Articles

Deciding on the Worth of Agricultural Land

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The price farmers pay for farm land can be a critical determinant of the continued success or eventual failure of a farm business. A decision support model has been developed to make explicit the usually implicit assumptions about expected profitability, financing and debt servicing aspects of land purchase decisions. The model can be used to help the decision maker to identify offer prices for farm land which are probably sound and prices which are likely to be unsound.

1. Introduction

The ultimate risk to be managed by farm owning families is the risk of losing their livelihood, their equity and their way of life. When a farm business becomes illiquid and then insolvent and is sold up, it is most commonly found that the price paid for land in the expansion phases of the business, and the subsequent gearing of the investment, were too high, in the light of subsequent commodity prices, yields and interest rates. Decisions made about buying agricultural land were identified by rural counsellors in Victoria as the most common factor contributing to financial difficulties faced by many of their clients (Madden). In a study by Edwards of farms in financial difficulty in South Australia, all 13 farms had been expanded during the early 1980s and were on the brink of bankruptcy by the early 1990s. Earlier, Ripley and Kingwell had found that the farmers most likely to be in financial trouble paid high prices for land and had investments in machinery which were high relative to those farmers in stronger financial positions. While many factors combined to cause financial problems for farmers during the late 1980s (low commodity prices, high interest rates, poor seasons) it is highly likely that in many cases decisions about borrowings, asset valuations and investments exacerbated the situation.

To help answer questions about land value and financing arrangements a spreadsheet based decision-support model for analysing land prices has been developed[1]. In this model the implicit assumptions about future profitability and debt servicing ability, which form the basis of the land valuation and which underlie land offer prices, are made explicit. This facilitates judgments about how realistic are the key assumptions. For each particular case, land purchase prices and whole farm debt servicing ability can be identified which have an unacceptable chance of putting the sustainability of the business in jeopardy. The prospective buyers will then have a good idea when to stop bidding if they wish to continue farming.

2. Appraisal of Land Value

Theoretically, in a well-working market, assets with the same expected return, same risk profile, same tax implications and same liquidity would sell for the same price - if bought by the same person at the same time and if there were no non-economic considerations involved. Analyses based on models in which attempts are made to relate land value to factors such as required rate of return and expected net returns, whether constant or variable over time, including or excluding inflation, variable interest and tax regimes, including or excluding consideration of capital structure, tax structure, transaction costs and long term wealth objectives, almost always reach the conclusion that there seem to be even more factors affecting the final bid price for farm land (Clark *et al.*; Robison & Hanson; Bjornson; Bjornson & Innes; Just & Miranowski; Alston).

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[1] This decision aid, 'Land Price' is designed for use by advisers to farmers and other investors who are contemplating purchasing farm land. It can be used to identify prices for farm land which pass tests of common sense and reasonable expectation, and those prices which do not - thereby providing information useful to the decision about when to stop bidding so the buyer will not be forced later to stop farming.

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The value placed on land, like anything else, is based on economic criteria of expected return to capital (net income capitalisation and present value approaches, called 'should pay' measures); whole farm financial criteria (whole farm debt servicing ability after the land purchase, called 'could pay' measures); plus the hard to measure extras (convenience, family goals, lifestyle, tradition, amenity and so on). Taken all together these factors define how much someone 'would pay'. A useful decision model for assessing the value of land would combine the measurable 'should pay' and 'could pay' elements of the decision, and make explicit the conditions which would need to prevail in the future for land purchase at various prices to be sound (ie. not having too high a chance of sending the business bankrupt).

In asset valuation the required rate of return is a vexed question, and never more so than in the case of valuing farm land. The required rate of return, also known as the capital charge or cost of capital, is based on what the equity capital could earn elsewhere and what the borrowed capital costs (Johnson). The required rate of return in land investment is complicated by the issues of business risk and the return the investor would like to earn on equity, by the capital structure of a business which determines financial risk, by taxation and by the tax deductibility of interest. In terms of the cost of capital, the gearing of the business and the tax situation are very important. This compares with early suggestions that the relative proportion of debt to equity capital was of little consequence for the cost of capital of a firm (Modigliani and Miller 1958, 1963). Cost of capital theory has generally related to non-agricultural firms, where gearing ratios of one or more are found. In agriculture in Australia, highly geared businesses rarely exist, or if they exist they rarely persist. The cost of capital or required rate of return question in agriculture has to be considered in terms of farm firms which have at a minimum around 70 per cent equity. Generally at least 30 per cent of Australian farms have 100 per cent equity and another 40 per cent of farms have 85-95 per cent equity, plus considerable off-farm assets (ABARE Farm Surveys). For new entrants, equity will normally be lower.

The case for using the weighted average cost of capital in investment analysis has been well made (Barry *et al.*; Musser *et al.*). Risk adjusted equity return is subject to business risk, so return required on equity capital could be higher than the interest on debt - with perfect capital markets and without any 'non-economic considerations' (Johnson, p.12). As gearing increases, the operation of the principle of increasing risk (Kalecki), as well as internal and external capital rationing and transaction costs, ensures that the cost of borrowed capital and the weighted average cost of capital increases, albeit lowered to an extent by tax considerations, government underwriting of some business and financial risk, and efficiency gains from increased leverage. In agriculture the return required on equity is not simply defined in the Modigliani/Miller sense because 'there is not an efficient market for farm equity capital where the equity capitalisation rate can freely compensate for increased debt' (Johnson, p.13). The required rate of return on equity is affected by details of each particular case in question, the stumbling block of more general inquiries into the value of 'land'. For example the 'way of life' factor can mean farmers accept relatively low real returns to equity. In sum, the required rate of return in assessing land value is affected by the situation of potential buyers of the farm land, such as:

- The case where the farm land is a 'stand-alone' purchase of a farm business by an intending farmer or the farm land is an addition to an existing (complementary) farm business. For the latter, the net return to land, and return to marginal capital, will usually be higher than the return on total capital of the farmer. The buyer adding land to an existing operation can offer a greater price because of the effects of economies of size, including various complementarities of labour, risk, and capital.

