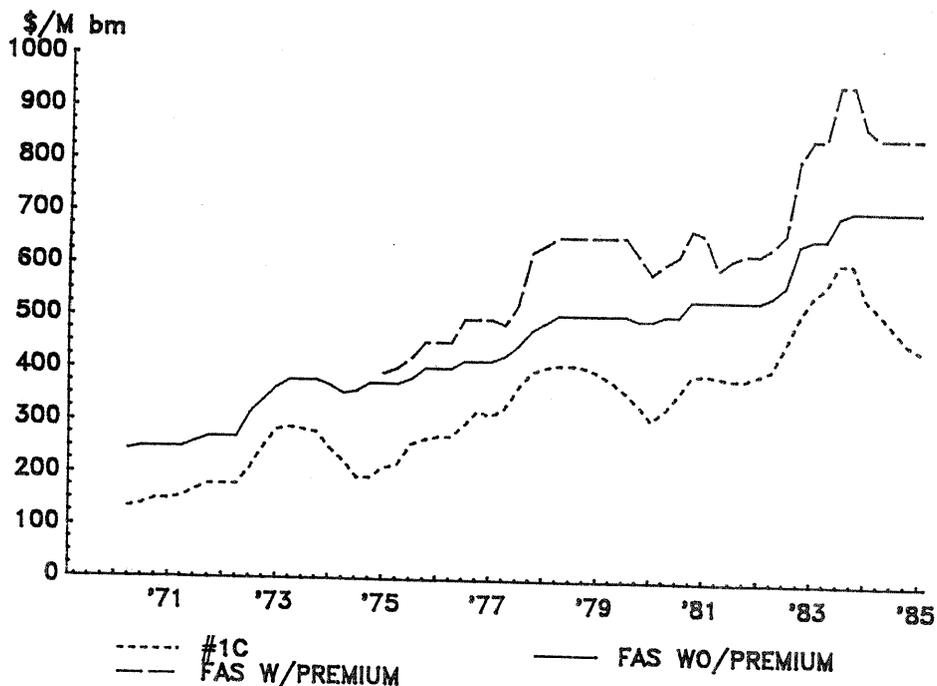


Figure 2.--Price of 1C and FAS oak with and without premium, 1970-1985.

manufacturing much easier than other species can be substituted for oak in flooring manufacturing. Furthermore, pallets need not be manufactured from low-grade hardwood lumber or cants but can be manufactured directly from low-grade, small-diameter poletimber. Because pallets can be manufactured from low-grade timber, the cost of purchasing and transforming low-grade timber into pallet material effectively sets a cap on the price of low-grade hardwood lumber of all species. The fact that 2C and 3A oak prices have not increased at the rate of 1C oak price, even as pallet use of hardwood and oak material has tremendously increased, reflects this price cap (fig. 3).

The effects of pallet material procurement procedures are not uniform across regions, individual states, or even within states because the low value of pallets and pallet material limits arbitrage. The extent of the pallet market in a region, the availability of low-grade lumber versus low-grade timber, and existing markets for low-grade lumber or timber within an area all affect local low-grade lumber markets. For instance, the market for 2C oak in Tennessee is more influenced by the flooring industry located in that region than the pallet industry. However, 2C oak demand in Virginia is very much affected by the pallet industry. The result of regional demand and price variation is very apparent to individual hardwood lumber producers, but is less apparent in price reporting because of limited base point pricing and variation in the amount of the freight cost being absorbed by the purchaser.

#### CONCLUDING COMMENTS

Changes in demand over the last three decades have affected the way oak lumber has been priced and marketed. Although oak lumber price movement may have been the exception rather than the rule in the overall hardwood lumber market, some of the trends noted first in the oak market are becoming noticeable in the markets for other major hardwood species. The two most predominant trends are: (1) the discontinuation of higher grade mixed-bundle pricing and the increased use of premiums on FAS-only bundles; and (2) the continual drop in 2C price, relative to 1C price of species desired by furniture manufacturers.

Although the difference between 1C and 2C price is, in part, caused by the fact that 2C has little export value, this problem is aggravated by the fact that the primary users of lower grade hardwood lumber also can satisfy their material needs with low-quality timber. The recent increases in oak flooring demand may reduce the decline or reverse the decline in 2C oak against 1C oak in regional markets. However, given the fact that even in the expanding flooring market less than 0.5 billion fbm of oak lumber will be used compared to an estimated 2 billion fbm of oak used in pallets, and given current lumber production and processing practices, the lower grade lumber market will continue to be affected by pallet demand and pallet material procurement patterns.

