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Financial Returns on Timberlands in Mississippi Between 1977 and 1994

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Abstract

The objective of this study is to compute the real annual rates of return from mature, undisturbed timberlands in Mississippi during a 17-year period (1977-1994). This was done using Southern Research Station, Forest Inventory and Analysis data on timber volumes and Timber Mart-South data on timber prices. Simple and adjusted financial maturity models were used to estimate rates of return. Average annual rates of change in value were computed and compared for four forest types across Mississippi. The average annual rate of change in volume was also computed for these stands and compared to the financial rates of return. Three distinct time periods were considered: 1977-1987, 1987-1994, and 1977-1994. For the 1977 to 1987 period, the average annual real rate of return of all forest types was 6.8% using simple financial maturity and 3.5% using adjusted financial maturity. For 1987 to 1994, the real rates of value change were much higher – 18.6% using simple financial maturity and 11.3% using adjusted financial maturity. Average annual real rates of return for the entire study period, 1977 to 1994, were 13.8% using simple financial maturity and 8.1% using adjusted financial maturity methods.

METHODS AND PROCEDURES

This study investigates biological and financial growth rates of undisturbed stands in Mississippi by applying Timber Mart-South (TMS) stumpage prices to Forest Inventory and Analysis (FIA) sample trees. Each FIA sample tree was assigned a dollar value based on species, size, and condition. Sawlog trees were divided into multiple products and cull trees were treated as pulpwood. Tree values were summed for each plot to derive the total plot value in dollars per acre.

Study Area

The study area was timberland in Mississippi. The FIA definition of timberland is land that is at least 10% stocked by trees of any size, or formerly having such tree cover, and not currently developed for nonforest uses. Minimum area considered for FIA classification and measurement is one acre.

FIA Data

Biological tree and stand data were obtained from the USDA Forest Service Southern Research Station (SRS) Forest Inventory and Analysis (FIA) research work unit located in Ashville, NC and Starkville, MS. The FIA unit conducts periodic surveys of forest resources in 13 southern states (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia) and Puerto Rico. FIA's mission was originally established by the McSweeney-McNary act of 1928 and has been subsequently modified by the Forest and Rangeland Renewable Resources Planning Act of 1974 and the Forest and Rangeland Renewable Resources Research Act of 1978. Forest surveys were conducted in Mississippi in 1934, 1947, 1957, 1967, 1977, 1987, and 1994. FIA data from 1977, 1987, 1994 were used in the present study.

The two levels of FIA data used in this study were plot and tree. Plot-level includes forest type, ownership, stand origin, stand age, stand size, and evidence of harvesting and management activities. Each plot is assigned one of four possible forest types. These forest types are: pine; mixed; oak-hickory; and oak-gum-cypress. Forest type is based on the plurality of stocking. Tree-level FIA data contains all information on the individual trees measured on the plot. Tree-level variables include species, diameter at breast height (DBH), tree height, volume and condition.

Plot Selection

Value change computations require input from two points in time. For this study, the earlier time period is referred to as time 1. The more recent time period is time 2. Therefore, when

discussing the 1987-1994 period, 1987 is time 1 while 1994 is time 2.

To be included in the present study, plots must have been classified as forested for all survey periods in question. All time 2 plots must be classified as sawlog-size stands, while time 1 plots may be either poletimber-size or sawtimber-size stands. Stands classified as seedling/sapling in either survey were omitted. All time 2 stands must have at least 5,000 board feet per acre. Several plots were classified with forest types of elm-ash-cottonwood. These were excluded because of insufficient sample size (less than 10 plots for each survey period). All stands with evidence of management, disturbance, or harvesting for the survey periods in question, as well as the previous survey period, were excluded

Tree Selection

All live trees greater than or equal to 5.0 inches DBH were included in the sample set, except rotten cull trees. Rough cull tree volumes were given pulpwood value. No cull trees were used in sawtimber computations. Tree selection was performed by variable radius sampling (37.5 Basal Area Factor (BAF)). Since tree selection was performed by variable radius sampling, new trees appear over time. These new trees were included in all computations and therefore affect growth and value changes. Trees that died between survey periods were included only in the survey year(s) in which they were alive. This has the potential to create negative biological and economic value growth between surveys.

