WHY DO STUMPAGE PRICES INCREASE MORE THAN LUMBER PRICES?

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ABSTRACT

Every sawmiller who has been in business more than 5 years realizes that hardwood stumpage prices tend to increase faster than lumber prices, decreasing the margin between these two prices. Although increases in stumpage versus lumber prices are readily apparent, the reason for the decrease in the margin is not. Recent research findings indicate that the stumpage/lumber market margin is decreasing as sawmills become more efficient. During a given year, progressive sawmills adopt new production technologies and marketing procedures in an effort to increase profits. Other mills implement these processes if they seem profitable while others cannot or will not adopt them. When periodic downturns in the lumber market occur, many less efficient mills are forced out of the market. When subsequent increase in price occurs, the remaining efficient mills vigorously compete for stumpage, eventually erasing any short-term profits gained by adopting new technologies or marketing methods. Each time this happens, the stumpage/lumber market margin decreases. These margins tend to decrease faster for a species that experiences large increases in lumber prices. However, most species eventually will have similar decreases in lumber stumpage market margins because of similarities in production and market methods across sawmills.

INTRODUCTION

One painful aspect of the hardwood sawmilling business is that stumpage prices continue to increase faster than lumber prices (Luppold and Baurngras 1995). This is especially apparent when stumpage and lumber prices are indexed at a common year and examined over a 30-year period (Figure 1). Because of this trend, profit margins in sawmilling have become thinner, forcing lumber producers to become more efficient or go out of business.

Although increasing stumpage prices are readily apparent, the cause is less clear. In this paper we clarify what has been happening to stumpage price by presenting recent findings on the relationship between lumber and stumpage prices for four Appalachian timber species. These findings link the decline in margin between lumber and stumpage prices to competitive market forces, hardwood production cycles, and demand for specific species.

The remainder of this paper is presented in four sections; (1) we discuss the hardwood market cycle and changes in demand for white oak, red oak, yellow-poplar, and hard maple as related to this cycle; (2) we examine whether stumpage prices are increasing because of changes in supply or changes in demand; (3) we analyze changes in the margin between lumber and stumpage prices and how demand for different hardwood species has affected these margins; and (4) we summarize our findings. The data and models used to develop the results in section three are presented in the Appendix.

THE HARDWOOD CYCLE AND CHANGES IN THE HARDWOOD LUMBER MARKET

Both hardwood lumber production and prices cycle every 5 to 6 years because lumber producers and users are seldom in sync with one another (Fig. 2). These cycles can be severe when combined with a general economic downturn or delayed by economic growth, but would occur even if the economy grew at a constant rate. Between 1970 and 1995, hardwood production has cycled five times. During this period, the relative demand and prices for various species also has changed. In this section we analyze changes in species demand with respect to the hardwood cycle by examining demand for the five periods shown in Figure 2.