- The case where a farm purchaser who does not intend farming on a fully commercial basis, but is purchasing with 'lifestyle' considerations paramount, and so may well apply a low required rate of return.

- The case where real annual capital gains are in prospect, most likely because of proximity to 'non-commercial' agricultural investors.

- The case where a non-farm business operator may look at farm investment as part of an overall portfolio of investments and require rates of return similar to those achievable elsewhere in the economy.

From a population of farm land buyers over time, some will buy well and others will buy badly. Some of these outcomes will be largely due to good or bad luck while some will be due to good or bad investment evaluation. The question arises: how are land purchase decisions currently analysed? Most commonly there seems to be a district consensus based on informal rules of thumb which have some basis in theory and fact regarding past and expected profitability (with the short term past frequently seen as a good guide to the long term future), and on recent sales which were based on similar factors. Around this consensus, the bidder in the strongest financial position and with the most optimism is likely to set the price as other bidders reach the limits of their debt servicing ability and their optimism, as determined by their expectations about interest rates and future prices. A scan of the current main farm management texts reveals that the literature is only of limited help to potential buyers of farm land. For example, two leading U.S. farm and financial management texts, *Farm Management* by Boehlje and Eidman (1984) and *Financial Management in Agriculture* by Barry, Hopkin and Baker (1983), and the Australian text *The Farming Game Now* by Makeham and Malcolm (1993), all offer variations on methods for assessing how much to pay for farm land, and each has limitations in their recommended approach. Combining the best aspects of these alternative approaches into a model which harnesses the power of the computer spreadsheet to explore scenarios, may result in a more theoretically comprehensive and practically useful method of valuing farm land.

From the preceding discussion, the following factors need to be taken into account when estimating how much to pay for farm land.

(a) The planning horizon relevant to the decision.

(b) Expected future costs and returns to be generated from the property.

(c) Cost of equity capital (required return on equity including risk).

(d) Cost of debt capital.

(e) Expected inflation.

(f) Taxation.

(g) Financing terms for borrowings.

(h) Whole-farm debt servicing ability.

(i) Capital required for machinery and livestock.

(j) Scope for development of the property.

(k) Expected capital gains if any.

(l) Expected salvage value of the land at the end of the planning period.

(m) Expected salvage value of machinery and stock at the end of the planning period.

In this research, an attempt has been made to combine the valuable aspects of these above-mentioned approaches into a method for assessing the value of farm land; a method which is comprehensive, yet operational. The whole farm approach is used. The cost of debt and the cost of equity are included explicitly and seperately to capture fully the phenomenon that the method of financing land purchase affects the value of the land to the buyer, as well as to incorporate fully the tax effects of debt finance on the ultimate worth of an investment. The effect of the method of financing is incorporated in a present value method of estimating farm land values. The aim of this land value model is to make it easier to identify prices which probably should not be paid, and thus assist buyers of farm land to avoid 'buying their way out of business' when the inevitable decline in profits and liquidity occur sometime later.

3. Approaches to Valuing Farm Land

Boehlje and Eidman estimate land value as follows:

$$V = \frac{R - E - L - I}{d}$$

where

V = property value

R = total cash farm receipts

E = total cash farm expenses

L = unpaid family labour

I = interest on non real estate capital

d = pre-tax nominal discount rate

This formula is often simplified to the following form:

$$V = \frac{a}{d}$$

where

a = net annuity earned from the farm (R-E-L-I)

d = pre-tax nominal discount rate

Further, Boehlje and Eidman adjust the capitalisation (or discount) rate by the expected growth in the value of the asset arising from an expected increase in the income stream generated by the asset. For example: Boehlje and Eidman cite the case of a potential buyer who has a cost of capital of 12 per cent. A 1 per cent risk premium is added to the discount rate and a 1 per cent 'non-economic benefit' is deducted. Finally a 6 per cent capital gain is deducted from the discount rate, giving a capitalisation rate of 6 per cent. With this income capitalisation approach expectations about changes in net returns to land in the future due to inflation or real gains, and thus expected changes in land values in future, are accounted for by adjusting the capitalisation rate. The attempt to account for capital gains by deducting the expected annual rate of gain from the capitalisation rate does not correctly allow for the reality that the annual percentage capital gain is a percentage of a different value each year.

Makeham and Malcolm use the discounted cash flow approach with a defined planning horizon including the walk-in-walk-out value of land, machinery and livestock. This allows expected inflation or capital gains over time to be considered (see Table 1). They use the traditional investment appraisal approach. That is, they estimate first the economic value of the land using the opportunity cost discount rate (which implies either a weighted average cost of capital is used, or the perfect capital market theorem is invoked and the cost of debt and equity capital is assumed to be the same), and then they assess the financial feasibility of the investment separately. This method does not take account of the fact that the method of financing the purchase itself affects the ultimate value of an investment.

In the above example the conclusion from this approach is that if an 11 per cent (nominal) annual return on the capital invested is required, and the other assumptions hold, then the investor should pay up to $494,914 for the property.

