Hancock
Timberland Investor

Hancock Timber Resource Group®

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To What Extent Do Timber Prices Drive Timberland Returns?

We are often asked to identify a single factor behind timberland performance. In theory, several factors combine to influence timberland returns, most notably: timber prices, interest rates, skilled forest management, portfolio management and timber marketing. Among these factors, one would think that the value of the product your investment is producing — timber — should have a fairly substantial effect on your investment's return. Detailed empirical analysis confirms this common sense and suggests a strategy for controlling the volatility in portfolio returns associated with volatility in timber prices.

Timber prices have historically had a substantial influence on timberland returns. To show the effect, we compare southern pine prices reported by Timber Mart-South with southern timberland returns reported by the National Council of Real Estate Investment Fiduciaries (NCREIF) Timberland Index.

The role of timber prices in timberland returns has been addressed as part of larger studies by Milliken & Cubbage (1985), Redmond & Cubbage (1988), Washburn (1990) and Zinkhan (1988). Washburn found that expectations of future timber prices are perhaps the most obvious determinants of timberland value. But, other potentially important factors include expectations of future forest management costs (including the consequences of future environmental regulations on them), expectations of revenue from non-timber sources (including any proceeds from planned conversion to an agricultural, commercial or residential use), the "option" value of adaptive forest management, inflation expectations, and the risk-adjusted interest rate (or rates) used to discount expected revenues. As these value-determining factors evolve over time, so does the value of forest capital. While interesting and useful, all of these studies were conducted prior to the creation of the NCREIF Timberland Index — an index based on actual property performance.

The NCREIF Timberland Index began publishing timberland returns in the South beginning first quarter, 1987, separating the total return into income and capital components.

The income component of NCREIF's timberland index is a measure of property-level operating income and is analogous to EBITDDA (earnings before interest, taxes, depreciation, depletion and amortization) for timberland.

The capital component is determined as properties are "marked-to-market" each year. Because many properties are

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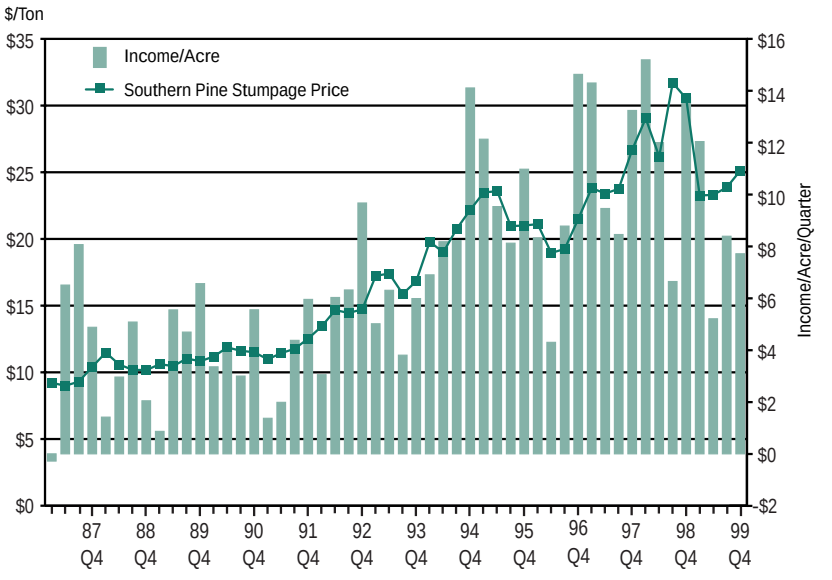
Figure A.
Timberland Income and Southern Pine Stumpage Prices



Source: NCREIF and Timber Mart-South

appraised only at year-end, only calendar year returns truly capture changes in timberland values.

Timber prices logically affect the income and capital returns differently. Hence, we conducted separate analyses for each component.

Income Returns. Figure A (page 1) plots quarterly timberland income per acre and composite southern pine timber prices (a 50:50 mix of sawtimber and pulpwood) in dollars per ton.

Casual observation reveals a fairly close relationship between timber prices and timberland income per acre in both magnitude and direction of movement over time.

