

EXAMINATION OF LUMBER PRICE TRENDS FOR MAJOR HARDWOOD SPECIES

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ABSTRACT

Over the last 40 years, trends in interspecies and intergrade hardwood lumber prices have been erratic. In the early 1960s, high- and midgrade hard maple commanded high prices while red oak was the least valuable lumber regardless of grade. In the 1980s, high- and midgrade oak prices surged, but prices of all grades of maple and yellow-poplar declined. During the 1990s, maple prices increased in all grades while the price of oak increased only in the lower grades. It is important to understand changes in interspecies and intergrade pricing as well as the market forces causing these changes because lumber price reflects the use of these products relative to availability. In turn, relative utilization is used to evaluate and justify the relevance of emerging research problem areas. This paper examines changes in the interspecies prices for the major grades of hardwood lumber and relates these changes to species preferences, end markets, manufacturing processes, and sawtimber supply.

Keywords: Price variability, hardwood lumber, fashion trends.

INTRODUCTION

The Appalachian market region contains 49 percent of the U.S. hardwood sawtimber inventory¹ and states within this region account for more than 55 percent of eastern hardwood lumber production (Smith et al. 2001; USDC 2005). Oaks, maples, and yellow-poplar account for over 68 percent of sawtimber volume in the region (USDA 2005). Oaks and maples encompass several individual species sold as red oak, white oak, hard maple, and soft maple; yellow-poplar is a single species.

An examination of inflation-adjusted or real prices for these products reveals considerable variability within and among species (Table 1). In the early 1960s, hard maple commanded a relatively high price for higher grade (First and Seconds or FAS) and middle grade (No. 1 Common or 1C) lumber. Yellow-poplar lumber was the most valuable in the lower grades (No. 2 Common or 2C).² By contrast, soft maple and yellow-poplar lumber had the lowest value for grade FAS, red oak lumber had the lowest value for grade 1C, and red oak and soft maple had the

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¹For this paper the Appalachian market region includes Kentucky, Tennessee, Ohio, West Virginia, North Carolina, Virginia, Pennsylvania, New York, Maryland, Delaware, New Jersey, Connecticut, Massachusetts, and Rhode Island.

²Grade 2 Common can be separated into material with clear-cutting (2A) or material with sound defects (2B). Prior to January 27, 1990, prices for Grade 2 red oak, white oak, hard maple, and soft maple were listed for 2C; after this date, prices were listed for 2A. There was no change in price associated with the changed designation.

TABLE 1. *Inflation-adjusted prices^a of lumber grades FAS, No. 1 Common, No. 2 Common Appalachian red oak, white oak, hard maple, soft maple, and yellow-poplar lumber 1961, 1985, and 2005.*

Grade	Red oak	White oak	Hard maple	Soft maple	Yellow-poplar
-----1982 dollars/M ³ -----					
1961					
FAS	268	295	322	260	261
1C	141	148	206	200	173
2C	94	103	105	97	119
1985					
FAS	354	316	198	164	189
1C	199	166	136	138	110
2C	84	84	84	82	74
2005					
FAS	348	329	449	406	191
1C	206	206	347	173	113
2C	151	105	181	119	86

^a Constant dollars were calculated by dividing nominal prices by producer price index for all commodities.

lowest value for grade 2C. During the 1980s, the demand for oak lumber increased; by 1985, red oak lumber was the highest priced species for grades FAS and 1C, while soft maple and yellow-poplar lumber remained the lowest priced for grade FAS. During the late 1990s demand for maple increased, and in 2005 hard maple lumber was the highest priced lumber in all grades while yellow-poplar lumber was the lowest priced.

Understanding these shifting patterns is important because lumber price is an indicator of relative utilization; high prices normally indicate high levels of utilization relative to availability, while low prices indicate relatively low utilization levels. Economists and wood technologists have used the concept of underutilization to identify areas where limited research dollars would provide the greatest benefit. However, these variations are the result of numerous market forces that affect the production of, and demand for, a particular species and grade of lumber. In this paper we examine price trends for FAS, 1C, and 2C red oak, white oak, hard maple, soft maple, and yellow-poplar lumber and relate these trends to changes in fashion, manufacturing processes, and relative timber availability. In gaining a better understanding of the way in which these factors have influenced interspecies prices, researchers may be able to develop utilization processes and marketing

strategies that augment or adjust to market forces.