Barry, Hopkin and Baker analyse the effects of expected inflation and taxation on the value of land by using the discounted cash flow technique with a defined planning horizon. They do not make technical aspects of the analysis explicit and focus on land separately from the associated assets of livestock and machinery. But, their focus on how the method of financing the purchase affects the value of the land is extremely valuable to the decision process. The valuation formula used by Barry, Hopkins and Baker is:

$$NPV = -INV - \sum_{n=1}^{m} \frac{P_n + (1-t)\,I}{(1+r)^n} + \sum_{n=1}^{m} \frac{a(1+f)^n}{(1+r)^n} + \frac{V_m - C_m - D_m}{(1+r)^m}$$

where

INV = the initial investment or deposit

r = the after tax nominal discount rate

Table 1: Present Value Method of Land Valuation Developed by Makeham and Malcolm (1992)

Net 'Cash' Flow Year	0	1	2	3	4	5
Expected Inflation (4 per cent)	1	1.04	1.08	1.12	1.17	1.22
Annual Farm Income		$165,298	$171,910	$178,786	$185,937	$193,375
Expected land Salvage						$624,948
Expected Stock & Machinery Salvage						$103,433
Annual 'Cash' In	$0	$165,298	$171,910	$178,786	$185,937	$921,755
Land price	$494,914					
Stock & Machinery Capital	$154,000					
Total Farm Expected		$105,581	$109,804	$114,196	$118,764	$123,515
Annual 'Cash' Out	$648,914	$105,581	$109,804	$114,196	$118,764	$123,515
Annual Net 'Cash' Flow	($648,914)	$59,717	$62,105	$64,590	$67,173	$775,431
PV of Returns (@ 11 per cent nominal required rate of return)	($648,914)	$53,663	$50,153	$46,872	$43,805	$454,420
Net Present Value	$0					

P_n = the principal repayment in period n

t = average marginal tax rate

f = annual inflation rate

a = annual net return from the land

I_n = the interest payment in period n

V_m = the expected salvage value of the property at time m

C_m = the capital gains tax liability at time m

D_m = the debt outstanding at time m

3.1 A Summary of the Models

The models of land value examined so far have ranged from the simple income capitalisation method through to the Barry, Hopkin and Baker method which separates out the costs of finance from the cost of other capital invested. A summary of the features of the three models examined is given in Table 2. As shown in Table 2 none of the models examined include all of the thirteen key determinants of a realistic bid price which were outlined above.

Table 2: Features of the Land Value Models Contained in the Literature

	B&E	M&M	BHB
The planning horion for the decision		*	*
Cost of capital invested	*	*	*
Profitability/Productivity	*	*	*
Capital required for machinery and stock	*	*	*
Intended improvements to the property		*	
Expected inflation	*	*	*
Expected capital gains	*	*	*
Taxation liabilities		*	*
Financing terms for any borrowings			*
Debt Servicing Ability			
Salvage value of the property		*	*
Salvage value of machinery and stock		*	

4. A Comprehensive 'Should Pay' and 'Could Pay' Land Value Model

4.1 Should Pay

A starting point to developing a model which adequately covers more aspects of the land purchase decision than is generally the case is to build an investment budget. An example of such a budget is shown in Table 3. The expected net present value (NPV) of the investment is calculated as the difference between the expected annual net cash flow (NCF) after tax plus expected salvage value of land, machinery, stock and improvements, less the initial investment of equity capital, the repayments of principal and the after tax interest payments. If the NPV of the investment is positive, purchase of the land at the asking price represents a good investment as it is expected to earn more than the required rate of return (the discount rate). If, on the other hand, the NPV is negative, the expected returns do not justify the asking price at the required rate of return. Calculating the maximum offer price for land is then a matter of calculating the expected NPV of the net cash flows at the required rate of return for a range of possible land prices. If the expected NPV of the net cash flows at the required rate of return is zero then this means the price paid for the land is equal to the present value of the future returns plus the present value of any capital gains, minus the cost of having capital tied up in this investment instead of some other investment.

The required rate of return comprises the actual cost of debt capital and the required return on the equity capital after tax, risk and all the other considerations which help determine the annual rate of return a farmer is willing to accept from investing in a piece of farmland. Some of the business risk is included by adjusting the expected cash flows, and some of the business and financial risk makes up a risk premium component of the required return to equity. At the same time capital markets are not perfect - there is usually no equity market for farm capital, way of life factors can affect required rate of return and debt costs can range from being lower than they should be because of concessional credit, to higher than they should be if bank risk premiums are judged inefficiently or are not highly competitive.

In the following section an equation is derived which adequately represents the budget in Table 3, and enables calculation of the maximum price which could be paid for the property given the assumptions and the required return on capital.

Table 3:- Example investment budget for the purchase of agricultural land.