Timber Mart-South Data

Timber Mart-South (TMS) price data were used to calculate individual tree values. TMS price data for Mississippi is reported by region. Survey date and region determined which TMS price report was used. TMS has been collecting delivered prices and stumpage prices for 11 southern states since December, 1976. All TMS price data are nominal. Real prices were calculated using the U.S. Bureau of Labor and Statistics Producer Price Index (PPI) for all commodities.

Tree Products and Tree Values

The logic used for determining tree products was: 1) all poletimber-size trees are used for pulpwood; 2) the entire volume of rough cull trees, even sawtimber size trees, is used for pulpwood; 3) the sawlog section of sawtimber-size trees is used for sawtimber; and 4) the section between the sawlog top and 4-inch DOB pole top is used for pulpwood and often referred to as topwood.

In 1981, TMS began to report southern pine chip-n-saw prices. Therefore, the two survey periods after this time included a third product, southern pine chip-n-saw. Chip-n-saw trees are southern pines 9.0 to 12.9 inches DBH. All trees less than 9.0 inches were still treated as pulpwood, and trees greater than or equal to 13.0 inches DBH were treated as sawtimber trees. This modification was made for the 1987 and 1994 survey periods.

FIA traditionally computes all board foot volumes in International 1/4-inch log rule. Most of the TMS price data is in Doyle log rule. To accommodate the price data, all FIA tree volumes were recalculated using the Doyle formula. There are a few instances where prices are reported in Scribner log rule. To accommodate this, the Doyle prices for these few instances were converted to Scribner prices by multiplying the Doyle price by 0.75 (Timber Mart South, 1996).

The TMS reports include a low, high, and average price for standing timber for various products. This report does not consider peeler logs or poles and piling as possible products because determining these products from FIA data is questionable. Omitting these classes allows for a slightly conservative approach to estimating tree and stand value. FIA data has information on species, product size (poletimber or sawtimber), and quality (tree class and tree grade). Prices for each section of the tree were assigned based on these factors. These prices were then applied to the different sections of a tree. Table 1 details the methodology used to assign TMS prices to FIA trees.

Table 1. Logic used in combining Timber Mart-South prices with FIA sample trees.

Tree characteristic	Price assignment
Growing stock pine poletimber	Average pine pulp price
Non-growing stock pines	Low pine pulp price
Hardwood growing stock poletimber	Average hardwood pulp price
Hardwood non-growing stock, non-oak trees	Low hardwood pulp price
Pine sawtimber topwood	Low pine pulpwood price
Hardwood sawtimber topwood	Low hardwood pulpwood price
Southern pine chip-n-saw tree	Average chip-n-saw price[1]
Tree grades 1 and 2 oaks[2]	High oak sawtimber price
Tree grade 3 oaks[2]	Average oak sawtimber price
All other growing stock sawtimber-size oaks[2]	Low oak sawtimber price
Post oak, Delta post oak, and black oak	Low mixed sawtimber price
Tree grades 1 and 2 southern pine	High pine sawtimber price
Tree grade 3 southern pine	Average pine sawtimber price
All other pine sawtimber growing stock	Low pine sawtimber price
All non-oak tree grade 1 hardwoods	High mixed hardwood price
All other non-oak tree grade 2 and 3 hardwoods	Average mixed sawtimber price
Any remaining growing stock hardwoods	Low mixed hardwood price
Cedars and cypress prices	Obtained from personal correspondence[3]

[1]Except for the 1977 survey, in which this category does not exist. For 1977, all southern pines <9.0 inches DBH were treated as pulpwood, larger trees were treated as sawtimber.
[2]Except for the following species: post oak, Delta post oak, and black oak.
[3]B.J. Dye, Seitz Lumber Company

Growth Models

Timber volumes and values were summed for each plot. These totals were then used as inputs for the growth models. Three growth models were used in this study. Each is based on the formula used in determining average annual change.

Timber Value Growth (TVG) is a simple financial maturity model that considers only the actual change in value for a plot for the survey period in question. Future incomes are ignored.