WHAT DETERMINES THE PRICE OF HARDWOOD LUMBER?

The price of hardwood lumber emanates from a series of demand and supply interactions in numerous final markets including furniture, pallets, flooring, and kitchen cabinets and on four market levels: final consumer, secondary (furniture etc.), primary (lumber), and timber. Each species and grade designation varies in visual and physical characteristics. For ease of presentation, we focus on the major appearance-grade markets: furniture, cabinetry, flooring, and exports. While these markets account for less than 60 percent of total sawn hardwood consumption (Hardwood Market Report 2005a), they essentially determine the price of 2A and better lumber for the products examined.

The most important factors that influence consumer demand for hardwood products are associated with income. These include current income, future perceived income, the portion of income that consumers allocate to hardwood products, and the periodic cost of these products relative to income flow. In general, the higher a consumer's income, the more wood products the consumer will purchase (i.e., wood products are normal goods). Still, hardwood products also must compete against cars and other substitute

durable goods for the consumer dollar. Purchasing decisions also are influenced by the availability of credit and terms of credit. Products that can be purchased as part of a mortgage, e.g., kitchen cabinets, millwork, and flooring, may be perceived as more affordable than products purchased via a short-term loan, e.g., furniture.

FASHION INFLUENCES

Consumer selection of a particular style of furniture featuring a specific lumber species is influenced by fashion. Two major indicators of fashion trends are species shown at the High Point, NC, furniture markets and the International Builder Show and Kitchen & Bath Industry Show. In 1962, 4 percent of the furniture showings at the High Point market were classified as oak compared to 17 percent maple, 29 percent cherry, and 36 percent walnut or mahogany (Table 2). Through the 1970s, the percentage of maple, cherry, walnut, and mahogany showings declined, while the percentage of oak showings increased. In the 1980s, the percentage of oak showings increased, while showings of maple, cherry, walnut, and mahogany all decreased. Since the early 1990s, the oaks have declined in popularity, while the maples and

cherry have become more fashionable. Similarly, in 1989 more than 55 percent of kitchen cabinets on display at the International Builder Show and Kitchen & Bath Industry Show were oak, while less than 5 percent were maple (Hardwood Market Report 2005a). By 1995, these percentages had changed to 40 for oak and 30 for maple. By 2004, oak accounted for less than 10 percent of the showings versus more than 40 percent for maple.

Production of oak solid strip flooring has increased by 300 percent since 1989 (Emanuel and Rhodes 2002, 2005). Red oak is preferred over white oak in flooring production, though this industry consumes considerable amounts of 2C lumber in both red and white oak. Hardwood millwork is used in commercial and residential construction, and manufacturers of hardwood millwork are major users of FAS lumber. Although there are no published data on the use of appearance hardwood in commercial construction, fashion considerations for this industry apparently were similar to those of the furniture and cabinet industry, with the oaks being fashionable in the 1970s and 1980s and maple and other closed-grained species becoming more fashionable in the 1990s.

Exports are another major end market for ap-

TABLE 2. *Percentage of dining room showings featuring major hardwood species at the High Point (NC) furniture market, 1962 to 2005.*

Year	Oak ^a	Maple ^a	Cherry	Walnut	Mahogany	Other ^b
1962 ^c	4.0	17.0	29.0	27.5	9.0	13.5
1966 ^c	5.5	20.0	15.0	21.0	6.0	32.5
1970 ^c	14.0	12.0	10.0	15.5	2.5	46.0
1974 ^c	11.5	9.0	3.5	8.0	2.0	66.0
1978 ^c	19.0	8.0	6.0	4.5	3.0	49.5
1982 ^c	25.5	6.0	10.5	2.5	4.5	51.0
1986 ^c	21.0	2.5	12.0	2.5	6.0	46.0
1990 ^c	30.0	4.5	15.0	2.0	7.5	41.0
1994 ^c	27.5	7.0	16.5	1.0	7.0	41.0
1998 ^d	20.0	6.2	21.0	1.0	7.0	44.5
2002 ^e	17.0	9.0	20.0	2.0	6.0	46.0
2005 ^f	15.0	9.0	15.0	2.0	5.0	54.0

^a Data distinguishing between red and white oak or hard and soft maple are not provided because statistics were not collected consistently for individual species.