In theory, timber prices have two effects on timberland income. First, higher prices for timber mean that a given level of harvest will produce more income. And secondly, with net preset value-maximizing behavior, managers will increase harvests at times of higher timber prices and reduce them at times of lower prices.

Statistical analysis of these data finds that prices explain about half of the variation in income returns. Further, 83 percent of the effect is due to the fact that the timber is more or less valuable, whereas 17 percent is due to price-responsive harvesting. As a result of the interaction of these effects, a 1.0 percent change in timber prices produces a 1.2 percent change in timberland income. (See Notes on page 6 for more complete statistical results).

Capital Returns. Figure B (below) plots percentage changes in year-end timberland values per acre reported by NCREIF along with percentage changes in fourth-quarter composite southern pine prices.

Statistical analysis of these data shows that changes in fourth-quarter timber prices explain almost two-thirds of the variation in capital returns. The regression coefficient indicates that a 1.0 percent change in prices produces about a 0.5 percent change in capital returns. This suggests (i) that the effect of a change in timber prices is only partially transmitted into changes in timberland values, and (ii) that other factors are responsible for determining timberland values.

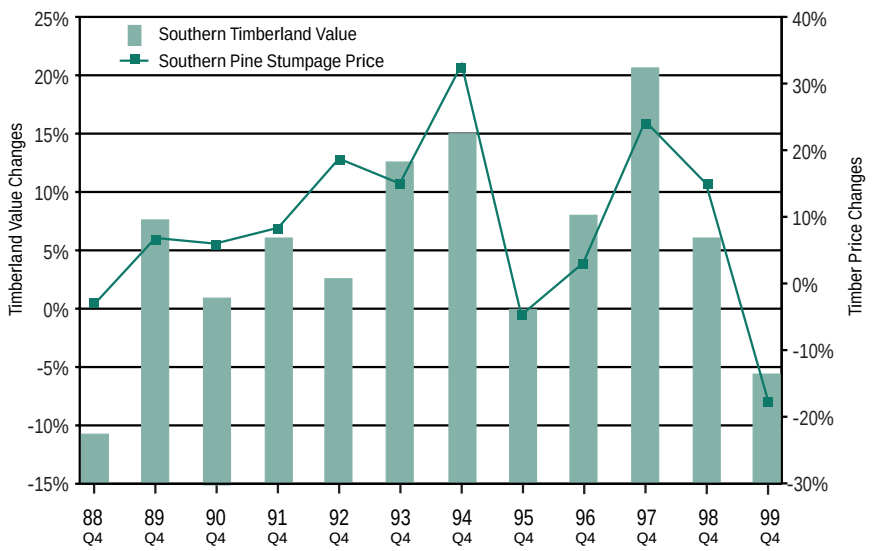
Historically, NCREIF's reported total returns can be attributed roughly one-third to the income component and two-thirds to the capital component. Taken together, our results suggest that timber prices alone have explained 57 percent of timberland returns since 1987.

Conclusions. In theory, other factors should influence timberland returns. According to capital theory, the value of any asset is the present worth of the net revenues that the asset is expected to produce. In the case of a forest, this present worth depends on a complex interaction among numerous value determinants. But timber prices should play a critical role.

Detailed statistical analysis confirms the commonsense idea that timber prices largely determine timberland returns.

Timber prices have different effects on the income and capital components of return. The volatility of timber prices tends to be amplified in income returns, and muted in appreciation returns. This suggests that by judiciously choosing the mix of income and appreciation in their portfolios, investors can manage the return volatility created by fluctuations in timber markets.

Figure B.
Changes in Southern Timberland Values and Southern Pine Stumpage Prices



Source: NCREIF and Timber Mart-South

Literature Cited

Milliken, R.B. and F.W. Cubbage. 1985. Trends in southern pine timber price appreciation and timberland investment returns, 1955 to 1983. University of Georgia, College of Agriculture, Experiment Station Research Report 475. Athens, GA.

Redmond, C.H. and F.W. Cubbage. 1988. Risk and returns from timber investments. *Land Economics* 64:325-337.

