The Sensitivity of the Value of Timberland Assets to Changes in the Discount Rate

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Abstract. This paper examines the sensitivity of forestry asset values to changes in the discount rate (called “asset-value risk” in this paper). All else equal, high-growth forests suffer less asset-value risk than do low-growth forests. Forests that generate high rates of return suffer less asset-value risk than do ones with low rates of return. Both factors suggest that forestry assets in emerging markets should be, all else equal, less sensitive to changes in asset pricing arising from changes in the cost of capital than are their counterparts in the developed world. Of course, all else is not always equal, and the relative sensitivity of emerging market forestry assets depends on how spreads change in response to overall changes in return expectations.

I. Introduction

The current turmoil in financial markets appears to be re-pricing many assets. Much of the re-pricing results from changes in the cost of capital or, equivalently, changes in the discount rate. Because of the long tail of cash flows associated with forestry assets (i.e., their long Macauley duration), their value depends heavily on the discount rate; we therefore would expect particular volatility in the market for forest assets. However, this market is thinly traded, illiquid, and poorly reported. As a consequence, forest valuations are always opaque, and perhaps more so now than ever. It is therefore useful to examine how forest asset valuations might change in response to overall asset re-pricing. This paper uses a simply model of sustainable forestry to do so.

We define “asset-value risk” as the change in asset value due to a change in the discount rate that underlies that asset value. We examine asset value risk as a function of growth rates and discount rates, concluding that faster growing and higher-return forestry investments will have lower asset-value risk. High absolute growth rates and high relative returns characterize plantations investments in emerging markets; this analysis suggests that such investments may perform comparatively well during this time of market turmoil.

II. Valuation Methodology

While realistic forest valuations must take into account the age-class structure, growth rates, markets,… of a specific forest, it is useful to examine a highly simplified special case. Imagine a forest growing at a rate of g m^3/ha/yr with a net stumpage price of \$p/m^3. To keep the analysis simple, assume that the costs can just be netted out of the stumpage price. This would be precisely correct if (a) there are no costs (as with a low-intensity natural forest) or (b) if this were a sustained-yield forest where the stand re-establishment costs are simply netted out of the stumpage price. It may be a useful approximation in other instances.

The sustainable annual income from such a forest is p•g.

At a real discount rate of i, the present value V of this income stream is

$$V = p \cdot g / i$$

We wish to examine how this value changes with respect to changes in the discount rate. The change in V with respect to i is:

$$\partial V/\partial i = - \; p \cdot g / i^2 = -V/i$$

The higher the discount rate, the lower is the sensitivity of asset value to changes in the discount rate.[1]

How is the sensitivity of value to interest rate changes affected by growth rates? The most straightforward way to determine this is to examine the second derivative of V with respect to I and g:

$$\partial^2 V/\partial i \partial g = -p/i^2 = - V/(g \cdot i)$$

It is not surprising (and perhaps not very interesting) that the sensitivity of the value of a timberland investment in absolute terms is proportional to the value of the investment. For a specified value of the investment, sensitivity is inversely proportional to the growth rate and the interest rate.[2] All else equal, the asset values of low-growth forests are more sensitive to changes in the discount rate than are asset values of high-growth forests.

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[1] Note that because the present value function is log-linear, the sensitivity of value to interest rate changes is -1 in elasticity form. We return to this point in our conclusions.

[2] One way to scale the analysis is simply to look at the percentage changes, or to divide by V:
$\partial^2 V/\partial i \partial g \, / \, V = -p/i^2 / \, p \cdot g \, / I = 1/ \, (i \cdot g)$
In other words, the percentage sensitivity of a timberland investment to a change in interest rates depends inversely on the underlying timber growth rate.

III. Conclusions and Implications

Investors face considerable uncertainty in the current economic climate. One of the key issues is future discount rates relevant to various assets. The discount rates for timberland implied by market transactions have fallen by 300-400 bps in the last five years or so, but the relevant benchmarks (10-year TIPS; commercial real estate cap rates) have recently risen. The data for timberland remain in the fog of uncertainty, so the risks associated with changes in discount rates are most important for timberland investors.

This analysis suggests that the risk can be minimized by investing in rapidly-growing forests, even in markets where timber prices are low. Put more specifically, the asset-value risk associated with changing discount rates will be

- greatest where growth rates are lowest (e.g. the US Northeast and Lake Sates; Northern Europe; tropical hardwoods),
- moderate for temperate plantations (e.g. Douglas-fir in the US Pacific Northwest and British Columbia), and
- Lowest where growth rates are high (Brazil, Uruguay, SE Asia).

Similarly, the sensitivity of asset values to changes in the discount rate depends on the level of the discount rate. We can interpret the discount rate to be the appropriate risk-adjusted hurdle rate for the investment. Under these circumstances, a given change in the discount rate will have a larger impact on the asset value of forests in relatively developed economies (e.g. the US, Canada, Australia, New Zealand, Western Europe) than in emerging markets where the returns are higher.

Suppose the relative value of timberland assets in different regions depends on a “spread model”: the return on a plantation investment in, say, Brazil, equals the return on timberland in the US plus a spread to reflect the sovereign and other risks of investing in Brazil. Then three cases obtain:

A. If the spread is fixed regardless of the levels of returns in the US, then the asset-value risk in Brazil would be less than that US.

B. If the spread is proportional to the level of the discount rate, then a percentage change in the US discount rate will produce the same percentage change in asset values in the US and in Brazil.

C. If the spread widens more than proportionately, the percentage change in asset values in Brazil would be greater than that in the US, but the impact would be offset by the higher growth rate in Brazil.[3]

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[3] This issue can be addressed empirically. Take $S_{i,t}$ to be the spread of country i’s $US-denominated sovereign debt in period t over the yield I_t on comparable tenor US Treasury bonds in that same period. We can estimate the following panel model (likely in first-difference form to account for the likely serial correlation among the residuals):

$$S_{i,t} = \alpha_i + \beta_i \bullet I_t + \varepsilon_{i,t}$$

Of course, the real world is far more complicated than this simply valuation model suggests, and there is no substitute for careful *ex ante* risk assessment. However, these results suggest that emerging market forestry investments may carry less asset-value risk than commonly perceived.

Then four possible outcomes can occur, corresponding to the cases mentioned above:

		β	
		=0	>0
α	=0	?	B
	>0	A	C

Standard statistical test of the parameters of the model can distinguish among the cases.