Forest Value Growth (FVG) includes the value of land in the computation of economic value change. FVG is an example of adjusted financial maturity because land value (LV) accounts for future incomes and the inclusion of LV adjusts the simple financial maturity model. This study computes FVGs using LVs ranging from $50.00 per acre to $550.00 per acre in $50.00 increments.

Biological Growth Percent (BGP) is similar to TVG, except it uses timber volumes instead of timber values. The BGP model accounts for the actual annual change in volume for a plot over a survey period.

RESULTS

TVG, FVG, and BGP were computed for each plot and survey period. Plots were classified based on forest type. Tables 2 through 4 detail the results for each survey period. Table 2 represents the 1977-1987 period, while table 3 and 4 represent the 1987-1994 and 1977-1994 periods, respectively.

Table 2 details the sample size, BGP, TVG and FVG of Mississippi timberlands by forest type for the 1977-1987 survey period. FVG was computed, in $50.00 increments, for land values ranging from $50.00 per acre to $550.00 per acre. Total sample size and average TVGs and FVGs are given for the entire state. Both TVG and FVG are expressed in real terms. The average BGP for all plots is 3.8% per year, while the average TVG is 8.0% per year. These measures indicate that while these stands' volume increased 3.8% per year, their value increase was even greater. Statewide average FVG at $50.00 per acre is 6.8% per year but decreases to 2.9% when LV is $550.00 per acre. Pine stands outperformed all other stands in both biological growth and timber value growth for this time period. Mixed stands, which are

Table 2. Average annual biological, real timber value, and forest value growth rates, expressed as a percentage, by forest type, Mississippi, 1977-1987.

Forest type	Plots	BGP	TVG	FVG 50	FVG 100	FVG 150	FVG 200	FVG 250	FVG 300	FVG 350	FVG 400	FVG 450	FVG 500	FVG 550
Mixed	59	3.96	8.09	6.88	6.03	5.39	4.88	4.46	4.12	3.82	3.57	3.35	3.16	2.99
Oak-Gum-Cypress	121	3.33	6.62	5.61	4.90	4.37	3.95	3.61	3.32	3.08	2.87	2.69	2.53	2.39
Oak-Hickory	93	3.64	7.00	5.71	4.87	4.26	3.80	3.44	3.14	2.89	2.68	2.50	2.34	2.20
Pine	91	4.64	11.01	9.51	8.42	7.58	6.90	6.35	5.88	5.48	5.14	4.83	4.57	4.33
All types	364	3.84	8.05	6.82	5.96	5.31	4.80	4.39	4.04	3.75	3.50	3.28	3.09	2.92

Table 3. Average annual biological, real timber value, and forest value growth rates, expressed as a percentage, by forest type, Mississippi, 1987-1994.

Forest type	Plots	BGP	TVG	FVG 50	FVG 100	FVG 150	FVG 200	FVG 250	FVG 300	FVG 350	FVG 400	FVG 450	FVG 500	FVG 550
Mixed	61	3.78	19.13	17.41	16.05	14.94	13.99	13.18	12.47	11.84	11.28	10.77	10.32	9.90
Oak-Gum-Cypress	130	2.21	17.45	15.86	14.58	13.53	12.64	11.88	11.21	10.62	10.09	9.62	9.20	8.81
Oak-Hickory	89	2.92	20.47	18.28	16.60	15.24	14.12	13.17	12.35	11.63	11.00	10.44	9.94	9.49
Pine	62	5.00	17.69	16.42	15.36	14.46	13.68	12.99	12.38	11.83	11.33	10.88	10.47	10.09
All types	342	3.18	18.58	16.87	15.51	14.40	13.46	12.65	11.94	11.32	10.77	10.27	9.82	9.41

Table 4. Average annual biological, real timber value, and forest value growth rates, expressed as a percentage, by forest type, Mississippi, 1977-1994.