Washburn, C.L. 1990. The determinants of forest value in the U.S. South. PhD diss., Yale University.

Zinkhan, F.C. 1988. Forestry projects, modern portfolio theory, and discount rate selection. *Southern Journal of Applied Forestry* 12:132-135.

Quarterly Average Regional Composite Prices: Softwood Sawtimber Stumpage

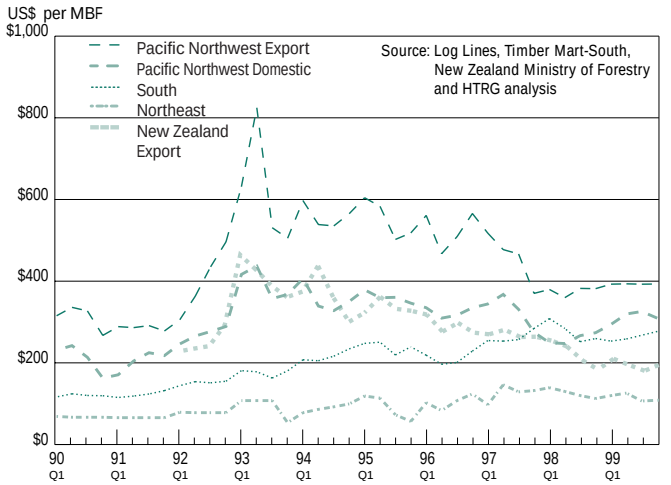


Figure 1. Regional Softwood Sawtimber Stumpage Prices

Softwood sawtimber prices were up slightly over third quarter levels across all regions except the Pacific Northwest, where prices fell in sympathy with declines in regional lumber prices. Export Douglas-fir prices began the quarter relatively flat to slightly below last quarter's levels and moved upward toward quarter-end, resulting in a flat average quarterly price. Southern pine prices continued another quarter of upward movement, yet fourth quarter levels are still 10 percent lower than the historical highs experienced two years ago.

Quarterly Average Regional Composite Prices: Softwood Pulpwood Stumpage

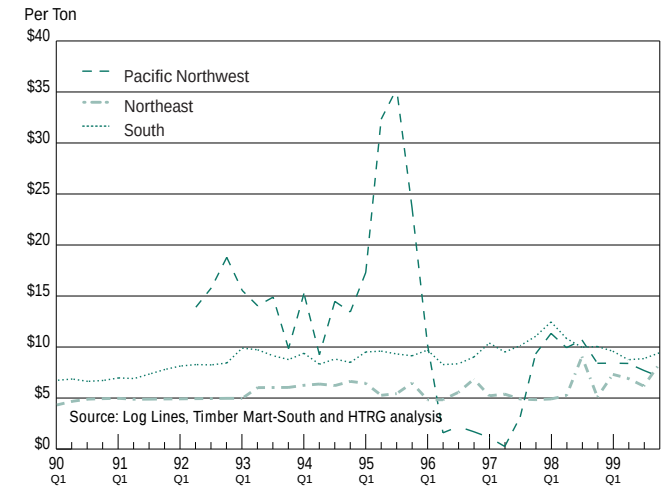


Figure 2. Regional Softwood Pulpwood Stumpage Prices

The composite pulpwood price in the South averaged $9.11/ton for 1999, down 15 percent (about $1.60/ton) over the average price in 1998. Fourth quarter prices, however, reflect the long-awaited price increase for softwood pulpwood in two out of three regions. In the South, prices were up 6 percent over the third quarter, still 60 cents lower than prices one year ago. Softwood pulpwood prices in the Northeast were up more than 30 percent from third quarter. Consolidation continues to occur in the industry and few capacity expansions are taking place. This has allowed pulp and paper producers to increase pricing, leaving room for improved raw material prices.