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	m
Annual Farm Receipts																	
Wool Sales		126,536	130,332	134,242	138,269	142,417	146,689	151,090	155,623	160,291	165,100	170,053	175,155	180,409	185,822	191,396	
Trading Profit		28,583	29,440	30,323	31,233	32,170	33,135	34,129	35,153	36,207	37,294	38,412	39,565	40,752	41,974	43,234	
Agistment		3,955	4,074	4,196	4,322	4,452	4,585	4,723	4,864	5,010	5,161	5,315	5,475	5,639	5,808	5,983	
Total		159,073	163,845	168,761	173,824	179,038	184,409	189,942	195,640	201,509	207,554	213,781	220,195	226,800	233,604	240,612	
Annual Farm Expenses																	
Crutching		2,833	2,917	3,005	3,095	3,188	3,284	3,382	3,484	3,588	3,696	3,807	3,921	4,038	4,160	4,284	
Jetting		1,545	1,591	1,639	1,688	1,739	1,791	1,845	1,900	1,957	2,016	2,076	2,139	2,203	2,269	2,337	
Lamb Marking		1,416	1,459	1,502	1,548	1,594	1,642	1,691	1,742	1,794	1,848	1,903	1,960	2,019	2,080	2,142	
Lamb Drenching		425	438	451	464	478	493	507	523	538	554	571	588	606	624	643	
Shearing		15,965	16,444	16,937	17,445	17,969	18,508	19,063	19,635	20,224	20,831	21,456	22,099	22,762	23,445	24,148	
Wool Packs		915	942	971	1,000	1,030	1,061	1,092	1,125	1,159	1,194	1,229	1,266	1,304	1,343	1,384	
Freight		1,654	1,703	1,754	1,807	1,861	1,917	1,974	2,034	2,095	2,158	2,222	2,289	2,358	2,428	2,501	
Wool Selling Fees		15,184	15,640	16,109	16,592	17,090	17,603	18,131	18,675	19,235	19,812	20,406	21,019	21,649	22,299	22,968	
Stock Selling Fees		2,073	2,135	2,199	2,265	2,333	2,403	2,475	2,549	2,626	2,705	2,786	2,869	2,955	3,044	3,135	
Overheads		62,029	63,890	65,806	67,780	69,814	71,908	74,065	76,287	78,576	80,933	83,361	85,862	88,438	91,091	93,824	
Total		104,038	107,159	110,374	113,685	117,095	120,608	124,227	127,953	131,792	135,746	139,818	144,013	148,333	152,783	157,366	
Net Cash Flow b/f Tax		55,035	$56,686	$58,387	$60,139	$61,943	$63,801	$65,715	$67,687	$69,717	$71,809	$73,963	$76,182	$78,467	$80,821	$83,246	
Tax Payable on Net Cash Flow		13,759	14,172	14,597	15,035	15,486	15,950	16,429	16,922	17,429	17,952	18,491	19,045	19,617	20,205	20,811	
Net Cash Flow after Tax (b/f Int)		41,277	42,515	43,790	45,104	46,457	47,851	49,286	50,765	52,288	53,857	55,472	57,136	58,851	60,616	62,434	
Purchasing Costs																	
Initial Investment	$400,000																
Debt Repayments		9,188	10,291	11,526	12,909	14,458	16,193	18,136	20,312	22,750	25,480	28,538	31,962	35,798	40,093	44,904	
Interest Repayments		30,828	30,001	29,075	28,038	26,876	25,575	24,118	22,485	20,657	18,610	16,317	13,748	10,872	7,650	4,041	
Capital Gains Tax																-	Cm
Debt Owing																-	Dm
Total Costs	$400,000	$40,017	$40,292	$40,601	$40,947	$41,334	$41,768	$42,254	$42,798	$43,407	$44,090	$44,854	$45,710	$46,669	$47,743	$48,946	
Expected Salvage Values																	
Land Salvage																$916,923	Vm
Machinery & Stock Salvage																$119,963	SCMm
Total Expected Salvage Value																$1,036,887	
Net Cash Flow	($400,000)	$1,260	$2,222	$3,189	$4,157	$5,123	$6,083	$7,033	$7,967	$8,881	$9,767	$10,618	$11,426	$12,181	$12,873	$1,050,376	
Net Present Value	($0)																

Pn

EC

(1-t) * In

NPVatcf = $429,724 @7% real before tax

As a first step to understanding the budget shown in Table 3 it is broken down into four parts as follows:

(a) the initial investment of equity capital

(1a) $-EC$

(b) the PV of future principal and after tax interest payments on debt capital

$$(1b) \quad -\sum_{n=1}^{m} \frac{P_n + (1-t)I_n}{(1+r)^n}$$

where r = after tax nominal discount rate

(c) the NPV of the annual nominal cash flows after tax, generated from the property (without asset purchase or salvage)

(1c) NPV_{atcf}

(d) the PV of the salvage value of the property and associated capital less any capital gains liability and outstanding debt at the end of the planning horizon.

$$(1d) \quad + \frac{V_m + SMC_m - C_m - D_m}{(1+r)^m}$$

where

V_m = expected salvage value of land at time m.

SMC_m = expected salvage value of stock and machinery capital at time m.

C_m = capital gains tax liability at time m.

D_m = outstanding debt at time m.

Combining the four parts (1a - 1d) produces equation (1) which represents the NPV of investing in agricultural land taking account of all thirteen factors outlined previously.

$$(1) \quad NPV = -EC - \sum_{n=1}^{m} \frac{P_n + (1-t)I_n}{(1+r)^n} + NPV_{atcf} + \frac{V_m + SMC_m - C_m - D_m}{(1+r)^m}$$

Equation (1) can be solved for V_0 (the initial land value) on the basis that, for the given assumptions, the maximum offer price will be defined when the NPV is zero. Solution of equation (1) requires the terms for principle, interest, land salvage value, capital gains tax and any outstanding debt to be expressed in terms of V_0, the initial land value. These equations and the substitution process are detailed in Appendix 1.