Forest type	Number of plots	BGP	TVG	FVG 50	FVG 100	FVG 150	FVG 200	FVG 250	FVG 300	FVG 350	FVG 400	FVG 450	FVG 500	FVG 550
Mixed	26	3.63	13.36	12.08	11.10	10.31	9.64	9.08	8.59	8.15	7.77	7.42	7.11	6.82
Oak-Gum-Cypress	70	3.16	12.43	11.17	10.22	9.44	8.80	8.25	7.78	7.36	7.00	6.67	6.37	6.10
Oak-Hickory	38	4.35	15.14	13.22	11.85	10.79	9.94	9.23	8.64	8.12	7.67	7.27	6.91	6.59
Pine	25	5.22	16.14	14.57	13.38	12.42	11.63	10.95	10.36	9.85	9.39	8.98	8.61	8.27
All types	159	3.84	13.82	12.34	11.25	10.37	9.66	9.05	8.52	8.06	7.66	7.30	6.97	6.68

comprised of at least 25% softwoods, were close behind. In general, for this time period, stands that had at least 50% pine outperformed hardwood stands in both TVG and BGP.

The data in Table 2 illustrates a peculiarity that exists between TVG and FVG. The rankings based on TVG do not remain the same for FVG. The forest-type rankings for Table 2, based on TVG, would be: pine; oak-hickory; mixed; and oak-gum-cypress. FVG rankings, based on land value of $550.00 per acre, are: pine; mixed; oak-hickory; and oak-gum-cypress. Note that mixed and oak-hickory switch places between TVG and FVG. This is due to the moderating effect of LV on FVG computations.

Table 3 describes the 1987-1994 survey period. The statewide average BGP is 3.2% per year. However, statewide average TVG increased to 18.6% per year. The lowest statewide FVG value, at $550.00 per acre, is 9.4%, which is greater than the TVG for the preceding survey. As in the previous time period, the BGP for pine and mixed stands outperforms hardwood stands. However, this is not the case with TVG. Many differences arise when comparing TVG to BGP. Not only does the magnitude of change increase, but the ranking by forest type changes. Where pine and mixed stands outgrow all other stands biologically, oak-hickory and mixed outperform pine financially in TVG. Oak-hickory's 20.5% per year TVG increase dwarfs its 2.9% per year increase in BGP. Mixed stands (19.1% per year) are close behind in TVG rankings, followed by pine (17.7% per year) and oak-gum-cypress (17.4% per year).

The general conclusion drawn is that while stands that have pine still outgrow hardwood biologically, stands with a fairly large component of oak and other high quality hardwoods outperformed other stands in regard to TVG. The primary reason for the increased financial growth of hardwood and mixed stands is due to the increase in price for hardwood stumpage, particularly oak, that occurred during this period.

Table 4 represents the 1977 to 1994 period. As in the two previous tables, statewide average BGP of 3.8% per year is greater than 3.0% per year and less that 4.0% per year. The data on this table conflict with conclusions drawn from the previous two tables. Pine is still the fastest growing forest type and oak-gum cypress the slowest, but now the mixed and oak-hickory forest types have switched places based on BGP, with oak-hickory stands outgrowing mixed stands. Two of the forest types, pine and oak-hickory, have higher BGP for the 1977 to 1994 survey period than the other two periods. The BGP of the combined surveys (1977-1994) is higher for some forest types than each survey period's BGP.

The most plausible explanation for this phenomenon lies in the nature of the survey and the plot selection process used in this study. Table 2 represents a one-time period estimate. Plots that comprise the data set have met the requirements of no evidence of disturbance or harvesting in the current or previous survey period, and are of minimum threshold size and volume class. Table 3 represents the next time period. The same plot selection criteria are used but the data sets are composed of a different set of plots. Many plots that were included in Table 2 (the 1977-1987 period), were not included in Table 3 (the 1987-1994 period) because of harvesting, disturbance, or failure to meet other plot selection criteria. Additionally, new plots appear in Table 3. These plots are either too small or underwent previous activities that excluded them from the earlier time period; they now meet the second time period's standards. For example, Table 2 indicates that there are 93 oak-hickory plots in the 1977-1987 survey. Table 3 shows 89 oak-hickory plots for the 1987-1994 time frame. Of these plots, only 38 are common to both. Having fewer plots reduces the confidence and statistical reliability of any conclusions drawn from this data set. A sample set of 38 plots is approaching the marginal size needed for definite conclusions. All other plots are unique to each time period and have impact over trend estimates in a complex manner. The removal and addition of plots over time adds much complexity to one-time estimates of trend analysis. In analyzing the 1977-1994 survey period, only plots common to both measurement periods were used.