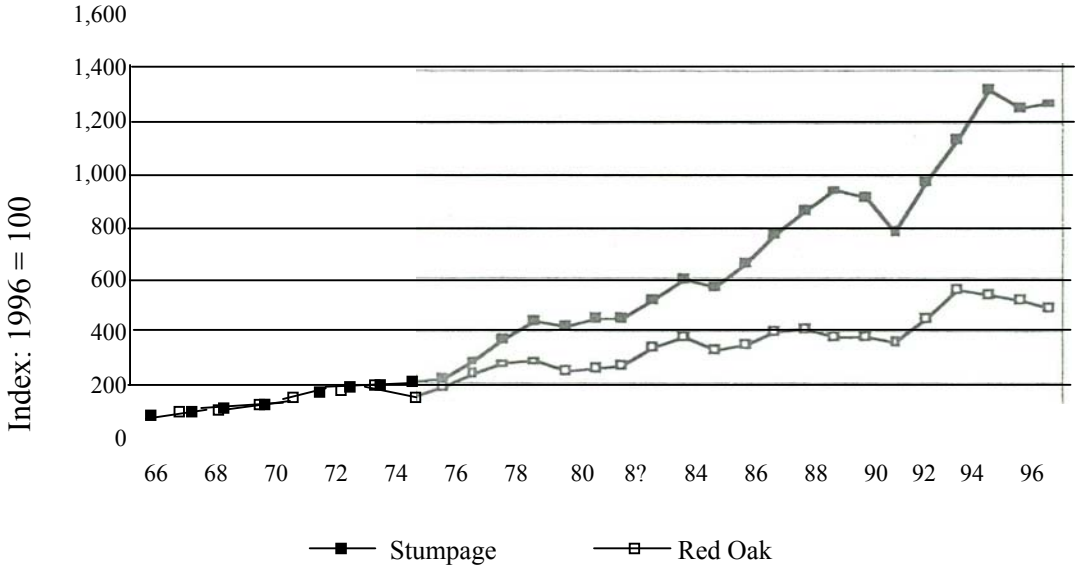

Figure 1. Index of 1 Common red oak. lumber and red oak. stumpage prices in Ohio, 1966 to 1995.

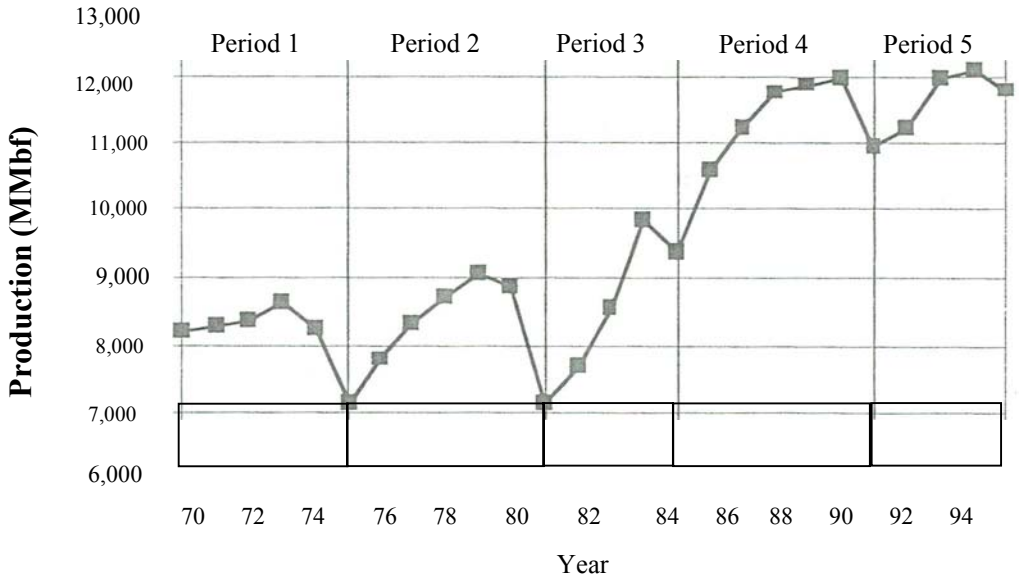

Figure 2. Hardwood lumber production in the United States, 1970-1995, in million board feet.

Period 1 (1970 to 1974) was marked by economic change resulting from moderate inflation, wage and price controls, and the adoption of floating exchange rates. During this period, the demand and price of red and white oak surged as oak became an important furniture lumber and a major export to the European market (Frye 1996; Luppold and Araman 1988) and wage and price controls were eliminated. Prices for yellow-poplar lumber also increased sharply in 1972 and 1973 after the lifting of wage and price controls (see Hardwood Market Report, March 1971 through August 1973). The price of maple also increased during this period, but the magnitude of the increase was considerably less than that for the other three species. This period ended with a large drop in lumber prices and a 17 percent decrease in production (Luppold and Dempsey 1989).

Period 2 (1975 to 1980) was marked by increased export demand and inflation. Prices for oak lumber increased sharply as red oak became the predominant furniture lumber and a weak dollar caused white oak exports to Europe to increase (Frye 1996; Luppold and Araman 1988; Nolley 1994). Demand for yellow-poplar increased as U.S. furniture production peaked in 1978 (Nolley 1994). Prices for maple lumber cycled moderately as the use of this species began to decline. Overall, the production of eastern hardwood lumber increased by 27 percent between 1975 and 1979 but decreased by 21 percent between 1979 and 1981 (Luppold and Dempsey 1989).

During period 3 (1981 to 1985), the influence of the furniture industry decreased while the use of lumber by the flooring, kitchen cabinet, millwork and pallet industries increased. Total exports grew little because of the high value of the dollar against European currencies (Nolley 1994). However, exports of white oak lumber continued to grow (Luppold and Thomas 1991). The use of red oak as an appearance lumber continued to increase while the use of maple continued to decline (Frye 1996). Although there were slight decreases in domestic production of furniture and cabinets at the end of Period 3, a 5 percent decrease in production at the end of 1984 was influenced by a drop in international demand (Nolley 1994) caused by historically high exchange rates.