4.2 Could Pay or Maximum Feasible Bid

A limitation of the 'should pay' model developed so far is the implicit assumption of a perfect capital market. It is assumed that the debt can always be serviced. This allows negative annual cash flows to be generated through the life of the project if the expected salvage values at the end of the planning horizon make the investment economically viable. In practice this is not usually financially feasible and even though a property may have a higher 'economic value, the buyers offer price will be limited by the financial criterion of expected debt servicing capacity. This capacity will be determined by the expected annual cash flow from the property and the availability of cash from other sources (from existing farm or off farm income). In such cases the maximum 'feasible' amount which can be offered for the land will be determined by the expected debt servicing ability plus the available equity capital less the value of the associated livestock and machinery capital.

(2) Expected Debt Servicing Capacity

$$= (NCF_1 + \text{Other Cash Surpluses}) \times \frac{i(1+i)^1}{(1+i)^1 - 1}$$

(3) Maximum Feasible Bid
= Equity Capital + Debt Servicing Capacity
- Stock & Machinery Capital

5. Case Study Valuation of Farm Land using the 'Land Price' Decision Support Model.

The case study farm to be used in this example is a 31,000 acre grazing property located in South Western New South Wales on the salt bush plains to the north of Balranald. The total asking price for the land is \$700,000, and a further \$154,000 would be required to purchase livestock and machinery. The property has a total carrying capacity of 10,000 Dry Sheep Equivalent (DSE). Over the last five years the current owners have run an average of 5,000 breeding ewes, with an average wool cut of 4.5kg of 22 micron wool per head. Lambing has been in autumn with a weaning percentage of 60 per cent being achieved regularly.

The main assumptions used to calculate the expected annual costs and returns from the property are: a greasy wool price of $7/kg, 4 per cent annual inflation, 25 per cent marginal tax, 12 per cent nominal interest on debt and a required real return of 7 per cent after tax (equal to a required nominal return of 11.28 per cent after tax).

5.1 The Effect of Financing on Property Value

To illustrate the effect of financing on the property value, two cases have been investigated. Case 1 represents a potential purchaser who wishes to purchase the property entirely with equity capital. Case two represents a potential purchaser with $400,000 of available equity capital who wishes to finance the remainder of the investment with borrowings serviced from the net cash flow of the purchased property, plus $25,000 p.a. expected annual cash surplus from the current farm and other assets. The resulting property values at a range of interest rates on borrowings are shown in Table 4.

Table 4: Effects of Financing on Property Value at 7 Per Cent Required Real Return, 4 Per Cent Inflation and 25 Per Cent Marginal Tax

Nominal Discount Rate	Interest Rate on Borrowings	Case One 100% equity Capital	Case Two $400,000 equity, Balance Borrowed
11.28%	8%	692,704	897,671
11.28%	11.28%	692,704	692,704
11.28%	12%	692,704	662,496

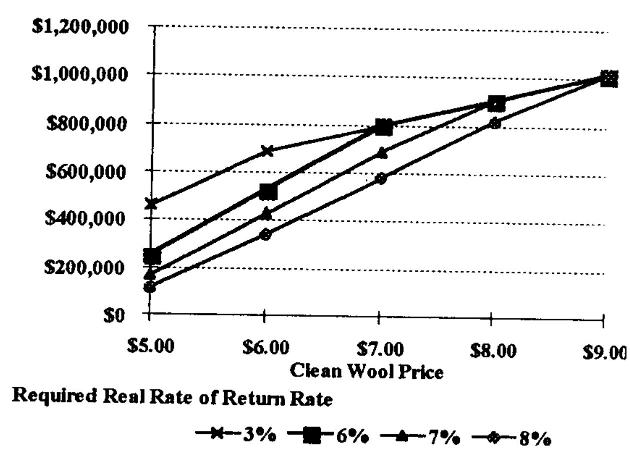
Obviously, when the after tax required nominal rate of return and the after tax interest rate paid on borrowings are the same, the offer price is the same ($692,704) regardless of how much equity and debt is used. This is the standard assumption of discounted cash flow analysis. This assumption causes problems though when the market interest rate is different to the required nominal rate of return. If debt financing was available at 8 per cent nominal interest and the required rate of return was 7 per cent real (11.28 per cent nominal) the offer price of the purchaser using financing would rise to $897,671. If a nominal interest rate of 12 per cent p.a. was incurred, the offer price of the purchaser using financing falls to $662,496.

5.2 Identifying a Realistic Price

The current asking price for the case study property is $700,000. The question which needs answering is 'What conditions (prices, yields, interest rates, required real returns) need to occur to justify this price and is there a reasonable chance of achieving such conditions?'. For instance assume that the property is to be bought with $400,000 of equity capital and the remainder of the purchase price and the stock and machinery capital will be financed with an amortised loan over 15 years at 12 per cent nominal p.a. Initial use of the model generates a maximum offer price for these conditions of $662,496. This would appear to indicate that the asking price of $700,000 is too high for this particular bidder. By varying the assumptions, the conditions which would justify the asking price can be identified. Figure 1 shows the effects of yields, prices, interest rates and financing conditions on the maximum bid price for the property.

