Agricultural finance Lecture 7 Capital Budgeting

Rodney Beard

November 15, 2016

Annuities

Present value of an annuity is

$$A_{PV} = P\left(\frac{1-\left[\frac{1}{1+i}^{n}\right]}{i}\right)$$

Deriving the annuity from the present value formula (see appendix)

Future value of an annuity is

$$A_{FV} = P\left(\frac{(1+i)^n - 1}{i}\right)$$

Loan payments

$$\text{Loan payment (P)} = \frac{A_{PV}}{\left(\frac{1-\left[\frac{1}{1+i}^{n}\right]}{i}\right)}$$

Amortization

How long until the loan is paid off?
Amortization schedule:

Year	Beginning balance	Payment	Interest	Principal	Ending balance
1	42500000	499203	425000	74203	4175797
2	4175797	499203	417580	81623	4094174

Loan balance:

$$= P\left(\frac{1-(1+i)^{-(T-t)}}{i}\right)$$

- T is the maturity of the loan
- t is the current date

Interest paid

$$\begin{array}{c}\text{Interest paid}\\ \text{within a period}\end{array} = \begin{array}{c}\text{Total payments}\\ \text{within a period}\end{array} - \begin{array}{c}\text{change in}\\ \text{loan balance}\end{array}$$

NPV - including financial flows

$$NPV^* = I_0^* + \sum_{t=1}^{T} \frac{R_t - P_t}{(1+i)^t}$$

I_0^* is investment net of loan amount.
However as he notes this confounds cash-flows which seems intuitively obvious. So don't do it this way.

NPV and the price of farmland

Farmer purchases asset as long as NPV ¿ 0.
So

$$\text{Bid} = \sum_{t=1}^{T} \frac{R_t}{1+i}$$

this depends a little on the way land is marketed. The bid might differ under different auction rules.
for infinitely lived assets, then

$$V_t = \frac{R_t}{i_t}$$

Growth in returns to farmland

$$V_t = \sum_{t=1}^{\infty} \frac{R_{t+\pi})(1+g)^{\pi}}{[(1+\tilde{i})(1+\pi)]^{\pi}}$$

In present value terms we get

$$V_t = \frac{R_t}{r+i-g}$$

Stochastic NPV

Recall the comments about real options

$$NPV_j = -I_0 + \sum_{t=1}^{T} \frac{R_t + \xi_{it}}{(1+i)^t}$$

some comments in the text about Excel not being able to generate normal random variates are incorrect so ignore them. The suggested fix is also not a good solution even if this were true.
An alternative formulation is also suggested

$$NPV_j = -I_0 + \sum_{t=1}^{T} \frac{R_t + \sigma_R \xi_{it}}{(1+i+\sigma_i \xi_{it})^t}$$

This is used if you have multiple draws over time. Be aware of the typo.