Chapter A3

Methods of Forest Valuation

IN THIS CHAPTER This chapter reviews the currently available methods of forest valuation.

Transaction Based Approach

BACKGROUND

The transaction based approach involves the analysis of market transactions. It is the theoretically correct procedure to estimate market value for a forest. However there are often practical difficulties.

The New Zealand market for forests generally violates the perfect market in which large numbers of willing buyers and sellers enter transactions where identical goods are being exchanged. Consequently the transaction evidence for forest sales should be interpreted with some caution.

However, despite this, available transaction evidence should always be considered and, where appropriate, used in the valuation of a forest.

ANALYSIS OF SALES

The value of a forest can be estimated by an analysis of transaction information. The analysis essentially involves an interpolation or extrapolation of the values of past sales to the forest of interest.

Even if forest value is not inferred from past transactions it can be possible to infer other relevant factors from sales. For example, implicit discount rate or log price assumptions may be estimated from market transactions.

An example of an analysis of sales is the work of Manley and Bell (1992) in developing a relationship between the prices paid for the State plantations sold in 1990 and their underlying characteristics.

PRACTICAL DIFFICULTIES

There are often practical difficulties, not unique to forestry, in obtaining transaction evidence, in analysing it and in extrapolating it to the target forest:

i) **Heterogeneous forests**
No two forests are identical. They may differ in terms of maturity, distance to market, species composition, terrain, site productivity, past silviculture and other factors which will influence their value. Therefore it will generally be difficult to find a recently-sold forest which is directly comparable to the forest of interest.

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ii) Point in time

Prices provide market information at a particular point in time. They must be interpreted with caution when subsequently used because underlying market conditions may have changed.

iii) Illiquid market

There are relatively few buyers in the market particularly of larger forests and of immature forests. Some sales may be forced (e.g. liquidation, matrimonial property split) and may not reflect a willing seller situation. Consequently they might not represent market value (as defined in Chapter E2).

iv) Scale

There are limited transactions involving large forests, for example, of the scale of the Central North Island estates.

v) Strategic factors

Transaction evidence may incorporate strategic factors such as the wish to enter or exit a region, complementary age-class distributions, the provision of access or vertical integration opportunities. These can cause difficulties in extrapolation to the target forest.

vi) Intangibles

In some situations the price paid for a forest may reflect factors other than the crop and the land on which it is growing, e.g. Waahi Tapu, aesthetics.

vii) Lack of publicly-available information

Forest sales information is often not available either for confidentiality reasons or because the forests represent one component of a "bundled" sale involving other significant assets. To be useful, disclosure is required not just of price but also the forest characteristics noted in (i) above.

Cost Based Approaches

INTRODUCTION

Cost based approaches involve the accumulation of costs to provide an estimate of value. Cost based approaches to valuation have had appeal because of:

- A preference in some cases to value young stands on the basis of replacement cost rather than on future expectations.
- The influence of accounting practice and the concept of objectivity.

The fundamental weaknesses of these approaches is that cost generally does not equal value. As noted by Davy (1987) a "high" cost forest does not necessarily reflect a "high" value forest and conversely a "low" cost forest does not mean a "low" value forest.

HISTORIC COST METHOD

The historic cost method equates forest value to the sum of the historic costs incurred in developing it. Variations of the method occur over:

- What are classified as development costs.
- Whether maintenance costs are accumulated.
- Whether interest costs associated with the debt-financing of the forest are accumulated.

Characteristics of the method are:

- There is no adjustment for inflation.
- Costs relate to the technology of the time in which operations were carried out.

CURRENT COST METHOD

The current cost method accumulates the inflation-adjusted costs incurred in developing a forest. It has received limited application because of the lessening interest by the accounting profession in current cost accounting concepts.

CURRENT REPLACEMENT COST METHOD (cost compounded method)

In the current replacement cost method, stand value is calculated as the sum of costs compounded forward from the time of occurrence to the present day. Costs are generally expressed in current day dollars. In addition, standard costs, representing current efficient practice, are generally used for each operation.

The current replacement cost approach is similar to the current cost approach when the latter includes the accumulation of interest charges. The difference is that the compounding rate used in the current replacement cost approach represents the opportunity cost of capital as distinct from the interest rate on borrowed funds used in the current cost method. As noted by Liley (1994) "whereas the accountant's preference is to recognise only actual, tangible financial charges against the forest, the economist is prepared to recognise a notional cost of capital".

The current replacement cost approach has some economic underpinning. "Its claim to validity rests on the assumption of rationality on the part of the investor. It assumes that an investor would not willingly put money into a project without a reasonable expectation of at least getting it back". (Fraser et al. 1985).

Its application to very young stands has reflected a view that "this method is most relevant in the initial development stages prior to future revenue being ascertainable" (Davy, 1987).

A specific limitation of the method is the need to determine an appropriate compounding rate. Often a conservative rate has been adopted. For example, a lower rate has often been used for compounding costs compared to the rate used for discounting future revenues.

Under very specific circumstances the value of a crop estimated by the cost-compounded method will equal that estimated in the expectation method by discounting future cashflows. This is when the same cost, revenue and discount rate assumptions are used, taxation is excluded, and a notional land rental is charged in both cases, based on the Land Expectation Value (LEV). This equivalence was noted in 1849 by Faustmann.

