Pine and Hardwood Stumpage Price Trends in the South

by

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Abstract

Over the last decade, several developments have occurred in the U.S. which may have an impact on stumpage prices in the South. Harvesting has shifted to the South from the Pacific Northwest due to environmental restrictions. Total removals now exceed total growth for softwoods throughout most southern states. Institutional investors have dramatically increased their ownership of timberland assets in the south. The demand for engineered wood products, both nationally and internationally, has increased substantially. This study examines stumpage price trends for pine, mixed hardwood, and oak sawtimber, and pine and hardwood pulpwood using Timber Mart-South data for the period 1977 to 1996. During the period 1977 to 1986, real stumpage prices were stagnant or decreasing for all commodities south wide, but during the period 1987 to 1996, real stumpage prices increased at an average annual rate of 5% or greater. No significant seasonal variations were found for any commodity using quarterly data. Price variation between states, as measured by the coefficient of variation, was greatest for pine pulpwood and lowest for mixed hardwoods during the period 1977 to 1996. Pine pulpwood showed a significant decrease in price variation between states, while mixed hardwood, and oak sawtimber and hardwood pulpwood experienced a significant increase in price variation.

INTRODUCTION

Spatial, temporal, and seasonal variations and fluctuations in stumpage prices are a major concern among forest products industries, forest resource management specialists, and academic researchers. Stumpage prices influence optimal rotation length and harvesting decisions. Understanding fluctuations in stumpage prices can aid in the development of suitable strategies for dealing with business cycles in forest product industries. Stumpage prices can exhibit volatility in response to demand fluctuations from the forest products sector (lumber & wood products, furniture & fixtures, and paper & allied products) which in turn are influenced by cycles in the general economy. The magnitude of fluctuations in output, employment, and capital expenditure of the forest products sector is considerably higher than real gross domestic product, total national employment, and national gross private investment during 1949-90 (Gan and Kolisan 1997).

Stumpage price differences between regions reflect tract characteristics and prospective characteristics of the market (Duerr 1993). Tract characteristics include accessibility, area, physiography, roadbed, timber quantity, quality, stocking, species, size, logging conditions, etc. Market characteristics reflect end products in view, transportation costs, degree of competition among sellers and buyers, terms of sale, characteristics of loggers, logging technology, proposed time and duration of sale, labor and capital availability, and so on. Although regional tract characteristics are relatively stable over time, market conditions can change rapidly. For example, competition has increased dramatically in the South. The number of pulpmills in the South has increased from 51 in 1953 to 105 in 1995, while the average mill capacity also increased from 470 tons per day in 1953 to 1325 tons per day in 1995 (Johnson 1996; Johnson and Steppleton 1996). More homogeneous prices (decreasing variability) suggest decreasing differences in markets while more heterogeneous prices (increasing variability) suggest increasing differences between markets. By measuring price variability, inferences about trends in market integration can be drawn.

Real price trends in the South have been examined by various researchers. Binkley and Vincent (1988) compared real price trends of southern pine sawtimber for the period 1910-1985 and found increases of 4.6% per annum during 1910-43 and 3.1% per annum since 1943. Cabbage and Davis (1986) analyzed pine sawtimber stumpage price trends in Georgia and estimated increases of 1.14% per
annum during 1952-84. Studying price trends in Ohio, Luppold and Baumgras (1995) estimated red oak stumpage prices grew at an annual rate of 5% between 1975 and 1994. The 1993 RPA Timber Assessment Update projects an average annual real price increase of 1.9% for softwood sawtimber and 1.0 to 2.4% for hardwood sawtimber over the period 1991-2040 (Haynes et al. 1995).

In the past, researchers have documented seasonal behavior in stumpage prices. For example, Anderson (1969) found that the lumber market affected stumpage prices in South Carolina where pine sawtimber prices increased in the fall season during 1947-57 as inventories were built up for winter. During 1958-67, prices increased in the spring due to increased housing starts. In the hardwood market, Luppold and Baumgras (1995) found evidence of cyclical behavior and attributed price changes to structural changes in the hardwood industry and changes in sawtimber inventories.