^b Other has included ash, pine, pecan/hickory, gum, elm, alder, yellow-poplar, birch, walnut, olive, yew, hackberry, koa, primavera, teak, rubberwood, rosewood, bamboo, cane and rattan, myrtle burl, European burl, zebra wood, lacewood, anigre, painted wood, and other domestic and imported species.

^c L.R. Frye 1996.

^d Source: Woods Unlimited News, 1988, Zionsville, IN.

^e Source: Appalachian Hardwood Manufacturers Inc., 2002, High Point, NC.

^f Source: Appalachian Hardwood Manufacturers Inc., 2005, High Point, NC.

pearance hardwood lumber. Although not technically a “consumer market,” exports are influenced by consumer demands in other countries and by foreign manufacturers that export consumer products to the United States. Exports have increased by more than tenfold since the early 1970s. During the 1970s and 1980s, the United States exported large quantities of FAS white oak to Europe and Japan. Mid- and lower grade exports of red oak began to increase in the mid-1980s with the development of the Taiwanese furniture industry. It is interesting that red oak declined from 25 to 10 percent of the total hardwood lumber volume exported to Asia from 1994 to 2004, according to U.S. Census figures. This is likely due to the decreasing popularity of red oak in the United States, the final destination for much of the furniture manufactured in Asia. Oaks still account for 38 percent of overall U.S. hardwood lumber exports, but maples now account for 13 percent and yellow-poplar for 10 percent (Hardwood Market Review Global 2005).

MANUFACTURING INFLUENCES

Although consumer demand for hardwood products ultimately drives lumber demand, secondary hardwood manufacturers are the actual consumers of hardwood lumber. In the short run, a fixed proportion production process and fixed market strategy govern demand for hardwood lumber. This means that manufacturers cannot substitute one species for another nor substitute veneer and particleboard for lumber. In the intermediate and longer run, secondary processors can change their manufacturing process to use different volumes of lumber per unit and can change species. It takes a minimum of one market cycle (6 months) for furniture manufacturers to develop and show an alternative product. However, Luppold (1983) estimated that furniture manufacturers took 1 to 2 years to initially respond to changes in interspecies pricing. There has been no analysis of lumber price sensitivity by kitchen cabinet manufacturers, though the more direct marketing process and lower inventory levels of finished product carried by cabinet

producers probably would enable this industry to react more quickly to changes in lumber prices.

Inexpensive lumber can be combined with veneer of a higher valued species, but the resulting furniture is classified as the more valuable species. In the 1960s, it was common for yellow-poplar lumber to be stained to match walnut and mahogany veneers in the production of lower cost furniture. Hard and soft maple also can be stained and matched with cherry veneer. Soft and hard maple also are somewhat interchangeable, as are red and white oak.

RELATIVE AVAILABILITY OF TIMBER

Although individual hardwood sawmills can react to changes in lumber prices relatively quickly, the ability of the industry to produce more or less of a specific species is constrained by production capacity in areas that contain specific species. This means there can be a slight increase in lumber supply in response to an increase in price of a specific product, but it takes several years for the sawmilling industry to increase capacity in any given region (Luppold and Bumgardner 2006)

The ability to increase the supply of specific species also is affected by the distribution and growth of that species. Oak species are distributed widely and account for 39 percent of the eastern sawtimber inventory; red oak is distributed more widely than white oak (Smith et al. 2001). Yellow-poplar is the most abundant individual species and accounts for 9 percent of the eastern sawtimber resource. The maples account for 13 percent of the eastern sawtimber resource and are more abundant in the northeastern and north-central United States. Soft maple is slightly more abundant and distributed more widely than hard maple. Over the last 40 years, oak inventories have increased at a fairly constant rate. Volumes of yellow-poplar sawtimber have increased over the last 40 years from 6 percent of total sawtimber volume in 1963 to 9 percent today. Inventories of hard and soft maple increased relatively slowly from 1963 to 1977, but have increased at a higher rate since

1977 (USDA 1965, 1973, 1982; Smith et al 2001).

In order to relate fashion influences, production influences, and relative timber availability to long-term price trends for major hardwood lumber species and grades, measures of these trends were needed as outlined in the section that follows.

MEASURING CHANGES IN DEFLATED PRICE

Deflated average yearly prices for grades FAS, 1C, and 2C red oak, white oak, hard maple, soft maple, and yellow-poplar are presented in Figs. 1–5. By focusing on FAS prices for these species, we can discern two periods of different price movements that appear to be influenced by changes in fashion. From the mid-1960s to the mid-1980s, the prices for FAS red and white oak increased while the prices for FAS hard and soft maple decreased. After the mid-1980s, the prices of the oaks remained relatively flat, and the prices of the maples escalated.