Regional Timberland Values

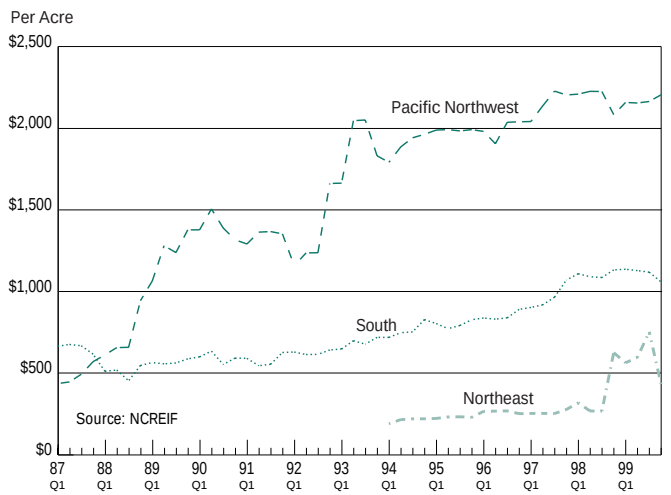


Figure 3. Timberland Prices

Timberland values in the Pacific Northwest were up slightly over third quarter levels and 6 percent above values a year ago. On the other hand, timberland values in the South dropped 5 percent from last quarter to just over $1,059 per acre. This is more than 6 percent below levels one year ago. In the Northeast, the average per acre value fell substantially after a large black cherry producing property in Pennsylvania was removed from the NCREIF database. This masked any increases in per acre values of other timberland properties in the Northeast.

Timberland Enterprise Value per Southern Equivalent Acre

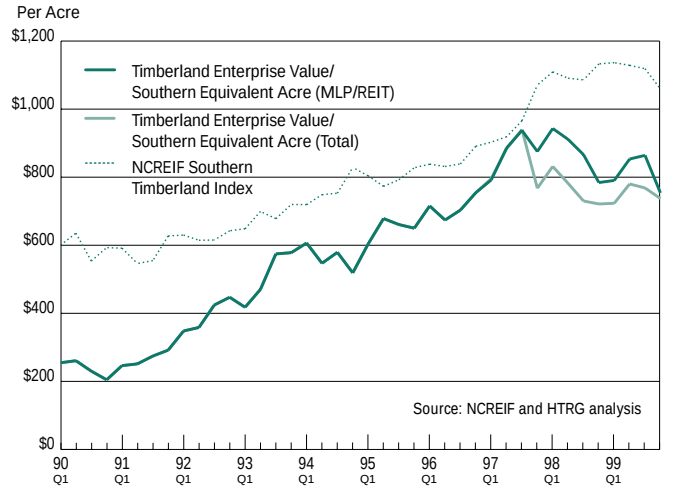


Figure 4. Timberland Enterprise Value

Securitized timberland held by companies in both the MLP/REIT Index and the Total Index fell from third quarter estimates, with the MLP/REIT Index dropping over 12 percent in the fourth quarter. This compares to a drop of more than 5 percent in private market timberland values.

EBITDDA Multiples for Privately Traded Timberland

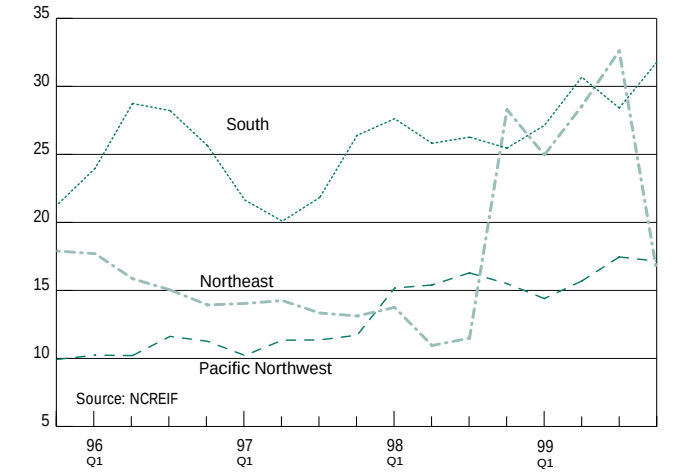


Figure 5. Timberland Price to Earnings Ratio

In the South and the Pacific Northwest, EBITDDA multiples were at historically high levels. In the Northeast, the EBITDDA multiple fell substantially due to NCREIF's removal of a large black cherry producing property in Pennsylvania that produced little income relative to its appraised value. It notes repeating that the high multiple for southern timberland is partly due to the relatively young average age of the timber inventory on southern properties in the NCREIF database.