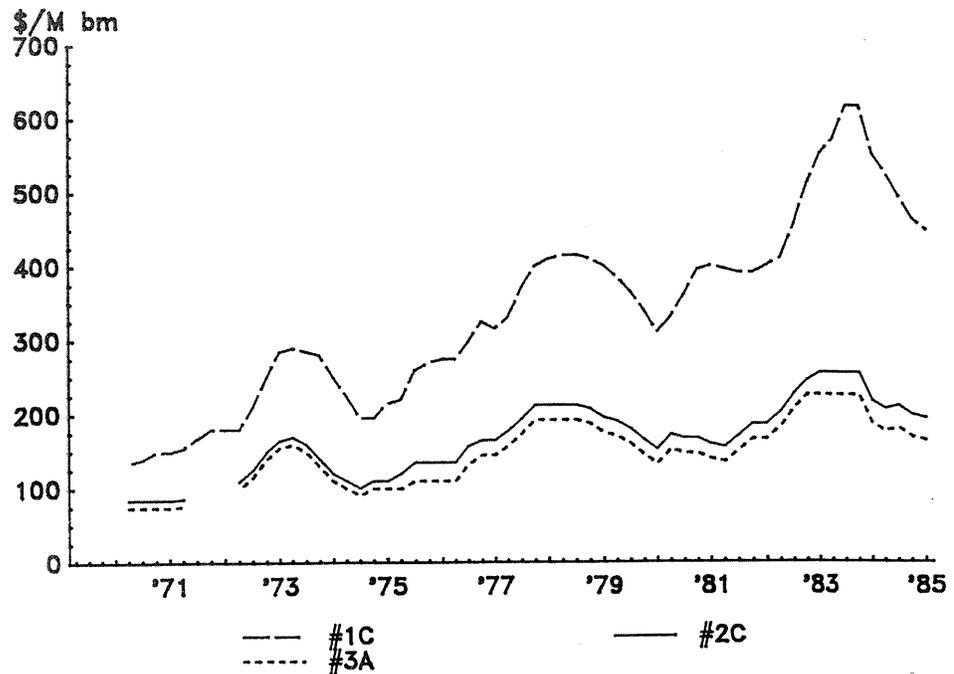


Figure 3.--Price of 1C, 2C, and 3A red oak, 1970-1985.

Although the impact of demand changes is easy to see in terms of changes in lumber price, the effects of these changes on the production process and marketing system are difficult to discern. A review of sawmill directories over the last 20 years indicates a shift toward larger, more automated hardwood sawmills. By softwood standards, even the largest hardwood sawmills producing 15 million fbm a year are small; but such a mill is still 15 to 30 times the size of an average hardwood sawmill 30 years ago. Since large mills tend to sort lumber by grades and have numerous customers, the practice of distributing mill-run lumber has diminished. The mill-run lumber tends to be handled by wholesalers. However, one of the primary reasons for increased sorting is that the price differentials between grades are large enough to make sorting profitable.

Even though lumber demand has changed, the grading rules have not. The current rules still are appropriate for industries that use defected hardwood lumber in the production of the final product. They are not fully applicable to pallet production where strength rather than clarity is the important factor. The fact that sawmill operators make their profit on 1C and Better, or at least perceive to make their profit on 1C and Better, tends to reduce the need for any strength grading rule by lumber producers and wholesalers. However, the lack of strength grading rules and the resulting inconsistency of material received by pallet mills from grade mills has been another factor that has encouraged pallet mills to produce their own lumber in-house.

Future changes in the hardwood lumber are difficult to anticipate largely because lack of good market information makes even changes and trends difficult to determine. It is doubtful, however, that modern technology will influence the demand, production, and marketing of hardwood lumber. The only question is how long it will take.

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#### APPENDIX I

##### Development of Missing Quantity Information

Quantity of hardwood lumber use was not reported by several wood-using industries in recent Census years. These omitted figures were estimated using the formula:

$$Q_i = (V_i/PI)s_i$$

where:

$Q_i$  = The quantity of hardwood lumber for wood-using industry  $i$ .

$V_i$  = The value of the hardwood lumber used by wood-using industry  $i$  as reported in the Census of Manufactures.

PI = The price index for hardwood lumber.

$s_i$  = A scaler for wood-using industry  $i$  calculated from quantity, value, and price index data for the Census year closest to the missing observation. The formula for  $s_i$  is:

$$s_i = PI_c (Q_{ci}/V_{ci})$$

where:

$PI_c$  = The price index for hardwood lumber in a Census year closest to the missing observation.

$Q_c$  = The quantity of hardwood lumber consumed by industry  $i$  in a Census year closest to the missing observation.

$V_c$  = The value of hardwood lumber consumed by industry  $i$  in a Census year closest to the missing observation.

#### APPENDIX II

##### Accounting for Hardwood Lumber Used by Firms Not Specifying Material Use by Kind

There are two aggregate categories in the Census of Manufactures:

1. All other material and component parts, containers, and supplies.
2. Material, parts, containers, and supplies (nsk).

This first category includes materials used by the manufacturers that were not specifically listed on the questionnaire. The second category includes materials used by establishments that did not report detailed material use data. This second category is of interest since it includes materials that are also listed by kind. Thus, the figures for material listed by kind are underestimates. To account for these underestimates, all value and quantity figures used in this paper have been adjusted using the following formula:

$$\frac{0}{1 - \text{pnsk}}$$

where:

0 = Original value of figure being adjusted.

pnsk = Percentage of total material usage classified in the nsk category.