Further analysis of southern stumpage price trends is essential because the timber market has undergone major changes over the last two decades. Environmental restrictions to protect spotted owl habitat greatly reduced timber supply in the Pacific Northwest. Consequently, timber harvesting has shifted to the South. Annual removals now exceed annual growth in most of the major softwood producing states, including Alabama, Arkansas, Georgia, Louisiana, Mississippi, South Carolina, and Texas. According to recent Forest Inventory and Analysis (FIA) reports, overall annual growth-to-removals are currently at 1:1.05 for softwoods in the South. In the southern region, which continuously increased softwood and hardwood inventories during the 1960s and the 1970s, inventories have leveled off due to increased removals during the 1990s. Increasing national and international demand for forest products, coupled with substantial harvest cutbacks on public lands in the western U.S. have greatly increased demands on timber supplies in the South (Cubbage et al. 1995). The rapidly changing domestic and international hardwood markets of the 1980s had a large impact on the demand and price of hardwood stumpage (Hansen et al. 1991; Luppold and Dempsey 1994).

Technological progress led to increased use of hardwoods in pulp mills. Price pressure brought by international demand and substitution for pine pulpwood is expected to result in increased prices for hardwood pulpwood and price parity between pine and hardwood pulpwood making them true substitutes during the next few years (Stewart and Wikle 1996; McDill 1997). The share of hardwoods in total pulpwood production steadily increased from 12.5% in 1953 to 33.8% in 1995 (Johnson 1996; Johnson and Stepleton 1996).

The last 10 years saw new developments with respect to ownership of timberland. Rinehart (1985) correctly predicted that increasing land holding costs and capital needs in the timber industry might lead to widespread shifts in land ownership and management. Increasingly, timber processing was separated from timberland ownership and management. The ownership of timberland by institutional investors is on the rise. The institutional ownership of U.S. timberland, particularly by pension funds, has grown during the last several years and now amounts to about $2.8 billion (Binkley et al. 1996). This is most evident in the southern U.S. By the end of 1994, five big institutional investors had more than half their timberland assets ($1.6 billion). Institutional investors are generally more patient in their timber sales decisions. These owners do not need to meet hard annual cash flow targets and likely to put less timber on the market during economic downturns, ultimately leading to less price volatility (Binkley et al. 1996).

This paper examines stumpage prices and trends for the period 1977 to 1996 in the southern region. Products examined include pine, mixed hardwood and oak sawtimber and pine and hardwood pulpwood. Specifically, this paper examines: 1) real rates of price change as determined for all commodities; 2) changes over time in regional price variability; and 3) seasonal variations in stumpage prices.

DATA AND METHODS
Timber Mart-South (TMS) stumpage price data for both pine and hardwoods are used. It is the only comprehensive historical data source available (since 1977), for key product categories in the southern states. There is, however, some question concerning the reliability of TMS data. Cubbage and Davis (1986), while examining Georgia pine sawtimber prices from 1952 to 1984, found that TMS prices were much higher than those reported by the Georgia Forestry Commission. Comparing TMS prices with those collected from forestry consultants and industry representatives in North Carolina, Franklin and Hazel (1983) concluded that TMS reported prices provided reliable information.

In the absence of comprehensive historical data covering all southern states and all product categories, TMS stumpage price data were used in the
analysis. Southern states of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Oklahoma, North Carolina, South Carolina, Tennessee, Texas, and Virginia were included in the analysis. Data for Kentucky and Oklahoma were available from the 2nd quarter of 1980 to the 2nd quarter of 1994 only.

Although regional prices within states were available, state prices were used in our analysis. The number of regions recognized in the TMS reports was reduced from three to two per state in 1992. Real stumpage prices were obtained by deflating the nominal prices using the All Commodities Producer Price Index Series (1982=100) of the Bureau of Labor Statistics.

To compare trends in real prices, ordinary least squares regression analysis was used to estimate average annual compound rates of growth. The equation estimated for annual average compound growth rates of real prices is as follows:

$$ Y = \alpha_0 + \alpha_1 T $$

where, $Y$ is the natural log of price during the period, $T$ is the time variable in years, and $\alpha_0$ and $\alpha_1$ are the parameters to be estimated. The annual average growth rates can be readily calculated from $\alpha_1$ (de Steiguer et al. 1989). To examine changes in real price growth rates, the period was divided into two sub-periods, 1977 to 1986 and 1987 to 1996. The second period saw increasing institutional ownership of timberland, environmental restrictions on timber harvesting on federal lands in the Pacific Northwest, and uncertainties about Canadian imports. Separate equations were estimated for each period and stumpage product.