Timberland Investment Performance

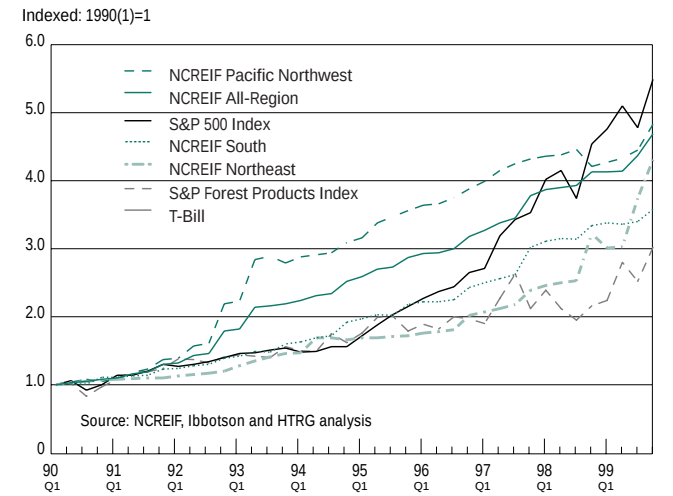


Figure 6. Timberland Returns (1990-1999)

Returns for private timberland were positive in the fourth quarter, moving the All-Region NCREIF return ever-so-close to the returns measured by the S&P 500.

Timberland Investment Performance

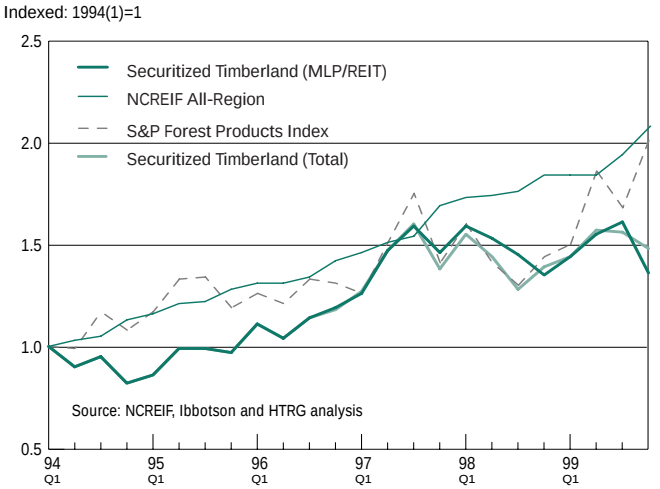


Figure 7. Timberland Returns (1994-1999)

The performance of alternative timberland-related return series diverged widely over the fourth quarter. Returns for public timber-focused companies were negative, perhaps partly in response to weakening conditions in markets for lumber and panels. Returns for private timberland equity were positive, the result of relatively stable timber prices and increases in appraised timberland values. The S&P Forest Products Index rose on the heels of solid paper company performance resulting from a positive near-term outlook.

Securitized Timberland Performance

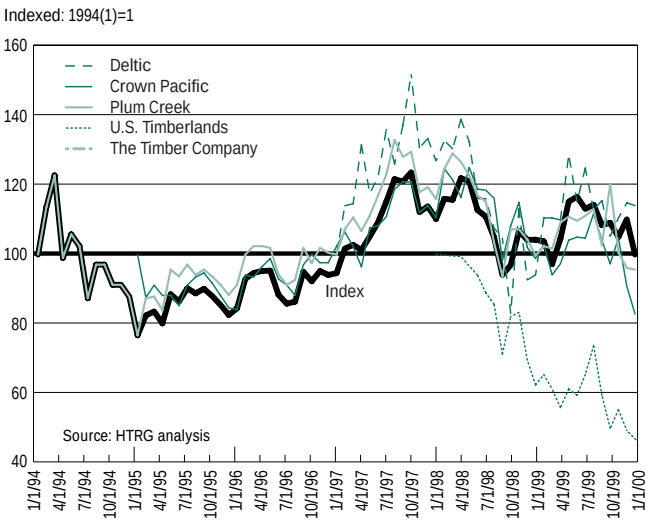


Figure 8. Hancock Securitized Timber Index

The share price of four of the five companies included in the HSTI declined during the quarter, depressing the index by more than 9 percent. The Index now stands at nearly the same level at which it was initiated in 1994. This suggests that returns to date have come largely from dividends. In inflation-adjusted terms, however, the HSTI has fallen 14 percent below its original level.