Period 4 (1986 to 1990) was marked by rapid growth in exports to Europe and Asia and relatively strong demand by the furniture, flooring, pallet and kitchen cabinet industries. The use of red oak as an appearance lumber peaked in 1990 while the use of maple began to rebound in the late 1980's (Frye 1996). Production of eastern hardwood lumber increased by nearly 28 percent between 1986 and 1989 and dropped by 8 percent between 1989 and 1991.

The post-1990 hardwood market (period 5) was marked by large increases in lumber prices in 1992 and 1993 that resulted from the wood-product industry's inability to increase production as demand for lumber increased. Although part of the reason for this was sawmill attrition that occurred following the 1991 downturn, wet logging conditions and a lack of loggers seemed the primary hindrances to increased lumber production. The post1991 lumber market also was marked by the increased use of closed-grained lumber by the furniture industry and a maturing export market (Frye 1996; Nolley 1994). The price of yellow-poplar lumber surged for the first time since the early 1970's while prices for hard maple also increased sharply.

SUPPLY VERSUS DEMAND

At first glance, one could attribute increasing stumpage prices to reduced supplies. This explanation is supported by anecdotal evidence but is difficult to support when examining estimates of forest sawtimber inventories. Another explanation, that timber supplies may be increasing but demand is increasing greater than supply, also has merit, but inventories apparently have increased as fast or faster than hardwood lumber production. In fact, circumstantial evidence indicates that the large increases in lumber production that occurred in the late *1980's* might have been a result of the large volume of the eastern timber resource maturing into sawtimber size classes (Fig. 3). Although Luppold and Dempsey (1996) found that estimates of forest inventory may not reflect the resource desired by or available to the

hardwood saw milling industry, changes in timber availability cannot solely explain escalating stumpage prices. However, changes in the demand curve for stumpage provides an alternate explanation.

The demand curve for stumpage emanates from the production process that converts stumpage into lumber and is influenced by the price of lumber and prices of all materials and labor used in lumber production. If lumber price increases, the demand for stumpage shifts upward, increasing the volume of stumpage demanded (Fig. 4). Similarly, if sawmilling processes becomes more efficient, the demand for stumpage changes. In either case, the upward shift in demand increases both the total quantity demanded (Q^{d1} to Q^{d2}) and the stumpage price (P^{s1} to P^{s2}).

Although the economic theory described may be valid in the long run, it may not be apparent. While an increase in lumber prices seems to cause an instantaneous increase in stumpage price and quantity demanded, increase in efficiency by one mill or a group of mills does not have the instantaneous impact. The fact is that mills upgrade equipment to increase profits. Mills that undertake such efforts do not attempt to bid up stumpage prices to erase these profits. Therefore, stumpage prices tend to be influenced by mills with lower levels of production efficiency. However, the hardwood cycle then kicks in.

During periods of declining prices and production, the less efficient or poorly managed sawmills are forced out of business. Once demand begins to increase, the remaining (more efficient) sawmills that upgraded their equipment are forced to compete in the stumpage market to quickly procure material to capitalize on high lumber prices. Each time this happens, the price of stumpage is pulled closer to the price of lumber and any temporary increase in profits is transferred to the resource owner in the form of higher stumpage prices.

THE DECLINING MARGIN BETWEEN LUMBER AND STUMPAGE PRICES

The margin between lumber and stumpage prices is primarily the result of processing costs but can include short-term profits and the value of veneer and export logs. Most people consider a margin as the difference between lumber and

Figure 3. Index of eastern hardwood sawtimber inventory volume and hardwood lumber production, 1970 to 1992.