The coefficient of variation for stumpage prices was used as a measure of price variation calculated from state average prices. A time trend was fitted to investigate changes in price variability over time. The estimated equation is:

$$ CV = \alpha_0 + \alpha_1 T $$

where, $CV$ is the coefficient of variation for stumpage prices, $T$ is a time variable expressed in quarters, $\alpha_0$ and $\alpha_1$ are the parameters to be estimated.

Seasonal variation in stumpage prices was examined by regressing a time variable and quarterly dummy variables on real prices. In the absence of seasonal price data, quarterly data were used to detect any seasonal trend in stumpage prices. The estimated equation to test for seasonal effects on stumpage prices is:

$$ P = \alpha_0 + \alpha_1 D_2 + \alpha_2 D_3 + \alpha_3 D_4 + \alpha_4 T $$

where, $P$ is the real stumpage price, $D_2$, $D_3$, and $D_4$ are dummy variables for the 2nd, 3rd, and 4th quarters respectively, $T$ is a time variable expressed in quarters, $\alpha_0$ is the intercept, and $\alpha_1$ to $\alpha_4$ are the parameters to be estimated. The omitted variable in this equation is the dummy variable for first quarter ($D_1$).

RESULTS

Real prices for five stumpage products are shown in Figures 1 and 2. During the 20-year period, the percentage increase in real prices was greatest for hardwood pulpwood (151%) followed by oak sawtimber (82%), mixed hardwood sawtimber (31%), pine pulpwood (29%), and pine sawtimber (27%). Prices for all product categories peaked in 1995. A substantial upward trend in real prices started in 1992, coinciding with the environmental restrictions on Forest Service lands to protect spotted owl habitat in May 1991 and sales restrictions on Bureau of Land Management lands because of the Bureau's failure to prepare environmental impact statements (Gorte 1993). Uncertainties about countervailing duties on softwood lumber imports from Canada under the U.S.-Canada Free Trade Agreement, and its panel decisions, re-analyses and subsequent reviews contributed a part in the upward trend in prices (Gorte
The gap between mixed hardwood sawtimber and oak sawtimber prices increased from $11 per Mbf in 1977 to $58 per Mbf in 1996. An increased demand for oak-strip flooring in domestic and export markets led to this increased gap (Luppold and Baumgras 1995). In contrast, the gap between pine and hardwood pulpwood prices declined from $10-$11 in 1977-1978 to $7-$8 per cord in 1995-1996. Lower stumpage prices for hardwood pulpwood relative to pine pulpwood and development of better hardwood pulping technology led to increased substitution, which in turn, led to a smaller price gap between the two commodities. It is likely that this trend for pulpwood prices will continue.

Rates of change in real prices
Annual compound rates of change in real prices for the five stumpage products during the three periods for the South are shown in Table 1. During 1977-96, rates of change in real prices were significant and positive for hardwood pulpwood (6.3%), oak sawtimber (4.6%), hardwood sawtimber (2.6%), and pine pulpwood (1.5%). Pine sawtimber prices grew at a rate of 0.5% which was not statistically significant.

<table>
<thead>
<tr>
<th>Stumpage</th>
<th>77-86</th>
<th>87-96</th>
<th>77-96</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawtimber:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pine</td>
<td>-3.6</td>
<td>8.8</td>
<td>0.5</td>
</tr>
<tr>
<td>Mixed hardwood</td>
<td>-5.0</td>
<td>7.9</td>
<td>2.6</td>
</tr>
<tr>
<td>Oak</td>
<td>-4.5</td>
<td>8.9</td>
<td>4.6</td>
</tr>
<tr>
<td>Pulpwood:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pine</td>
<td>-0.9</td>
<td>6.4</td>
<td>1.5</td>
</tr>
<tr>
<td>Hardwood</td>
<td>-3.5</td>
<td>13.6</td>
<td>6.3</td>
</tr>
</tbody>
</table>

* and ** indicate t-values in equation (1) significant at the 1 and 5% level.

However, there were substantial differences between decades. During 1977-86, the growth rates in real prices for stumpage products were significantly negative except for pine pulpwood. In contrast, during 1987-96, growth rates in real prices for all products were significant and positive ranging from 6.4% for pine pulpwood to 13.6% for hardwood pulpwood.

Regional variation in stumpage prices
The coefficients of variation in state mean stumpage prices (1977 to 1996) are depicted in Figures 3 and 4. Price variation between states was greatest for pine pulpwood and smallest for mixed hardwood sawtimber. The variation in pine sawtimber and pulpwood prices declined over time, while variation in hardwood prices increased. The results of regression equation (2) for the various stumpage products indicate a significant decrease in price variation between states over time for pine pulpwood (Table 2). Sawtimber and pulpwood hardwood prices experienced a significant increase in variation.