To examine these differences in price trends, we calculated estimates of annual rates of change for the different lumber grades and species. We decided to separate the data set into two

groups: 1961 to 1985 and 1986 to 2005. The separation point of 1985 was chosen because 1961 and 1985 represent major relative low points or downturns in hardwood production (USDC 1962, 1963, 1988, 2005).

Annual changes in deflated hardwood lumber prices for the major species and grades examined in this study were calculated by first estimating the natural logarithm of price as a function of time and allowing both the intercept and slope to shift between the two time periods. The specific equation estimated was:

$$\text{Ln}(P_{ij}) = B_{0ij} + B_{1ij} + B_{Fij}(T_F) + B_{Sij}(T_S)$$

where

$\text{Ln}(P_{ij})$ = Natural logarithm of real price for species *i* of grade *j*. Real price was calculated by dividing nominal price by producer price index for all commodities.

B_{0ij} = Intercept for species *i* of grade *j*

B_{1ij} = Intercept shifter for species *i* of grade *j* during second time frame (1986–2005)

B_{Fij} = Slope for species *i* of grade *j* during first time frame (1961–1985)

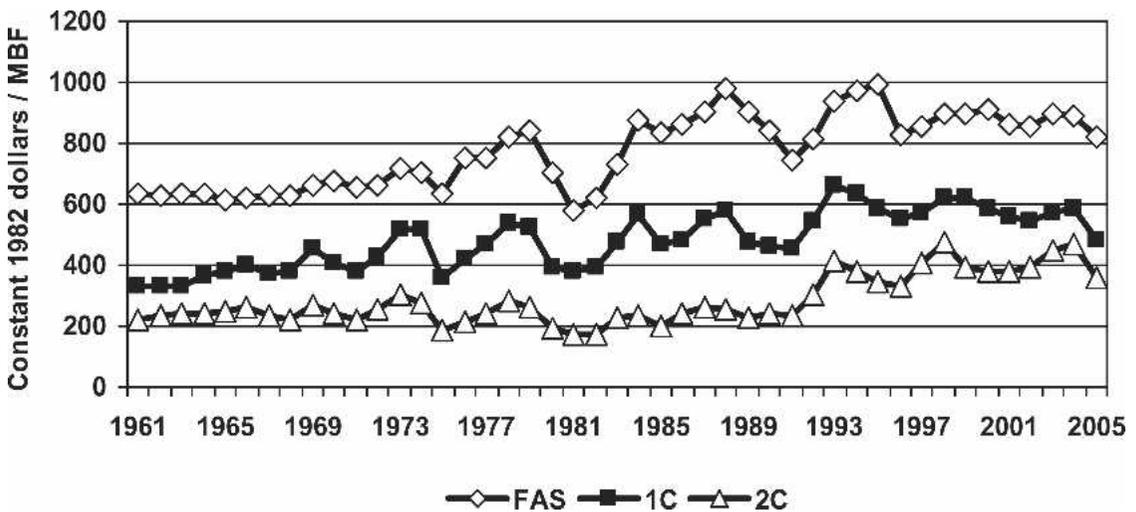


Fig. 1. Yearly prices of deflated FAS, 1C, and 2C Appalachian red oak lumber 1961–2005.

