FINANCIAL ASSET PRICING MODELS  
AND THEIR USE IN MANAGING TIMBERLAND PORTFOLIOS  
ROBERT G. CHAMBERS/1

ABSTRACT

The Capital Asset Pricing Model (CAPM) is not widely used in timberland investment analysis primarily due to lack of reliable historical investment performance numbers. Current efforts to surmount this problem center on hypothetical indices and/or individual timber product price histories such as pine sawtimber prices. Results are confusing because these indices may be unsuitable as proxies for total investment returns which are composed of land, timber growth and individual timber product price changes.

If one assumes development of a suitable proxy, the most obvious uses for CAPM are; 1). Portfolio asset allocation decisions, 2). Determination of timberland investment discount rates. 3). Risk adjusted performance measures, and 4). Construction of efficient timberland portfolios. Current indications of positive alpha and low or negative beta indicate that timberland offers risk adjusted return premiums in diversified portfolios; and that lower discount rates should be applied to investment decisions than is commonly done. As current investment managers accumulate actual return numbers, CAPM will provide a method for judging performance. Proposed for further study, is the idea that various independent southern timberland markets, rather than a "Southern Timberland Market", allows construction of efficient timberland portfolios using CAPM.

INTRODUCTION

Although several exotic (or so they appear to laymen) models for asset pricing seem to be in vogue, my comments will largely deal with the Capital Asset Pricing Model (CAPM). Once we put aside, for sake of this conference, arguments by writers calling for the demise of CAPM (Ross, 1984) and the challenge that CAPM is untestable because it is essentially untestable (Roll, 1977). And, if we disregard the growing body of literature on anomalies in capital markets which cast even further doubt on usefulness of the CAPM (Ross, 1984); we are left with a momentary discussion of

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1/ The author is Vice President and Manager of Timberland for First Wachovia Investment Management in Atlanta, Georgia.
Applicability of CAPM to timberland Investments. (Momentary cause surely timberland investment discussion will compress me, abandon CAPM, and rush headlong to Arbitrage Pricing Theory (APT) or other such cerebral studies of asset pricing).

I should first answer the obvious question, do we at First Union use CAPM in managing timberland portfolios? The simple answer is no! Why? We agree with Zinkhan who stated recently that no feasible methodology for determining a separate CAPM for timberland has been suggested (developed) (Zinkhan, 1988). We (corporate body of those who study such things) do not know, with sufficient statistical significance, the historical performance of timberland as an asset. Obviously, such reliable information is necessary for CAPM calculations.

We are aware of attempts to surmount this problem by creating hypothetical historical timberland portfolios. However, most, if not all, proposed timberland indices are fatally flawed in two general respects:

1. Most are based on a fully regulated forest. This theoretical forest does not exist in the real world and furthermore, cannot be replicated in the real world; therefore, it does not provide a useful measure of timberland returns.

2. Most are based on non-representative (from a total timber market perspective) timber and/or land price series. For example, average Louisiana timber prices and a constant, or smoothly increasing land price. Just as meaningless are those indices based on US Forest Service sales, or worse, that mix various price data sources for different time periods, i.e. USFS data prior to 1956, Louisiana data for 1956 - 1976, and Southern average Timbemart South data since 1977.

We are not critical of efforts to create useful indices for timberland performance, just unsatisfied with current results. As a matter of fact, we are working on the development of a timberland index in an attempt to overcome these problems. Our guidelines are that a timberland index should be reproducible in the real world by prudent investors, and should recognize regional price trends as well as unique return characteristics of different periods in the life cycle of a forest. Therefore,

1. A reliable indicator of historical timberland portfolio performance is urgently needed to allow us to proceed with investigations of the applicability of asset pricing models to timberland.

2. At risk of redundancy, efforts should continue to construct a meaningful timberland index.
APPLICATION

In the event a suitable index is developed the question becomes, how can CAPM apply to management of a timberland portfolio? Four applications come readily to mind.

1. Asset Allocation
2. Determining Discount Rate for Timberland Investments
3. Evaluation of Timberland Manager's Performance
4. Construction of an Efficient Timberland Portfolio

Asset Allocation

Determination of appropriate portfolio diversification is the most apparent use for CAPM. This subject has been covered extensively by the literature, therefore, I will not dwell on it.

We would caution, however, against indiscriminate use of inadequate proxies for historical timberland performance in developing conclusions about CAPM applications to timberland investment. We must be careful of the message we send potential or current investors. A recent report in Paper Age demonstrates this principle quite clearly. The lead sentence of the article was "Bad news for trees." The article continued to explain that demand for paper had increased to the point that more trees must be harvested to make the paper. It turns out that "Bad news for trees" could be interpreted as "Good news for investors who own trees."

Relying on untested Timberland indices simply because they are available may well lead to misunderstanding this important asset category. Of greater danger, in our opinion, is the use of timber product price changes, i.e. pine sawtimber, pine pulpwod, or Indiana high grade hardwood, as a proxy for timberland investments. This practice will invariably increase confusion over what, in fact, constitutes a timberland investment. Some research, for example, indicates that various timber products in a given market area have low correlation to other timber products in the same market. We also know that land price are much less volatile than timber price, and that timber increases in volume biologically. All these factors contribute to total timberland investment returns, and quite often, the proper combination of factors may yield investment results significantly different from timber price change analysis alone.