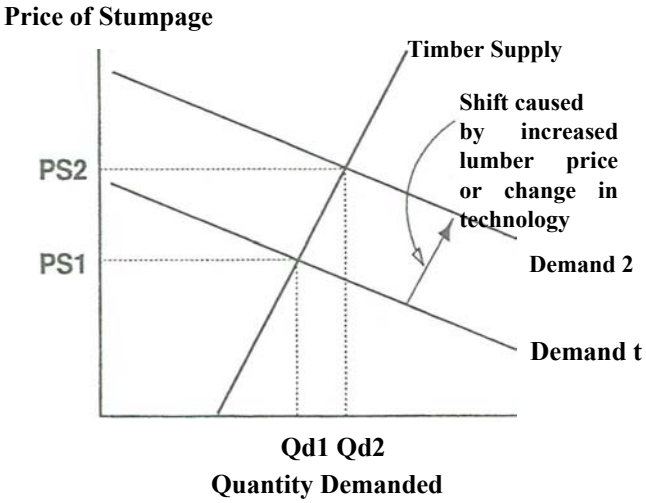

Figure 4. How increases in lumber price or production efficiency increase the demand and price for hardwood stumpage

stumpage price. Although this absolute margin is easy to estimate, alternate definitions may be better at explaining market behavior. In the hardwood lumber market, the constant percentage margin discussed by Haynes (1977) seems most appropriate (Luppold et al. in press). This formulation relates lumber price to stumpage price plus a percentage margin (k) times lumber price as

$$p^1 = p^S + kp^1 \quad (1)$$

Where,
p^1 = price of lumber
p^S = price of stumpage
k = percentage margin

Again, the idea behind this declining margin process is that some progressive sawmills adopt new production technologies or marketing procedures to increase profits. If these new methods seem profitable, then an increased number of sawmills adopt these procedures. Eventually, the market will cycle downward, forcing out less efficient mills. Once lumber price begins to increase, the remaining efficient sawmills compete vigorously for stumpage. Since these mills are more efficient, they can pay more for stumpage. Because of the competition at the beginning of the market cycle, the percentage margin declines. Sawmillers do not recognize this decline because the absolute margin is high during these period. Only after lumber prices stabilize or begin to decline do sawmillers feel the pinch caused by the declining margin.

The percentage margin between stumpage and lumber prices are presented in Table 1. Although the percentage margin has decreased for all four species, there are differences in the degree and timing of these decreases. White oak had the largest decline in margin, 41.7 percent between Periods 1 and 2. Although much of this decline probably is a direct result of an increasingly efficient production and distribution system, the veneer log market and log exports also have contributed to margin decline. The greatest decline in the margin for white oak occurred during Periods 3 and 4.

Table 1. Estimated percentage margin between stumpage and lumber prices for white oak, red oak, yellow-poplar, and hard maple in Ohio between 1970 and 1995.

Period	White oak	Red oak	Yellow-poplar	Hard maple
1970-1974	68.4	72.3	71.2	65.0
1975-1980	62.6	64.9	65.2	65.0
1981-1985	58.1	58.3	61.9	59.5
1986-1990	48.1	50.0	57.7	57.9
1991-1995	39.9	44.9	48.3	56.3

During Periods 3 and 4, exports *of* white oak lumber *to* Europe increased almost yearly while exports to Japan increased tremendously during Period 4. It should be noted that margins tend to decrease the most when lumber prices have the greatest increase.

Red oak experienced the second largest decline in market margin decreasing by 37.9 percent over the 25-year examination period. The red oak margin decreased at nearly a constant rate (10 percent per period) as red oak rose to prominence as an appearance lumber. The exception to this constant level of decrease was a 16.3-percent decline during Period 4. This decline corresponds to the high point *of* red oak lumber as an appearance species.

Yellow-poplar and red oak are two of the most commonly used domestic lumber species (Meyer et al. 1992). Both species have similar percentage market margins for Periods 1, 2, and 5. However, red oak showed the greatest decrease between Period 3 and 4; yellow-poplar had the greatest decrease between Period 4 and 5. This decrease corresponds to the surge in yellow-poplar price caused by increased domestic and international demand and other uses such as hardwood plywood, oriented-strand board, and laminated veneer lumber.

Hard maple had the smallest decrease in market margin. Much of the lack of change probably is related to the low demand for this species between the late 1960's and the late 1980's. Maple did not experience the rapid rise and fall in price in the mid-1970's and has not experienced the competitive pressures that have affected stumpage prices of the other three species. However, the large increases in maple lumber prices since 1995 has caused the margin decrease.

SUMMARY AND CONCLUSIONS

The hardwood market cycle combined with the competitive nature of the hardwood market causes any increases in production and marketing efficiency to decrease the margin between hardwood stumpage and lumber prices. The decrease has been greatest for the species with the greatest increase in demand. This occurred because the higher the increase in lumber price, the greater the competition between sawmills for stumpage of that species. However, as revealed by the recent increase in the price of hard maple lumber and the subsequent decrease in market margin, all hardwood species eventually will have similar margins because all are produced with a similar technology.