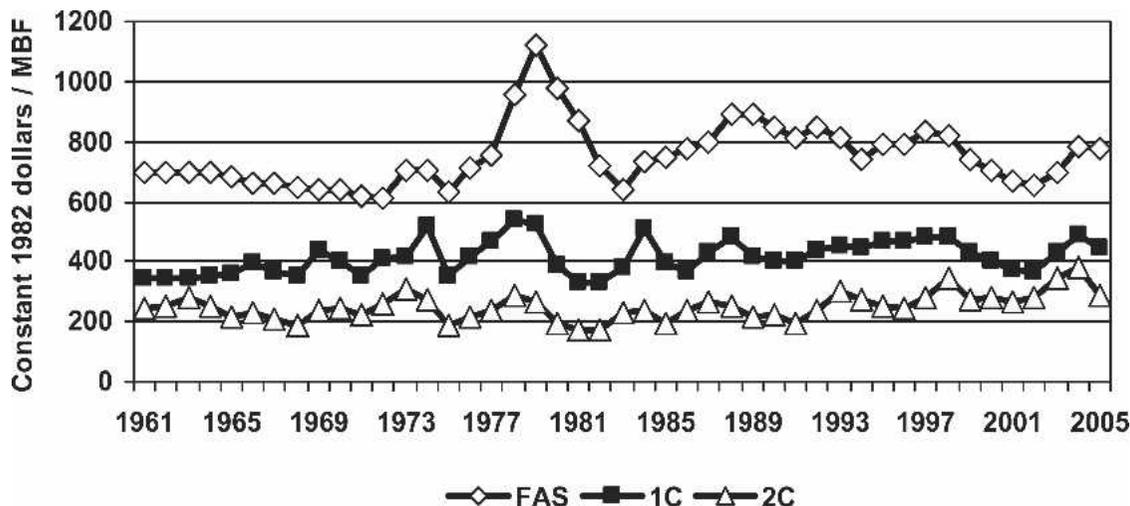


FIG. 2. Yearly prices of deflated FAS, 1C, and 2C Appalachian white oak lumber 1961–2005.

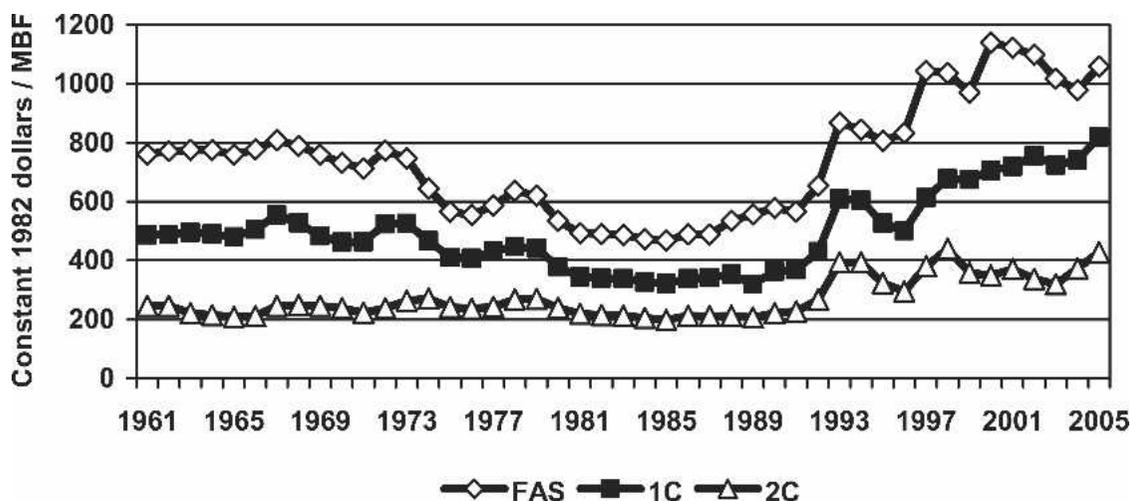


FIG. 3. Yearly prices of deflated FAS, 1C, and 2C Appalachian hard maple lumber 1961–2005.

T_F = Sequential time variable for first period (1 to 25 for 1961 to 1985, 0 otherwise)

B_{Sij} = Slope for species i of grade j during second time frame

T_S = Sequential time variable for second period (1 to 20 for 1986 to 2005, 0 otherwise)

$AC_{F \text{ or } S} = (\{\text{antilog of corresponding slope coefficients } (B_{Fij} \text{ or } B_{Sij})\} - 1) * 100$

Annual percent change in real price in the first (AC_F) and second (AC_S) time periods were calculated using the procedure described in Wagner and Sendak (2005):

Initial estimates for AC_F and AC_S for each grade and product were developed using ordinary least squares (OLS). However, the Durbin-Watson statistics developed for each price equation indicated serial correlation in all models, possibly biasing the t -values associated with the individual AC_F and AC_S . The presence of autocorrelation was not unexpected since the models attempted to estimate straight lines through cy-