Immediate Liquidation Approach

STOCK VALUE OR CURRENT REALISATION VALUE

In the immediate liquidation approach, forest value is calculated by determining the stumpage value of standing merchantable volume. The underlying assumption is that all merchantable stands in the forest can be liquidated immediately and sold at current stumpage prices.

Young immature stands are assigned zero value. The approach therefore generally gives a conservative value.

Characteristics of the method are:

- The assumption that a forest could be liquidated immediately without influencing stumpage prices is unrealistic except for very small forests.
- Assigning young stands which are not currently merchantable a zero value is also unrealistic.
- No account is taken of the future value increases brought about by tree growth or of the investor's time preference for funds.

Expectation Approaches

NET PRESENT VALUE (NPV) OR DISCOUNTED CASHFLOW (DCF) APPROACH

Under the expectation approach future wood volumes are forecast based on some underlying management and harvesting strategy. Log volumes are multiplied by log price to give forecast revenue. Costs are subtracted from these revenues to give future net cashflows. These are discounted to give forest value. Variations of the expectation approach arise depending on whether

- A single rotation or perpetual rotations are assumed;
  or
- The framework of an estate or a stand is adopted.

There is an economic school of thought that suggests that the replanting decision in forestry should be treated as a separate investment decision. Therefore forest valuation should only capture the value of the existing crop.

An alternative viewpoint is that a forest should be valued on the basis of a going concern. Accordingly the value of a forest should capture not just the value of the existing crop but also the value of subsequent rotations. In point of fact, if land rental is based on LEV, the crop values estimated under either the assumption of a single rotation or that of perpetual rotations are identical.

A characteristic of the expectation approach is that it uses price information from markets in which transactions are frequently occurring i.e. the log market. Whereas the market for forests tends to be thin, there are regular transactions in the log market. The disadvantage is that the log market of interest is that of the future.

Other features of the expectation approach are that it:

- Requires future woodflows to be forecast and future log price assumptions and cost assumptions to be made.

- Requires the determination of an appropriate discount rate.

ESTATE BASED EXPECTATION VALUE

The estate based expectation approach values the forest as a single entity. The net cashflows of the total estate are forecast and discounted to give forest value. These cashflows are associated with an underlying management and harvesting strategy which applies to the whole estate. The strategy varies depending on:

- Assumptions or constraints placed on the level of harvesting. At one extreme, the harvest might be unconstrained with each stand harvested at its optimum rotation age. At the other extreme total harvest (and harvest by log grades) might be constrained to be non-declining.
- Assumptions about the intensity of silviculture.
- Assumptions about replanting.
- Assumptions about new land planting.

STAND BASED EXPECTATION VALUE

This approach values a forest as the sum of the values of each individual stand. The net cashflows of each stand are forecast and discounted to give stand value. As for the estate-based expectation method, assumptions are made about the underlying management and harvesting strategy. The strategy varies depending on:

- Rotation age - the optimum rotation can be assumed or the rotation may reflect expectations about when the stand will be harvested to fit in with broader estate considerations.
- Silvicultural regime.
- Replanting - typically the assumption of no replanting is adopted in the stand-based expectation method.

Note:
Given the same set of assumptions the stand-based expectation method will give the same forest value as the estate-based expectation value.

USE OF IRR AS THE DISCOUNT RATE

Use of expectation methods requires a discount rate to be determined. A variation of the stand-based expectation method, which has been used in the past, sets the discount rate equal to the Internal Rate of Return (IRR) of the investment which would have applied at the time of establishment of the stand.

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The argument for using this approach is that the value of a forest (e.g. for insurance compensation purposes) should reflect the rate of return expected at time 0.

Use of the IRR as the discount rate ensures that crop value equals zero at the time of planting and equals the net standing value at the time of harvest. However the approach violates the economic principle that past costs are sunk and irrelevant to present decisions.

Another criticism is that the IRR is, by definition, internal to the investment, whereas the appropriate discount rate should represent the opportunity cost of capital reflecting the rate of return available in alternative (external) investments.

Option Pricing Approach

ABILITY TO CHOOSE WHEN TO HARVEST

Dixit and Pindyck (1994) developed an options approach to investment to deal with the situation where there is the ability to delay an irreversible decision. They use option pricing to value the situation where an investor has the right but not the obligation to make an investment.

The use of option pricing theory for forest valuation has been suggested (Hughes 1987). A forest owner has the option of when to harvest a stand. In theory the owner has the option to halt log production when prices are low and increase production when prices are high. Longley et al. (1993) suggest that the ability to defer the harvest has a value which is not captured by the expectation approach. In the forest option model of Hughes (1987), forest value is a function of future harvest volume, future harvest cost, current stumpage value, stumpage price volatility (i.e. variance), the time to harvest, and the discount rate. Hughes (1997) used this option pricing methodology to value the forest assets that Forestry Corporation of New Zealand sold in 1996. He estimated, using a discount rate of 7.5%, that the option value was $2.075 billion compared to a NPV of $1.804 billion. The implication of this is that there was an additional value of $271 million associated with harvesting options which was not captured by the expectation value approach.

Although attempts have been made to value forests using option pricing theory, the Working Party is not aware of any routine practical application. However there are ongoing developments in this area which have potential application in the future.

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