Figure 2. Real stumpage prices: pine, and hardwood pulpwood.

![Figure 3](https://example.com/figure3.png)

Figure 3. Coefficient of variation in pine, mixed hardwood, and oak sawtimber stumpage prices.

![Figure 4](https://example.com/figure4.png)

The decreasing price variation between states for pine pulpwood stumpage prices suggests more homogeneous markets. Increased competition and available substitutes, management and regeneration,
and institutional ownership may have all contributed to more homogeneous pine pulpwood markets. Price variation in hardwood sawtimber (oak and mixed hardwood) has increased over time suggesting market differences for these commodities have increased.

Table 2 Trends in coefficient of variation in southern stumpage prices: 1977-96

<table>
<thead>
<tr>
<th>Stumpage</th>
<th>Intercept</th>
<th>Time</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawtimber:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pine</td>
<td>27.1</td>
<td>-0.03</td>
<td>0.02</td>
</tr>
<tr>
<td>Mixed</td>
<td>15.1</td>
<td>0.07*</td>
<td>0.17*</td>
</tr>
<tr>
<td>Oak</td>
<td>18.9</td>
<td>0.17*</td>
<td>0.20*</td>
</tr>
<tr>
<td>Pulpwod:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pine</td>
<td>45.3</td>
<td>-0.13*</td>
<td>0.20*</td>
</tr>
<tr>
<td>Hardwood</td>
<td>20.3</td>
<td>0.17*</td>
<td>0.36*</td>
</tr>
</tbody>
</table>

*a indicates t-values and F-values in equation (2) significant at the 1% level.

Pulpwood markets have become more homogeneous as indicated by the gradual reduction in price differences (Figure 2) and convergence and synchronization of price variation (Figure 4) for pine and hardwood pulpwood.

Seasonal variation in stumpage prices

The results from equation (3) show no significant differences in quarterly prices for all commodities (Table 3). The coefficients for the seasons are not significant for any product or any state. This indicates that there is no significant seasonal variation in stumpage prices as measured by quarterly data. The seasonal differences in stumpage prices may be disappearing. This may be due to increased inventory capacities in the mills and extended duration of sale contracts through out the year.

Table 3 Effect of seasons on real stumpage prices in the south: 1977-96

<table>
<thead>
<tr>
<th>Stumpage</th>
<th>Intercept</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>Time</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawtimber:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pine</td>
<td>135.22</td>
<td>0.37</td>
<td>-4.11</td>
<td>-3.48</td>
<td>0.23*</td>
<td>0.03</td>
</tr>
<tr>
<td>Mixed</td>
<td>51.75</td>
<td>0.95</td>
<td>-0.64</td>
<td>-1.16</td>
<td>0.51*</td>
<td>0.31*</td>
</tr>
<tr>
<td>Oak</td>
<td>47.97</td>
<td>2.70</td>
<td>-0.98</td>
<td>-2.65</td>
<td>1.13*</td>
<td>0.54*</td>
</tr>
<tr>
<td>Pulpwod:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pine</td>
<td>13.02</td>
<td>-0.43</td>
<td>-1.03</td>
<td>-0.37</td>
<td>0.05*</td>
<td>0.27*</td>
</tr>
<tr>
<td>Hardwood</td>
<td>1.90</td>
<td>-0.23</td>
<td>-0.37</td>
<td>-0.33</td>
<td>0.09*</td>
<td>0.67*</td>
</tr>
</tbody>
</table>

*a indicates t-values and F-values in equation (3) significant at the 1% level.

SUMMARY

This paper examined recent trends in real prices for five stumpage products, using Timber Mart-South data, over the period 1977 to 1996. Overall, real stumpage prices declined or remained stagnant from 1977 to 1986. However, during 1987-96, real stumpage prices increased appreciably, resulting in an overall trend of annual real price increases for all stumpage products. The difference between mixed hardwood and oak sawtimber prices increased. The gap between pine and hardwood pulpwood prices decreased significantly over the period. Price variation between states was greatest for pine pulpwood and lowest for mixed hardwood sawtimber. Variation in pine pulpwood stumpage prices across states decreased over time. For hardwoods, regional variation in stumpage prices is increasing. As measured by quarterly prices, there is no seasonal variation in stumpage prices for any product in the southern region.

Literature Cited