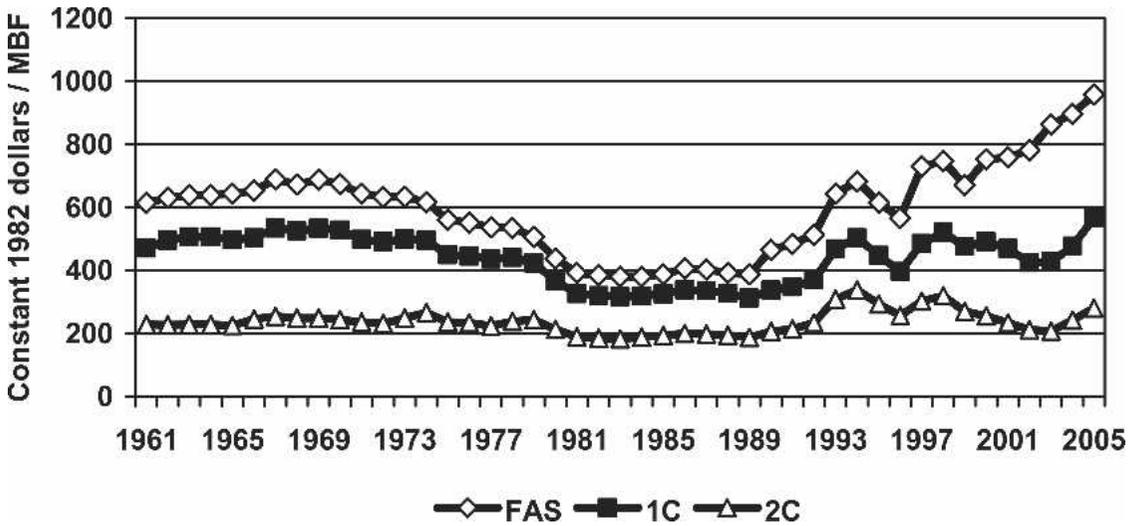


Fig. 4. Yearly prices of deflated FAS, 1C, and 2C Appalachian soft maple lumber 1961–2005.

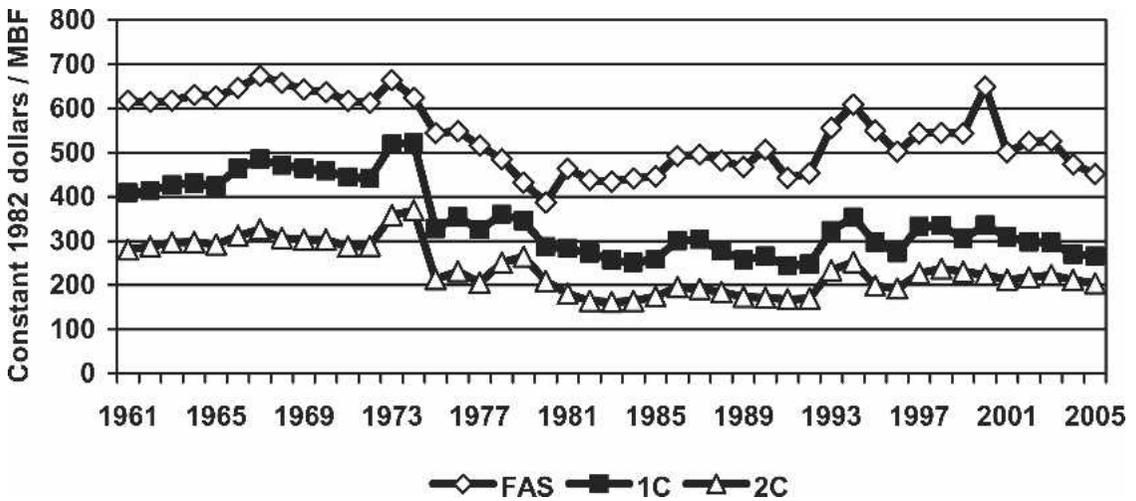


Fig. 5. Yearly prices of deflated FAS, 1C, and 2C Appalachian yellow-poplar lumber 1961–2005.

clical time series. The Maximum Likelihood (ML) estimation procedure for autoregressive systems available in SAS version 9.1 was used to correct for this problem. The lag structure was allowed to progress until the t-test associated with the autoregressive adjustment coefficient became insignificant at the $\alpha = 0.05$ level (Table 3). Table 3 also includes the AC_F and AC_S coefficients developed using ML estimation procedures and serves as the basis for the following price analysis.