DISCUSSION

Table 5 compares statewide FVG and TVG values to other investment options. These options include certificates of deposit (CDs), treasury bills, corporate bonds, Dow Jones Industrial Average, and Standard and Poor's 500 index (S&P 500). All rates of return are real and expressed as a percentage. A land value of $350.00 per acre is assumed for FVG. The data for this table were obtained from numerous internet and published sources such as the Federal Reserve Board, Bureau of Labor Statistics, Dow Jones, Standard and Poor's, Wall Street Journal, Value Line, and other newsletters from investment companies.

Timberland performance for the 1977-1987 period was comparable to other investment options. It is important to note that plots used in this study had no evidence of past or current management or harvesting. Stands that received proper management and provided landowners with sources of income from thinnings and other silvicultural practices would have the potential to outperform the calculated TVG and FVG returns for this time period.

A dramatic shift occurred during the 1987-1994 survey period. Increases in timber prices during this period are the primary driver for this increase. FVG, which accounts for the price of land, surpasses the Dow Jones Industrial average and the Standard and Poor's 500 index (S&P 500). Again, the prospect of even greater returns exists if one considers possible income from intermediate forestry practices.

When using FIA data, the most accurate indicator of trend is usually obtained using a data set of remeasured plots that exist in both survey periods. Thus, the 1977-1994 FVG and TVG values in Table 36 could be considered the best estimation possible of true long-term trends. The data indicate that timberland was a viable investment option for this time frame. FVG outperforms AAA Corporate bonds and the S&P 500.

Table 5. Real average annual rates of return, expressed as a percentage, on Mississippi timberlands and alternative investment options by survey period.

Investment Option	***1977-1987***	***1987-1994***	***1977-1994***
1 Month Certificate of Deposit	2.93	2.11	3.32
3 Month Certificate of Deposit	3.06	2.18	2.75
6 Month Certificate of Deposit	3.22	2.30	2.89
3 Month Treasury Bill Rate	2.11	1.61	1.96
6 Month Treasury Bill Rate	2.24	1.73	2.09
1 Year Treasury Bill Rate	2.18	1.86	2.11
AAA Corporate Bonds	4.23	4.67	4.43
Dow Jones Industrial Average	0.10	5.13	2.21
S&P 500 Stock Index	6.84	8.48	7.92
Timber Value Growth Percent (TVG)	6.82	18.58	13.82
Forest Value Growth Percent (FVG)	3.50	11.32	8.06

CONCLUSIONS

Financial returns on timberland holdings can compete with alternative investment options. This information may surprise landowners who believe that timberland investments cannot match the returns received from CDs, treasury bills, bonds and stocks. Failing to recognize timberland as viable investment option could adversely affect not only the landowner's financial situation, but the environment as well.

Earlier or extra thinnings allow landowners to receive additional income. Marginal lands harvested, or converted from agriculture, can now be managed for species suited to those sites. In the past, these sites were often left without regeneration, or were regenerated in a species unsuitable to the site because other species were deemed economically desirable. New technologies allow landowners the flexibility to investigate numerous management options. Landowners must be made aware of the benefits of investing in timber. Landowners who recognize financial returns from future stands are more likely to regenerate stands and manage stands actively. Landowners who believe timberlands are a poor investment are more likely to be passive investors.

Data from this study indicate that forest management has the potential to affect hardwood stand value growth rates to a greater extent than pines. Stumpage prices between hardwood species and grades vary more than softwoods. Growth rates between hardwood species are also highly variable.

LITERATURE CITED

B.J. Dye, 1995. Seitz Lumber Company. Personal communication.

Timber Mart South. 1996. Stumpage price mart: standing timber, Mississippi, 1st Quarter 1996. Daniel B. Warnell School of Forest Resources, University of Georgia, Athens, GA. 4 pp.