We live in a fast paced society, initial impressions are lasting, let's make sure our powder is dry before we shoot, and possibly wound, this asset class with premature CAPM analysis of timberland investments.
Determine Discount Rate for Timberland Investments

Recent articles, (Binkley and Washburn, 1988, and Zinkhan, 1988), indicate that timberland investments exhibit low betas, providing rational for using a lower discount rate to analyze timberland investments than for more traditional assets such as common stocks. Also, various timberland investment projects, whether land and timber acquisition, tree planting, herbicide application or others, may exhibit low betas to other timberland investments and therefore justify a lower discount rate. In other words, all timberland investments should not be analyzed with the same discount rate. (One should note here that only systematic risk is important in discount rate determination, because unsystematic risk can be diversified away in the total portfolio).

When our Timberland Fund II, which began in 1981, is regressed against the S & P 500 (income reinvested) the beta is 0.014. Using the CAPM formula as reported by Zinkhan, the required rate of return for TF II in 1988 and therefore, the implied discount rate of TF II investments was 6.62%.

This strengthens the argument, as some of us believe, that timberland is a low risk investment in relation to broad based market securities such as common stocks.

Timberland Manager's Performance

One obstacle many investors report is their inability to measure investment performance (risk adjusted) by and/or between timberland investment managers. CAPM provides an opportunity to make risk adjusted determinations of investment manager's performance. Chart 1 shows the CAPM concept visually. All investments lying on the required Rate of return line have met market based investment expectations for the particular asset. All investments lying above the line have provided superior performance relative to the market for the amount of risk taken, and conversely, all lying below the line have provided inferior risk adjusted returns to the total portfolio.

As shown in Table 1, the required rate of return for TF II in 1988 was 6.62%. The actual return of 19.75% provided excess returns of 13.13% indicating that TF II was a superior asset in 1988 and that it had met its objectives as a diversification to the total portfolio.

Other timberland portfolio managers reported different rates of return for 1988, ranging from 2% to over 50%. Were these returns better or worse than returns from TF II? Only by using risk adjusted comparisons can the proper determination be made. Unfortunately, most other investments have not been in existence long enough to permit determination of a meaningful beta, so risk adjusted comparison cannot be made presently. However, over time data will be available to make risk adjusted determination of investment manager performance using CAPM.
CHART 1
CAPM VISUAL CONCEPT

LEGEND

— REQUIRED RETURN
— RISK FREE RETURN

GOOD

BAD
Table 1: Determination of Required Rate of Return for Timberland Fund II in 1988.

<table>
<thead>
<tr>
<th>Required Rate (%)</th>
<th>U. S. Treasury bill rate (%)</th>
<th>Expected market premium (%)</th>
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<tbody>
<tr>
<td>6.62</td>
<td>6.76</td>
<td>.014 x (16.6 - 6.76)</td>
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U. S. Treasury: Average 90-day rate for 1988 of 6.76%
Market Rate: S & P (income reinvested) for 1988 of 16.6%

Construction of Efficient Timberland Portfolios

Finally, after the decision is made that timberland is to be added to further diversify the total portfolio, our attention turns to constructing the timberland portfolio. I now tread on dangerous ground. Financial advisers, consulted in preparing these remarks, tell me that diversification of the timberland portion of a totally diversified portfolio may be counterproductive. That is, a timberland portfolio constructed to diversify away portions of systematic risk may change the correlation of timberland to the total portfolio and be undesirable.

Intuitively, though not necessarily qualitatively, (because of our lack of comprehension of the total concept of CAPM) we believe this notion is predicated on the belief that there is an efficient "Timberland Market." We believe, in fact, there are many timberland markets, each of which may or may not be efficient, often with low correlation with each other. If so, total portfolio diversification may be enhanced by understanding different timberland markets.

The advisors quickly stated this might be better accomplished by identifying areas with low correlation to other timber areas and assets and using asset allocation models to determine the optimum investment.

However, humor me for a few minutes and brain storm some interesting concepts for more complete scholarly review.

Chart 2 is the reported pine sawtimber prices by Timberrart South (TMS) for Arkansas Area I, and Georgia Area II. Trend lines superimposed on this chart would indicate a negative trend for Arkansas and an increasing trend for Georgia. When Arkansas
FIRST WACHOVIA TIMBERLAND INDEX
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prices are regressed against Georgia (Chart 3), alpha is .002 and beta is 0.44, therefore, including Arkansas sawtimber with Georgia timber in a portfolio reduces risk with a small return premium and might provide a good portfolio addition.

Since we have condemned using timber price changes as indicators, we will quickly consider Chart 4, which regresses the First Wachovia Timberland Index Mature Growth Forest for Arkansas Area I against the First Wachovia Timberland Index. The alpha is -0.01 and beta is 1.11. Therefore including an additional segment of Mature Growth Forest from Arkansas Area I actually would reduce the expected return and increase the risk of the total timberland portfolio as represented by the First Wachovia Timberland Index. This obviously is undesirable, and the investment should not be made.

Chart 5, on the other hand, indicates that adding an additional segment of Emerging Growth Forest from Arkansas Area I with an alpha of .009 and beta of .37 might improve performance of the total timberland portfolio. Using CAPM and resulting beta, the required rate of return for this segment of investment would be 11.3%, while The First Wachovia Timberland Index indicates an expected return of 8.16% for the Emerging Growth Forest in Arkansas Area I. Although calculated alpha and beta indicate this to be a prudent addition to the portfolio, we would not make the additional investment in Emerging Growth Forest in Arkansas because the expected rate of return is less than the calculated required rate of return using CAPM. You be the judge, is this a prudent decision?

Literature Cited


