Negative and low LEVs – their nature and attendant problems of analysis

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1.0 Introduction

Land Expectation Value (LEV) provides a measure of the profitability of a forest investment on bare land. LEV is the present value of perpetual rotations on the land, land being bare of the crop at the commencement of the series. It represents the maximum price a buyer should be willing to offer to purchase bare land in order to achieve a required rate of return in a forestry land use, assuming that the use continues in perpetuity.

Under certain combinations of yields, log prices and discount rates the LEV of forestry on a particular site can be low, certainly less than the Land Market Value (LMV). This paper analyses this situation within the context of the NZIF Forest Valuation Standards. It discusses the practical consequences for the owner of a crop on such land and the assumptions that should be made when the crop is valued.

1.1 Occurrence

LEV is less than LMV (LEV may be positive or negative) when the forest project discount rate chosen is greater than the projected forest opportunity can bear. I.e., an investor could not afford to pay the LMV for the land and still make the required rate of return.

If total rotation revenues exceed total rotation costs, there will be a positive LEV (and possibly LEV > LMV) at some lower discount rate. If total rotation revenues are less than total rotation costs, LEV will always be negative at any positive discount rate.

LEV is an economic construct with only a tenuous relationship to the market value (LMV) of land. The LEV number is an indicator of economic land value in a given land use and has utility in valuation and economic analysis of crops placed on the land. It is not of itself an indicator of the value in exchange of the land or an analysis of crops placed on the land. It is not of itself an indicator of a rational course of action to take with the crop on the land.

A special case of LEV is calculated in a forestry valuation context. Here the projected costs and revenues are those that generate the optimal financial return on the land at the required discount rate. This LEV is the highest that can be assumed in a forestry land use. The following discussion relates to this valuation LEV but is also valid for LEVs calculated for forestry projects that may not be optimal.

LEV analysis gives rational messages whether the LEV number is positive or negative, namely (each case excludes the preceding case):

1. If LEV > LMV “this land is capable of meeting the desired return under forestry and the indicated LEV of the land exceeds its current market value”. (CASE a. STANDARD B12.1)
2. If LEV > 0 “this land under forestry has some value at the desired project economic return”. (CASE c. STANDARD B12-1)
3. If LEV < 0 “this land under forestry does not indicate positive value at the desired project economic return”, or, alternatively, “to make the desired project economic return on the trees the land has to be accorded a negative value”. (CASE c. STANDARD B12-1).

1.2 Is negative LEV a valid and useful concept?

Is a negative LEV a consequence of limitations or aberrations in the method of analysis or is negative LEV a useful concept that describes an actual phenomenon?

It is pragmatically evident that bare land without encumbrances never changes hands at a negative value (that is the vendor would pay the purchaser to take it, LMV < 0). LEV may erroneously be taken as a calculated counterpart to LMV, and as negative LMV is never seen in practice, negative LEV is therefore regarded as an aberration. However LEV is a constructed number with no necessary relationship to the LMV based on market transactions and the objection on these grounds is not valid.

1.3 Recognition of subsidy in costs and revenues

Low and negative indicated LEVs are likely to arise where the uneconomic nature of the forestry investment, regarded strictly from a production forestry viewpoint, is already evident. Examples are protection forests and recreation/amenity forests. Where (say) protection subsidies are actually paid or income is achieved from these other uses, the value of these subsidies can be adjusted in the calculation of the LEV to give a “production forestry LEV”. The subsidy would need to be of a substantial nature and able to be separately identified to be handled in this way. The costs and revenues handled in the commercial tree valuation would remain at commercial forestry levels. If the element of subsidy is negligible or bundled in other forest costs the subsidy is best handled as a by-product. “LEV” in this paper refers to “production forestry LEV”.

1.3.1 Fluctuating LEV

Forest crop investment is by nature a long-term enterprise with high entry costs and a limited time window in which to exit. Calculation of the LEV through the life of a crop on the same site at then current costs and prices and at a constant discount rate will show fluctuation in LEV, perhaps to the extent of

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1. See Forest Valuation Method, Page B12-7 Land Expectation Value “NZIF Forest Valuation Standards”.
2. See Forest Valuation Method, Page B12-7 Land Market Value “NZIF Forest Valuation Standards”.
3. STANDARDS refer to the valuation standards in NZIF Forest Valuation Standards.
4. Recognition of negative LEV is not new, see for example “Economics of Plantations” W.E. Hiley, 1956, page 52.
5. See Guidance Notes on Other Forest Revenues, Page B12-19 “NZIF Forest Valuation Standards”.
6. That is exit by logging and land sale, sale of a forestry project is in this context a transfer, not an exit.