Notes:

Cover.

Timberland income returns were estimated by the equation:

$\ln (I) = \alpha + \beta \ln (P) + \ln (\varepsilon)$

Where:

I= quarterly timberland income per acre

α,β = estimation parameters

P= quarterly southern pine stumpage composite price

ε= error term

	α	β	R^2
coefficient	-2.460	1.220	.48
standard error	0.6306	0.1796	

51 observations

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Timberland value returns were estimated by the equation:

$\ln (V_t/V_{t-1}) = \alpha + \beta \ln (P_t/P_{t-1}) + \ln (\varepsilon)$

Where:

V=year-end timberland value per acre

α,β = estimation parameters

P= fourth-quarter southern pine stumpage composite price

ε= error term

	α	β	R^2
coefficient	0.007	0.525	.62
standard error	0.0183	0.1286	

12 observations

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Figure 1. The composite price for southern sawtimber is based on quarterly average Timber Mart-South published prices for pine sawtimber and chip-n-saw stumpage. Pacific Northwest prices are derived from quarterly average Log Lines published prices for whitewoods and Douglas-fir with internal analysis of logging costs for stumpage calculations. New Zealand prices are based on New Zealand Ministry of Forestry quarterly average published prices for Radiata unpruned A-sort export logs with internal analysis of logging costs for stumpage calculations. Northeast sawtimber prices are calculated from internal analysis.

Figure 2. Pulpwood composite prices are derived from quarterly average Timber Mart-South published prices for southern pine pulp wood stumpage, Log Lines published whitewood and Douglas-fir pulp logs with internal analysis of logging costs for the Pacific Northwest, and HTRG analysis of Spruce/Fir pulpwood in the Northeast.

Figure 3. Regional NCREIF timberland market value per acre is derived by dividing the total regional market value at quarter end by the number of acres reported in that region. Due to the small sample of property in the Pacific Northwest in 1987 Q1 and 1987 Q2, these values were backcast from 1987 Q3 with quarter-end appreciation returns.

Figure 4. Timberland Enterprise Value per southern Equivalent Acre (TEV/SEA) for five timber-intensive publicly traded companies compared to southern timberland values per acre calculated from the NCREIF database. TEV is a quarterly estimate based on total enterprise value (total market equity + book value debt) less estimated value of processing facilities, other non-timber assets and non-enterprise working capital. SEV uses regional NCREIF $/acre values to translate a company's timberland holdings in various regions to the area of southern timberland that would have an equivalent market value.

Figure 5. EBITDDA multiples are calculated using NCREIF timberland value per acre at quarter end divided by a trailing four-quarter average NCREIF net income per acre.

Figure 6. Total quarter-end returns to timberland based on the NCREIF database. Northeast returns prior to 1994 are based on the John Hancock Timber Index. Ibbotson Assoc. database was used for S&P 500, U.S. T-Bill and S&P Forest Products quarter-end returns (dividends reinvested).

Figure 7. Total quarter-end returns to securitized timberland based on internal analysis. The Total Securitized Timberland Index includes Plum Creek (PCL), Crown Pacific (CRO), U.S. Timberlands (TIMBZ), Deltic (DEL) and The Timber Company (TGP). The MLP/REIT Securitized Index includes PCL, CRO and TIMBZ (dividends reinvested).

Figure 8. The HSTI uses a base-weighted aggregate methodology (similar to that used to construct the S&P 500) to calculate a market capitalization-weighted value for five publicly traded timber-intensive forest products companies. Base weights were readjusted for the emergence of new companies or at the beginning of each year. Dividends are not reinvested.