The question nagging sawmillers is: "Will the decrease in margins continue?" The answer is yes, though production efficiency will reach a point where it cannot be increased significantly and the percentage margin will reach a natural bottom. . That bottom is impossible to predict so sawmillers should keep track of what is happening, anticipate the decline in market margin, reap short-term profits when they are available, and if possible, forward contract the price paid for stumpage.

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APPENDIX: DATA AND MODEL USED

In this appendix we provide information on the data and model that was used to develop stumpage/lumber market margins. A more detailed discussion is found in Luppold et al. (in press). Data on stumpage prices used in this study were reported by the Ohio Agricultural Statistical Service (1969-1995) in cooperation with the Ohio Department of Natural Resources. This price series is developed from a biannual survey of sawmills for March through May and September through November.

Although Ohio stumpage prices have been reported since 1960, the earlier reports provided prices only for regions of the state and showed little yearly variation for the species examined. After examining the data, we decided to focus on the period from 1970 to 1995. This 25-year, 50-observation period provided sufficient information to examine lumber and stumpage prices under different market conditions.

The prices for hardwood lumber were obtained from the Hardwood Market Report (1970-1995). To correspond with Ohio stumpage price series, Market Report prices were from the first week of April and October. Although all grades of hardwood lumber for a specific species move in a similar direction in the long run, there is some short-term variation between grade prices. To account for all grades of hardwood lumber that result from sawing hardwood logs, the actual prices used in the analysis were calculated as a weighted average using formula 1. The weights used in formula 1 approximate the proportion grade mix associated with a typical Appalachian sawmill that produces appearance grade lumber:

$$PL_{it} = \{.15*PFAS_{it}\}+\{.4*PIC_{it}\}+\{.25*P2._{it}\}+\{.2*p3c_{it}\} \quad (1)$$

Where,

PL_{it}= Weighted price of species i (i=1 to 4 for white oak, red oak, yellow-poplar, and hard maple) in period t (t=1 to 52).
$PFAS_{it}$= Price of plain-sawn FAS lumber for species i in period t.
$P1C_{it}$= Price of plain-sawn 1 Common lumber for species i in period t.
$P2_{it}$ = Price of plain-sawn 2 or 2A Common lumber for species i in period t.
$P3C_{it}$= Price of plain-sawn 3A Common lumber for species i in period t except 2B for yellow-poplar.

The lumber-stumpage market margins were calculated by

$$Margin_{it} = PL_{it} - PS_{it} \quad (2)$$

Where,
$Margin_{it}$ = The lumber-stumpage market margin for species i in period 1. .
PL_{it} = From equation 1.
PS_{it}= Price of stumpage for species i in period t (in dollars per Mbf Doyle scale).

Plain-sawn prices were used in this analysis since most of the hardwood lumber is cut in this manner. The intent of this study was to examine trends, so no overrun factor was used in calculation of the hardwood lumber! stumpage market margin. All prices were deflated to constant 1987 dollars using the Producer Price Index for all commodities.

The model used to estimate the margin for each of the four species was

$$PS_{i.} = B_{ij}\, D_j\, (PL_i) \quad (3)$$

Where,

PS_i= Price of stumpage of species i (i = 1 to 4).
B_{ij}= I-kif where kjj is the percentage margin for species i in time period j. Note the margins reported in Table 1 were developed by substracting Bjj from 1.
D_j= 0-1 slope shifterfor time periodj G = periods 1 to 5 for 1970 to 1974, 1975 to 1980, 1981 to 1984,1985 to 1990, and 1991 to 1995).
PL_i= Price of lumber for species i.

The B coefficients in Table 1 were estimated using a Cochrane-Orcutt autoregressive estimation procedure described in the SHAZAM 7.0 user's reference manual (Shazam 1993). This procedure was used because the OLS estimates for all four species had statistically significant positive first-order serial correlation. Since positive serial correlation deflates standard errors and inflates apparent statistical significance, it was necessary to use the autoregressive procedure. Intercept terms were restricted to zero to conform to the specification of equation 3a. Estimations were made using the SHAZAM 7.0 econometric package (Shazam 1993).