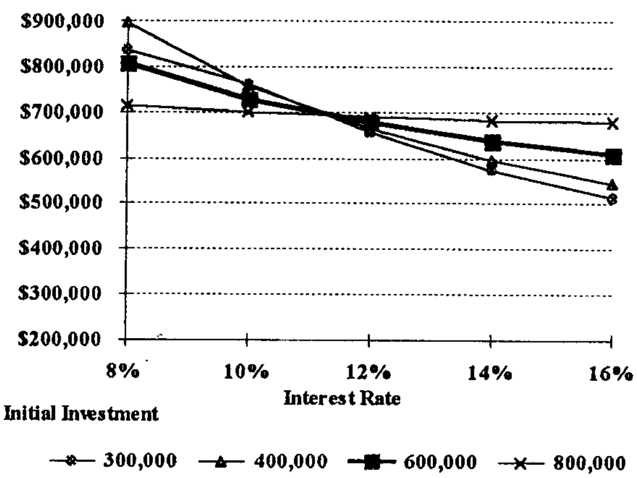
Figure 1: Effect of Changing Yields, Prices and Financing on Maximum Bid Price

A: Effects of Wool Price and Real Return on Maximum Offer Price, Assuming all Other Variables Constant



- The asking price of $700,000 implies real returns below 7 per cent with wool price below $7/kg.
- Even at a real return of only 3 per cent prices above $800,000 cannot be justified unless wool prices above $7/kg are received.

B: Effects of Initial Investment and Interest on Maximum Offer Price, Assuming All Other Variables Constant



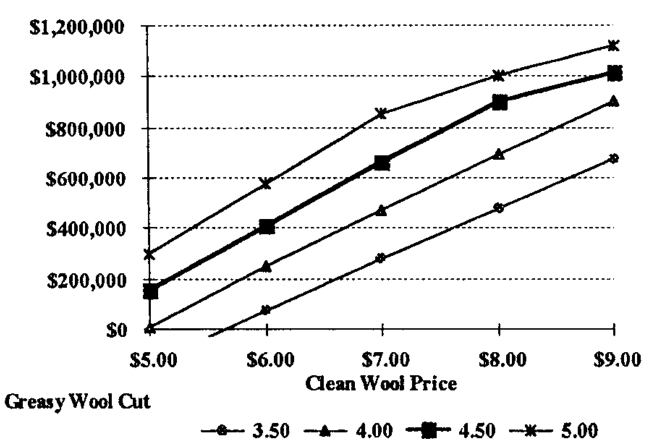
- With a full equity purchase the maximum offer price would be approximately $700,000, with interest rates naturally having no effect.

- Increasing the equity capital above $400,000 has little effect at 12 per cent p.a. interest.

- Prices above $700,000 can only be justified if interest rate below 11 per cent can be obtained.

- If interest rates rise to 14 per cent are a minimum of $400,000 initial equity capital is required to justify prices of $600,000.

C: Effects of Wool Price and Wool Cut on Maximum Offer Price, Assuming All Other Variables Constant



- Offer prices in excess of $700,000 would require wool prices above $7/kg and/or an increase in wool cut.

- If wool prices fall to $6 prices above $600,000 would be unreasonable regardless of wool cut.

- Likewise if the expected wool cuts can't be achieved prices above $600,000 will be unreasonable.

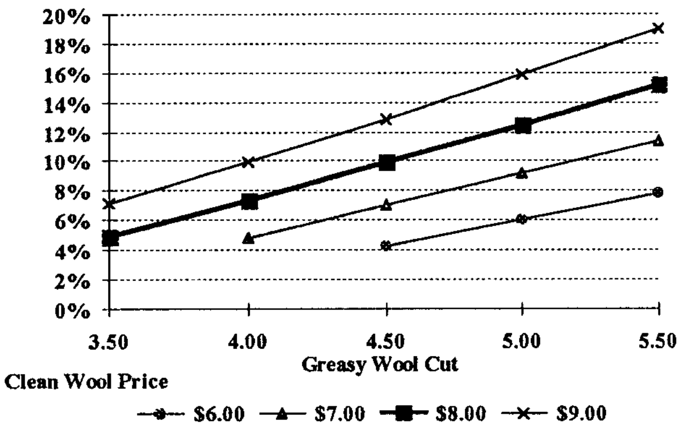
In summary, bids above $800,000 would appear unreasonable in any circumstances. A combination of at least $400,000 equity capital with a required real return of 7 per cent and market interest rates below 14 per cent are required to justify values above $600,000. Wool cuts and prices appear to be the major productivity factors which have an effect on property value. If the expected levels of these cannot be obtained land values over $600,000 appear unreasonable. Prices above $700,000, given the financing and the required real return, would appear to be based on unreasonable aspirations about the future profitability of the property and/or the likely future interest rates.

5.3 Allowing for Risk in the Analysis of Land Value

Agriculture is a risky business with yields and prices varying dramatically from year to year. Under most likely conditions, somewhere in the range of $600,000 to $700,000 would appear to be the maximum reasonable offer price. The question which needs to be answered is, 'If this price is paid, what will happen to net returns if yields, prices and interest rates do not turn out as expected?'. Figure 2 shows the effect of changes in some of the key assumptions on the pre-tax real return on the capital invested, when the property is purchased at the expected maximum offer price of $662,496. If the debt is unserviceable in any year, no return on capital is calculated as the business is likely to be in financial difficulty placing potential returns in jeopardy.

Figure 2: Effect of Changes in Key Assumptions on Return on Capital Invested Over the Life of the Project

A: Effects of Wool Price and Cut on Real Return on Capital Invested, Assuming Other Variables are Constant

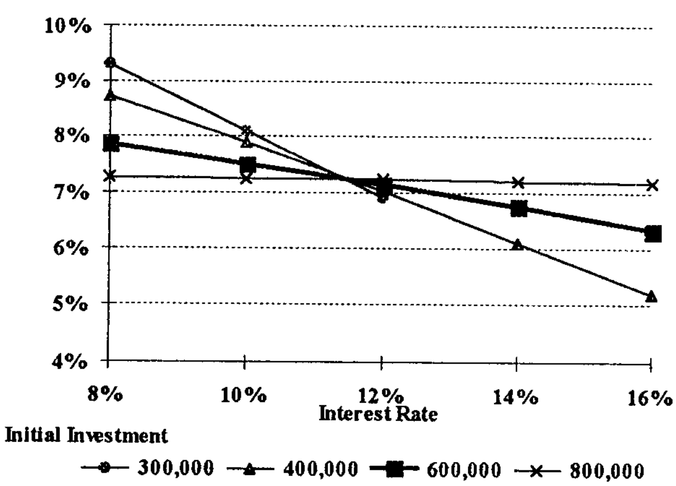


- If wool prices above $6/kg and wool cuts above 4.5kg are achieved returns of over 4 per cent can be expected.