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fluctuation between an LEV comfortably above LMV and a negative LEV. The purpose of the LEV calculation may indicate whether current costs and revenues or longer-term averages should be used. An LEV calculated at mid rotation from current cost and return levels indicates a situation, even if the message may not be capable of being acted on at that time.

Where a planting subsidy is available to the person establishing the forest, as noted above, the production forestry LEV should recognise the subsidy. For any subsequent purchaser the analysis of production forestry LEV will be a lesser level dependent on the level of subsidy still available. The central idea is that LEV does not attach to land but to the economic opportunity available on that land and LEV will vary as the future economic opportunity varies with time and circumstance.

1.4 New forest or existing forest

If a proposed project contains cost/revenue assumptions close to (but not more favourable than) the optimal LEV assumptions, and the forest project has not purchased the land, the practical consequences of LEV being below LMV are clear. The project is not economically feasible and should be cancelled if some cross subsidy to some other economic activity or other related forest project cannot be imputed. If the land has been purchased and the final assumptions do not support an LEV close to LMV then the bare land may be sold at the LMV.

If the LEV of a current forest project (i.e. the trees are planted) calculates as less than LMV under current assumptions then the implications for the analysis of crop value and the practical consequences for the forest owner are not so obvious or as easy to apply.

1.5 LEV less than LMV – Practical consequences for an existing crop owner

So far in this paper the assumption has been that the LEV has been analysed for a “project”, that is a forest with recognisable boundaries and a commercial entity able to be sold as a unit. If the forest project is in place, and the rate of return requirements are firm, and the future costs and revenues are “believed” to be the best achievable and LEV<LMV, then exit from the continuing forestry project is indicated.

For a large scale bounded project these costs and revenues are those calculated by usual means. For smaller areas more or less integrated into an existing estate the costs and revenues applicable should be those marginal to an exit decision. This is discussed further in section 1.5.1. There are other barriers to an economic exit, and these are discussed in section 1.5.2. It may be that the only feasible option is to retain the forest area in question, as discussed in Section 1.5.3.

Possible exits are “sell the land now”, “sell bare land when the existing crop is felled”, “run the investment down” or “sell the project at the most favourable time”. An exit analysis will probably consider all of these elements with the rational aim being to maximise the expectation value by the chosen strategy. Sale of the whole project at a fair price is essentially a transfer of the current economics to a new owner and a crystallisation of the profit or loss to the existing owner.

1.5.1 Costs used in analysis of integrated areas

The costs and revenues applicable to a “Hold or Quit” decision for part of an otherwise integrated forest, should be the costs and revenues marginal to the vendor’s whole forest enterprise if that part is sold. These numbers are difficult to calculate. Normally forest costs and revenues as recognised in typical record systems are averages over larger areas and/or contain costs allocated to area by more or less arbitrary methods.

Marginal cost savings in “Quit” situations are typically much less than average costs of continuation in the context of a larger forest. Improving the economics of the remaining forest by selling relatively small areas of estate is therefore unlikely in practice. The calculated marginal LEV of a stand may conceivably be positive while the LEV based on average recorded costs is negative.

1.5.2 Barriers to exit

There may be financial factors that act as barriers to a transaction. New Zealand tax rules mean that the vendor’s taxable profit on sale is calculated as the price achieved less the historic costs of establishing the plantation. The purchaser however is not able to claim the plantation purchase price against current tax, but may only claim it when the plantation is felled or sold. The tax burden is not complementary as between the vendor and the purchaser. To achieve a sale the burden of tax must therefore be met by, either the vendor accepting a lower after-tax consideration, or the purchaser paying a higher price than initially indicated. This situation is highly likely to prevent the after-tax pricing envelopes of the vendor and purchaser overlapping.

Other practical factors limit the economic shedding of small areas. Land subdivision requirements, access to the parts of the forest to be retained, succession of age classes, new fencing, borrowing security arrangements, work continuity and many other possible effects should be considered.

Not the least difficulty is finding a buyer. In the examples of forest sites selling at far above forestry LEVs contained in section 1.7, the sale initiator has probably been the buyer. It would be rare for a forest owner to initiate a sale solely on grounds of LMV>LEV.

It can be speculated that a practical forest estate contains different sites where the LEV calculated from the future of the crop existing on each site ranges from

7 Imputed subsidies are not actually paid and for this reason should thereafter not be included in any analysis. Continuing imputation of subsidy suggests that the subject forest is not a commercial proposition.