PRICE ANALYSIS

Red oak

Between 1961 and 1985, real prices of FAS and 1C red oak increased as oak became fashionable for furniture production. However, the price of these products did not continually rise but cycled upward. Cyclical variations in hardwood lumber prices have been attributed to an inventory adjustment process (Luppold 1984), but the consistent price cycle of 1C red oak also

TABLE 3. Maximum likelihood autoregressive results for goodness of fit (R^2), lag period, calculated percentage annual rate changes for periods 1 and 2 (AC_F and AC_S), and Student t test statistics of associated regression coefficients of time (t value) for inflation adjusted prices of lumber grades FAS, No. 1 Common, and No. 2 Common for Appalachian red oak, white oak, hard maple, soft maple, and yellow-poplar lumber, 1961–1985 and 1986–2005.

Grade	R^2	Lag period	1961 to 1985		1986 to 2005	
			AC_F	t value	AC_S	t value
Red oak						
FAS	0.87	2	0.96	4.88 ^a	-0.14	0.52
No. 1 Common	0.79	2	1.32	4.54 ^a	0.47	1.14
No. 2 Common	0.83	2	-0.79	2.15 ^b	3.24	6.09 ^a
White oak						
FAS	0.74	2	0.98	2.39 ^b	-0.83	1.51
No. 1 Common	0.37	2	0.72	1.97 ^c	0.07	0.13
No. 2 Common	0.61	2	-0.68	2.07 ^b	1.73	3.68 ^a
Hard maple						
FAS	0.94	2	-2.33	6.19 ^a	4.76	8.93 ^a
No. 1 Common	0.93	2	-1.99	6.09 ^a	5.18	11.06 ^a
No. 2 Common	0.88	3	-0.42	0.74	3.18	4.32 ^a
Soft maple						
FAS	0.93	1	-2.31	4.29 ^a	4.45	6.18 ^a
No. 1 Common	0.87	2	-2.09	4.73 ^a	2.50	4.13 ^a
No. 2 Common	0.76	2	-0.77	1.43	1.54	2.12 ^b
Yellow-poplar						
FAS	0.73	1	-1.77	4.00 ^a	0.13	0.22
No. 1 Common	0.80	1	-2.44	3.71 ^a	0.30	0.35
No. 2 Common	0.75	1	-2.56	4.08 ^a	0.70	0.82

^a Significant at 0.01 level.

^b Significant at 0.05 level.

^c Significant at 0.10 level.

may have been facilitated by the wide availability of red oak sawtimber. It is asserted that the ample volume of red oak sawtimber allowed existing mills to increase production rapidly enough to place a ceiling on the price of 1C lumber. While price of 1C and FAS red oak increased, the price of 2C red oak declined by nearly 0.8 percent per year during this period. This decline is associated with the 92 percent decline in flooring shipments between 1962 and 1980 and the continued low volume of flooring shipments during the mid-1980s.

Oak showings at the furniture market peaked in 1990 before declining to pre-1978 levels in 2002 (Table 2). The dominance of red oak as a kitchen cabinet species has declined steadily since the early 1990s (Hardwood Market Report 2005a). Because of the changes in these fashion

applications, prices of 1C and FAS red oak peaked in 1993 and 1995, respectively, but have been cycling downward since then. These changes in red oak markets resulted in no significant growth or decline in FAS and 1C red oak prices between 1986 and 2005. However, shipments of oak flooring increased by 430 percent between 1966 and 2004; this added demand caused the real price of 2C red oak to increase at an annual rate of 3.2 percent.

White oak

White oak has a similar appearance to red oak, but the market for this species differs slightly. White oak is used in furniture production, but it also is exported, and most export customers demand color separations that are independent of standard grading rules. Therefore, the listed price of 1C white oak lumber is less than the prices paid by many export customers. The increase in FAS white oak prices between 1961 and 1985 is strongly related to the export of this lumber to Japan and northern Europe; the decline in FAS prices after 1985 is a reflection of reduced export demand. As with red oak, the real prices of 2C white oak decreased from 1961 to 1985 as this species also is used in flooring production. However, the lower growth rate of 2C white oak versus red oak since 1985 reflects the fact that red oak currently is preferred in the production of flooring.