- If wool prices fall below $6/kg the debt associated with the offer price of $662,496 will be unserviceable.

- If wool cuts fall below the expected 4.5kg prices of over $6/kg will be required to maintain returns above 4 per cent.

B: Effects of Initial Equity and Interest on Real Return on Capital Invested, Assuming Other Variables are Constant

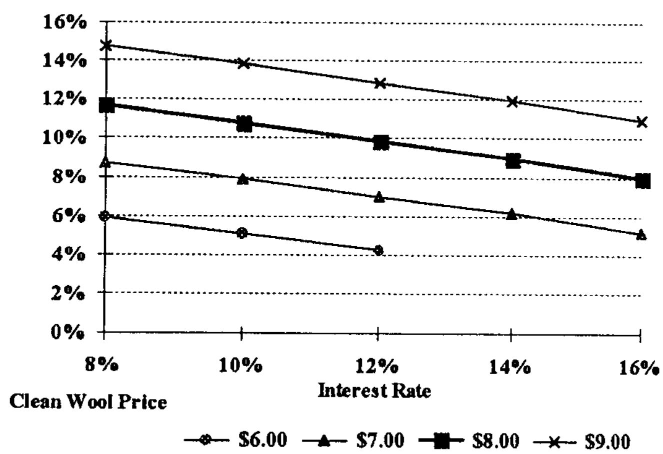


- If the debt is financed at below 12 per cent returns can be expected to rise above the required 7 per cent real.

- If as is more probable interest rates rise above 12 per cent returns will decline, however even at 16 per interest a return of 5 per cent could still be expected.

- If the purchase is financed with less than $400,000 equity capital the debt will be unserviceable at interest rates above 12 per cent.

C: Effects of Wool Price and Interest on Real Return on Capital Invested, Assuming Other Variables are Constant



- Wool price has a greater effect on the likely return on capital than interest rates.

- If wool prices fall to $6/kg the debt will be unserviceable if interest rates rise above 12 per cent.

- If wool prices remain at $7/kg or above returns in excess of 4 per cent can be expected regardless of interest rates.

In summary, provided at least $400,000 of equity capital is used, and wool prices above $6/kg are received, real returns above 4 per cent could be expected. Maintaining wool cuts at or above the expected 4.5kg/head would also appear important. Armed with this information the decision maker needs to decide two things:

(a) am I willing to invest and possibly receive annual real returns of 4 per cent after tax?;

(b) am I confident that wool prices will remain above $6/kg and wool cuts can be maintained above 4.5kg/hd?

If the answer to either of these questions is no, then the offer price needs to be revised. If the decision maker is satisfied with these conditions it is then a matter of trying ones luck in the bidding process.

6. Concluding Comments

Opportunity returns from alternative investments help to define the appropriate discount rate to use in evaluating the economic worth of land to a potential buyer. For instance, total annual returns (dividends and capital growth) from many portfolios of share market investments over the past decade have been around 10 per cent per annum nominal after tax, with very large year to year fluctuations. Returns from fixed interest investments have averaged around 4-5 per cent per annum nominal after tax over the same period. However, if non-farm market rates of return are used to evaluate farm land which will not be affected by expected capital gains, it is often found that the 'economic price which 'should be paid is markedly below the prices which are ruling in the farm land market for whole farms. With inflationary expectations of 4-5 per cent, a nominal 10 per cent after tax or higher discount rate often puts farm land buyers out of the market, while required nominal rates of return of 5-7 per cent will often put farm buyers right in the market. That is, despite the riskiness of investing in agriculture, apparent real rates of return required by farm land buyers are often low compared to non-farm returns of varying degrees of risk which are available elsewhere. The explanations for this phenomenon must include adjustments to required rates of return associated with having high equity ratios, government underwriting of some business and financial risk; hard-to-measure factors such as preference for the farming lifestyle, wanting to set up heirs with a farm of viable size in the future, and buying the 'only job I know/the job I am best at'. In sum, such considerations have the effect of reducing the required rate of return to equity and increasing the price farm buyers are willing to pay.

As well as these above-mentioned considerations, there are usually other difficult to measure aspects involved. For example, the benefits of close proximity of extra land, or the benefits of spatial diversification to spread climatic risk. Or, the risk reducing benefits of adding land nearby but which has characteristics which make it less susceptible to various problems which beset the existing operation. Also, farmers adding 20-30 per cent to their land area are able to capitalise the expected benefits of spreading overheads. This effect shows up in the analysis of value as higher net returns per hectare from the extra land as compared to a whole farm, and higher prices can be paid for marginal additions to land area than can be justified for a whole farm purchase. So while some of the net benefits of land purchase can be included in the budgets, not all of the benefits can be measured well. These factors will however all be included in one way or another in the offer price.