8 Each party will quite rationally seek to carry out the transaction at a price that is not fair to the other viewed from that party’s standpoint. This may be an expression of different perceptions of the future values involved or differing circumstances applying to each party.

9 This is a simplification as there will be instances where this calculation is modified by other tax effects. However the proposition that tax paid by the vendor at the time of the (sale) transaction is more than the tax able to be claimed by the purchaser at the time of the (purchase) transaction will generally apply if the trees are sold as assets.
negative to highly positive. Separation into discretely defined LEV classes is difficult and even after this separation the results are not likely to have relevance in all circumstances. LEV can be a useful guide to choosing between regimes on particular sites within an estate but it is unlikely to be a final answer without a great deal of intricate, speculative and expensive analysis. The conclusion is that LEV is a difficult tool to apply in micro-analysis situations.

1.5.3 Uneconomic areas are often retained and managed
A typical management response to the difficulties in recognising and acting on the true values of uneconomic areas, technically able to be separated or not, is to retain such areas in the estate. Replanting of cutovers on land known to be “uneconomic” by conventional analysis is not necessarily an irrational decision as it should be considered in the context of the whole estate and of the simple practicalities of not being able to shed joint costs and the potential costs of not managing the area in question to some degree. Such decisions are possibly immaterial as to cost when considered in the context of the whole estate. Continued ownership of an area of established trees not making an economic return is probably preferable to paying rates on an unsaleable piece of land covered in weeds and which is a fire hazard and an eyesore.

1.5.4 Sell the project now
A buyer is required who has a more favourable view of perpetuity future costs and revenues and/or lower expectations for the rate of return than the vendor. If such a buyer is found then exit will increase the vendor’s currently calculated wealth by replacing the forest and land with cash. Although a sale in this situation may be thought unlikely, it does happen as perceptions of future costs and (particularly) revenues are different from party to party and the setting of the valuation is different. A different setting might be that the vendor has general market prices in mind whilst the buyer has a utilisation intention in mind of the land. The features of such a future sale cannot be reflected into the vendor’s valuation projection of course.

1.5.5 Run the investment down
This will involve a reduction in silviculture and general estate maintenance expenditure. If tending has some value marginal to cost at the chosen discount rate, ceasing tending will not increase the expectation value. It is erroneous to assume the forest to be analogous to a capital asset of declining exploitation potential and value and therefore minimising future investment in it. Reduction in spending is a popular strategy however that relates to funding more profitable in preference to less profitable opportunities when funds are limited. In the analysis methods used here, funds are always assumed available and their use is solely dependent on meeting a desired discount rate threshold. It is therefore axiomatic that the funding levels are optimal and increasing or reducing expenditure will reduce returns to capital.

1.5.6 Sell bare land or hold on?
Removal of the existing crop and sale of the bare land is often seen as the most feasible alternative to forest ownership of uneconomic forests in perpetuity. However immediate liquidation and exit at young tree ages may not be more economically rational than a future liquidation and exit. This is a choice between the highest discounted market value of the stumpage plus LMV (less costs) at all future ages and the current value of the stumpage plus LMV.

The Terminating Forest Expectation Value ("TFEV") is the present value of stumpage plus LMV at rotation age (less costs). “Hold” is indicated where any future value is higher than the current value. The analysis would be carried out for all areas where LMV > LEV using data consistent with that used in the calculation of marginal LEV, as discussed in section 1.5.1.

It is likely that at younger ages the rational course is to scrap the trees, sell bare land and quit the investment. Past mid age the value increase of the trees will probably exceed the discount rate at some point and the rational course is then to retain the trees to the culmination of the rotation and then sell bare land.

1.5.7 Sell bare land decision may not mean that the forestry land use is discontinued in practice
There is a certain irony in the fact that bare land sold by reason of perceptions of uneconomic forestry use may be replanted by the new owner under different value parameters. However change of land use is implied in a bare land sale analysis, that is, the unsatisfactory forest perpetuity (LEV) is replaced by a LMV predicated by a more profitable land use.

For land with a young crop, it may be that the existing trees will have a value to the new owner as rotation growing stock and physical removal of the trees will not take place. The desirability of the hold or quit decision should however be analysed with a tree removal assumption in place as the sellers “upset” valuation for the sale.

A further practical consideration is that the bare land buyer must be found at the right time. Even if the rational intention is to sell bare land, retention and replanting is not unusual by application of the pragmatic approaches described in 1.5.3.