Hard maple

From 1961 to 1985, prices for FAS and 1C hard maple declined by 2.3 and 2.0 percent per year, respectively, though 2C hard maple prices remained relatively constant. Since 1985, the prices of all grades of hard maple have increased with the price of 1C lumber showing the greatest gain. While the price increases for hard maple since 1985 approached or exceeded 5 percent per year, the true extent of the growth in hard maple prices is muted because Table 3 does not reflect the development of a separate market for hard maple sapwood (“white hard maple”) during the mid-1990s. In October 2005, prices for

FAS, 1C, and 2C white hard maple were 30, 17, and 33 percent greater, respectively, than the prices of color unselect hard maple. (Hardwood Market Report 2005b)

Soft maple

The rates of decline in FAS and 1C soft maple prices between 1961 and 1985 were similar to rates of decline in hard maple prices, but the rates of increase in 1C and 2C soft maple prices since 1985 were considerably less than for hard maple. The primary reason for this lower rate of price growth might be the perception that soft maple is a slightly inferior product. Still, demand tended to increase as producers of moderately priced kitchen cabinets and furniture substituted soft maple for hard maple.

In general, Table 3 also reveals that there has been considerably greater change in the prices of FAS and 1C hard and soft maple than for red and white oak for the two periods examined. Although the large declines in maple prices between 1961 and 1985 correspond to large declines in the showings of maple furniture (Table 2), the large increase in price also may be influenced by the lower sawtimber volume of maple species that caused supply to be more inelastic, requiring a greater increase in price to satisfy demand.

Yellow-poplar

Yellow-poplar prices also trended downward between 1961 and 1985 but have remained relatively stable since 1986. The decline in yellow-poplar prices during the first period was the result of changes in the furniture industry. As apparent demand for closed-grain styles declined, less FAS and 1C yellow-poplar lumber was required for use with mahogany and walnut veneers. As particleboard and other substrate materials were developed, less low-grade yellow-poplar core stock was needed for solid core plywood. This reduction in demand occurred during a period when the inventory of this species was increasing. The inventory of yellow-poplar has continued to increase since 1986, but

domestic and international demands for this species have increased, resulting in stable real prices.

DISCUSSION

The trends in price movement of the different lumber grades and species are the result of changes in market forces over the last four decades. The emergence of oak (especially red oak) as a fashionable lumber for furniture and cabinets during the 1970s and 1980s was a major shift in the hardwood market. By contrast, furniture makers have used maple since colonial times, but the inventory of maple apparently was insufficient to satisfy demands without additional price increases during the late 1960s. In this respect, oak availability and the desire to keep the cost of furniture production low may have been the most important factors influencing the initial shift from maple to oak. Still, once consumers accepted oak as fashionable, the value of oak sawtimber increased even though inventories were abundant.

The shift from oak to maple that began in the late 1980s also could have been triggered by the relatively low price of maple versus oak, causing furniture and kitchen cabinet producers to show maple to potential customers. Since consumers have accepted maple, there seems to again be a negative connotation associated with oak. In a 2005 editorial published in the *Weekly Hardwood Review*, the term "anything but oak" seems to reflect the sentiments of the current generation of furniture, cabinet, and millwork consumers. Still, it is interesting that the popularity of maple in the marketplace does not seem to be associated with consumers' ability to identify maple among other wood species (Bowe and Bumgardner 2004). This could indicate that consumer purchases are based on a combination of appearance factors that include style and finish versus species recognition.

Another factor that seems to have allowed the price of hard maple to increase steadily over the last decade is consumer income and the portion of this income spent on secondary hardwood products. Increased income allows producers of

higher end furniture to pass on increases in lumber price to their customers. Increased new home size also has caused the size of kitchens to increase, and 30-year, low-interest mortgages have allowed consumers to schedule payment of expensive kitchens over a prolonged period. Recognition of relative income and wealth is critical in determining whether consumers can continue to afford expensive species that currently are in fashion, or whether they will begin to accept lower priced, less fashionable species.

Two resource issues that may affect future lumber prices are species availability and timber quality. The composition of the Appalachian timber resource has continued to change. Red oak remains a widely distributed species, but the proportions of yellow-poplar, red maple, and white oak are increasing. Each of these emerging species has different physical characteristics that influence production and marketing. Identifying and developing research problems that address these differences in physical characteristics would allow more complete utilization of the changing timber base.

Perhaps the most important conclusion that can be drawn from this analysis is that while interspecies and intergrade pricing appears to be a transient process, such prices are guided by market forces. A better understanding of how these forces operate can help researchers to develop utilization processes and marketing strategies that augment or adjust to them.

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