1.5.8 Stumpage is calculated back to bare land
Stumpage value is calculated inclusive of salvage and clean up costs. A crop will have positive stumpage value where the crop is merchantable and the sale value of the logs exceeds the harvesting costs and site clean up costs. The greatest negative stumpage will occur where the trees have no sale value and the cost of removing them from the land is highest – for radiata pine in New Zealand this may be at about age 8 years. At very young ages negative “stumpage” resolves itself as the cost of pulling out the trees and clearing up the site ready for land sale.

See Forest Valuation Method, Page B12-2 “NZIF Forest Valuation Standards”

The “upset value” is the minimum price at which the seller would let a sale take place.
1.6 Crop valuation where forestry LEV is less than LMV

LEV < LMV relates to uneconomic long term forestry on that land and indicates a future change in land use. How should the crop on such land be valued?

1.6.1 Small integrated areas unlikely to be sold

A pragmatic approach for valuation purposes is to amalgamate these with other more economic areas and use weighted average costs and revenues. Conventional perpetuity analysis applies thereafter. This situation tacitly occurs in many practical valuations. The upper limit of “small” is by judgement of materiality and is not likely to be more than 5% of the total forest area.

1.6.2 Separable areas unlikely to be sold

The crop should be valued assuming felling and quitting of the land at the rotation age. This value will be no higher than determined by “Hold or Quit” analysis, and may be less at younger crop ages. The reporting rationale here is that the holding strategy is not as favourable as a quit strategy to the ownership. The best time to re-consider the decision is at felling time.

1.6.3 Separable areas likely to be sold

Value crops at the highest crop value indicated by a “Hold or Quit” analysis (see section 1.5.6) for one rotation. Some test of the intention to sell and the practicality of making a sale should be noted to distinguish the case from 1.6.2 above.

1.6.4 Negative LEV on very low LMV land

This circumstance can be found where a woodlot has been established on a part of a property that is of marginal quality. The land itself is unsuitable for cropping or grazing and adds nothing to the value of the farm and, for practical reasons, is not able to be sold. The forestry opportunity returns very little or is negative.

The major difference to the situation outlined in 1.6.1 is that no other adjoining forest is available to “absorb” the economics of the woodlot. The existing trees may clearly have a value — how should the value be assessed?

In this situation the economics of the land input to the growing opportunity are irrelevant. Questions that can be answered by analysis are limited to “should we replant” and “when should we quit forestry” and the analysis is similar to that in 1.6.2 above. These analyses should be undertaken with a nil land value (LMV). These decisions tend to be made ‘irrationally’ from a forestry perspective and the LEV is therefore irrelevant. The question of the value of existing trees is best answered as a growing stock valuation.

1.7 Some actual events

1.7.1 Young trees pulled out

Young trees, age about four years, were pulled out from sites in Gisborne / East Coast and the land reverted to grazing in a “quit forestry” situation. This implies in terms of forestry analysis that at crop age four:

\[(\text{LMV} - \text{cleanup costs}) > \text{LEV}\] and implies TFEV (at rotation age) < (LMV-Clean up costs).

1.7.2 Young trees felled before maturity

Trees, age about 20 years, younger than rotation age, were logged from sites in Marlborough and the land then planted in grape vines. This implies that at crop age 20: \(\text{LMV > LEV}\) and

\[\text{TFEV (at age 20)} > \text{TFEV (at rotation age)},\] or perhaps that the LMV component of TFEV (say $10,000 /ha at time of sale) is seen as not reliably available at rotation age 20.

1.7.3 South Waikato forest land reverts to farming use

On felling at rotation age the land was sold to a farmer. Interestingly the successive land uses were: native bush, circa 1890 farming, circa 1925 radiata pine forest 2 rotations, circa 1997 farming. This implies that before felling age:

\[\text{TFEV} > (\text{Calculated net Stumpage} + \text{LMV})\] at any year before felling,

and, immediately after felling that \((\text{LMV-Clean up costs}) > \text{LEV}\).

1.8 Other aspects of LEV analysis

1.8.1 No trees ever sold at a negative price

Some forests have been sold bundled with other asset types or other forests where analysis has shown negative tree values. This is particularly the case where the sale is distressed (i.e. receivership or bankruptcy) or where a legal entity containing the forest assets is sold. It is difficult to unbundle assets and companies and such analyses may merely reflect that another asset in the bundle has been accorded a price by the buyer well above that placed on it by the seller. The case in reverse applies to bundled liabilities. A similar effect is that negative goodwill accorded to the assets or entity on sale is not reflected in the buyer’s analysis.

No case has been recorded which reliably shows a willing and reasonably informed seller in an asset transfer receiving a negative value that devalues the value of land plus trees below LMV in the transaction. This experience is supported by the classical Faustmann conclusion “that land value remains the same, whether the area carries a stand or not, whatever the age of the stand, and no matter whether it is fully stocked or abnormal”.

This situation should be distinguished from that in 1.7.1. In that case the buyer is not buying “land plus trees” at all but land on which there is an impediment to his intended land use. It is the level of the LMV that is affected, and the LEV with forestry as a land use is not an issue. The situation in 1.7.1 applies in a Forestry Quit situation.

1.8.2 Apparently Suboptimal Investment

It is generally assumed that the rational forestry investor will look at all types of forest investment in all possible locations and choose the location showing the best economic return. The best return implies that only one combination of crop, regime, rotation and location meets this expectation. The assumed model does not explain why adjacent and similar land will in practice attract different investment strategies in trees, and why investment does not crowd onto the most economic land.
The scope of forest models and the assumptions made in them are necessarily conventionalised and limited. It is unlikely that every investor adopts similar assumptions or conventions. Just as an investor does not look at all possible investments in all parts of the world in order to choose the one with the highest IRR, the forest investor may not want to locate in all possible areas and may have a limited range of species and end produce in mind.

Actual practice will in many respects appear to be suboptimal or even irrational as measured with the conventional economic model. The problem of fitting actual economic events to a conventionalised economic model is pervasive and certainly is present in forest value analysis. That events do not follow the market value model is therefore to be expected.

An example has arisen in recent years where large areas of land have been planted in Douglas fir in the South Island at lower rates of return (probably) than can be shown available for radiata pine planting on better sites elsewhere. Some factors emerge:
1. Douglas fir probably shows a higher return on the South Island sites than any other land use at all discount rates and can therefore acquire that land (LEV_{forestry}>LEV_{highest other use} at all discount rates).
2. The return for Douglas fir on these sites is possibly the best world return rate for the species.
3. Douglas fir is reckoned to be a lower risk investment than radiata pine and the rates received are equally acceptable when crop risk is considered.
4. The investment is predicated by Douglas fir as the species (just as an investment search in forestry excludes the consideration of retailing investments).
5. The land is cheap – land is a smaller component of the investment than other forestry investments.

Points 1, 2, 3 and 4 make a less than maximised analysis rational for the project. Point 5 makes project analysis less concerned with land economics per se. Point 6 makes investment at a lower rate possible.

If the factors above are appropriate a valuation at the discount rate as analysed along conventional lines would be appropriate but the choice of discount rate would need full discussion in the valuation. If Douglas fir (point 1) is evidently not the best land use and (say) a more profitable radiata pine investment is feasible on the site then the analysis should be made at the higher discount rate and the lower crop values should be recognised. If the site is economically or technically unsuited to radiata pine then the lower indicated discount rate should be adopted to calculate a market value.

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**Tropical forest valuation**

**Received from the Center for International Forestry Research (CIFOR)**

Forests provide huge benefits. Besides supplying wood and other products, they store a vast amount of genetic information, regulate the climate and the flow of water, protect and enrich soils, control pests and diseases, pollinate useful plants and disperse their seeds, safeguard water quality, offer beautiful landscapes, and enrich us spiritually.

Forests can also create significant costs. Each hectare of forest is one less hectare farmers can use for crops or livestock. Forest animals can become pests. Forests compete with other activities for water.

Many people believe economic techniques can tell us when the benefits of forests outweigh the costs and which forest to clear and which to protect.

Robert Nasi and Sven Wunder of CIFOR and Jose Joaquin Campos from CATIE are not fully convinced. In “Forest Ecosystem Services: Can They Pay Our Way Out of Deforestation?” they argue that in many cases we still know so little about the specific services forests provide that attempting to assess their value in a particular location would take us into the realm of science fiction. They point out that different economic valuation techniques often generate quite distinct results.

In any case, figuring out how much a forest is worth is not enough. To conserve them, someone has to give the people that want to clear forests a real incentive not to do so. That will often require paying them, either because they effectively control the forestland or because they have political influence. Creating protected areas and eliminating perverse policies that encourage people to clear forests are important, but they can only go so far.

Valuation efforts can contribute most by determining how much one would have to pay different groups to get them to maintain land under forest. That is more relevant than trying to come up with some theoretical figure about the forest’s “value”. Schemes to pay for environmental services should focus on those forests that are under threat but where small payments would be sufficient to keep them from being destroyed.

Of course, it is nice for policymakers to see the value of forests. But for most people who would like to clear those forests the bottom line is “show me the money”. Good research can contribute a lot to figuring out how to do that.

Request free electronic copies of Nasi and Wunder’s paper from Le vanity Santoso (l.santoso@cgiar.org).