While risk aspects of the decision can be dealt with in the analyses by adjusting expected cash flows and/or adding a risk premium to the discount rate, the more transparent, less ambiguous approach used in the example in this paper, is to proceed by changing the values of key risk variables in the budget, and checking the values which these risk variables would have to reach for particular purchase prices to be justified. Then, judgment can be made about the likelihood of these critical values being achieved. If they are unlikely, or very optimistic, then the land price being considered is over optimistic (too high!). Estimating economically sound (equation 10) and financially feasible (equation 12) 'yardsticks' of land price gives the bidders some 'fixed' points on which to focus. Having defined a reasonable range of economically sound and financially feasible land offer prices, then the potential bidder is in a position to evaluate, within the bounds of the 'fixed points of financially feasible and economically sound prices, how much more they might be content to pay for the difficult to measure benefits.

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Appendix 1: Derivation of an Equation for Maximum Offer Price (V_0)

(1a)

$$-\mathbf{EC}$$

(1b)

$$-\sum_{n=1}^{m}\frac{P_n+(1+t)I_n}{(1+r)^n}$$

*Sub*situte $P_n = A - iD_n,\ I_n = iD_n$

$$-\sum_{n=1}^{m}\frac{A-iD_n+(1+t)\times iD_n}{(1+r)^n}$$

Let $PVA_x = \dfrac{(1+i)^x-1}{i(1+i)^x}$ (present value of annuity at interest i for x periods),

*Sub*situte $D_n = A\times PVA_{term-n+1}$

$$-\sum_{n=1}^{m}\frac{A-i\times A\times PVA_{term-n+1}+(1+t)\times i\times A\times PVA_{term-n+1}}{(1+r)^n}$$

$$-A\sum_{n=1}^{m}\frac{1-i\times PVA_{term-n+1}+(1+t)\times i\times PVA_{term-n+1}}{(1+r)^n}$$

$$-A\sum_{n=1}^{m}\frac{1-i\times PVA_{term-n+1}+i\times PVA_{term-n+1}+t\times i\times PVA_{term-n+1}}{(1+r)^n}$$

$$-A\sum_{n=1}^{m}\frac{1+t\times i\times PVA_{term-n+1}}{(1+r)^n}$$

Let $AF = \dfrac{i(1+i)^{term}}{(1+i)^{term}-1}$ (annuity whose present value is one),

*Sub*situte $A = (V_o + SMC - EC)\times AF$

$$-(V_o+SMC-EC)\times AF\sum_{n=1}^{m}\frac{1+t\times i\times PVA_{term-n+1}}{(1+r)^n}$$

Let $DR = AF\sum_{n=1}^{m}\dfrac{1+t\times i\times PVA_{term-n+1}}{(1+r)^n}$

(the multiple of the initial debt which represents the NPV of the future after tax repayments)

$$-(V_o+SMC-EC)\times DR$$

(1c)

$$+\mathbf{NPV}_{\mathbf{atcf}}$$

(1d)

$$+\frac{V_m + SMC_m - C_m - D_m}{(1+r)^m}$$

Substitute

$$V_m = V_o(1+g)^m$$

$$SMC_m = SMC \times (1+f)^m \times SP$$

$$C_m = (1-t)\left[V_o(1+g)^m - V_o(1+f)^m\right]$$

$$D_m = (V_o + SMC - EC) \times AF \times PVA_{term-m}$$

$$+\frac{V_o(1+g)^m - (1-t)\left[V_o(1+g)^m - V_o(1+f)^m\right] - (V_o + SMC - EC) \times AF \times PVA_{term-m} + SMC \times (1+f)^m \times SP}{(1+r)^m}$$

$$+\frac{V_o\left[(1+g)^m - (1-t)\left[(1+g)^m - (1+f)^m\right] - AF \times PVA_{term-m}\right] - SMC\left[AF \times PVA_{term-m} - (1+f)^m \times SP\right] + EC \times AF \times PVA_{term-m}}{(1+r)^m}$$

Let $S = (1+g)^m - (1-t)\left[(1+g)^m - (1+f)^m\right]$ **(multiple of** V_o **salvaged after capital gains tax)**

$$+\frac{V_o\left[S - AF \times PVA_{term-m}\right] - SMC\left[AF \times PVA_{term-m} - (1+f)^m \times SP\right] + EC \times AF \times PVA_{term-m}}{(1+r)^m}$$

Pulling the Parts Together

The four parts can now be pulled together to give the expanded form of equation 1 from the text. Assuming that the maximum offer price will occur when the NPV of the investment is zero, the resulting equation is left with one 'unknown', V_O, the maximum potential offer price given the assumptions used.

$$NPV = -EC - (V_o + SMC - EC) \times DR + NPV_{std} + \frac{V_o\left[S - AF \times PVA_{term-m}\right] - SMC\left[AF \times PVA_{term-m} - (1+f)^m \times SP\right] + EC \times AF \times PVA_{term-m}}{(1+r)^m}$$

Set NPV = 0

$$(V_o + SMC - EC) \times DR = -EC + NPV_{std} + \frac{V_o\left[S - AF \times PVA_{term-m}\right] - SMC\left[AF \times PVA_{term-m} - (1+f)^m \times SP\right] + EC \times AF \times PVA_{term-m}}{(1+r)^m}$$

$$V_o \times DR + DR(SMC - EC) = -EC + NPV_{std} + \frac{V_o\left[S - AF \times PVA_{term-m}\right] - SMC\left[AF \times PVA_{term-m} - (1+f)^m \times SP\right] + EC \times AF \times PVA_{term-m}}{(1+r)^m}$$

$$V_o \times DR = -EC - DR(SMC - EC) + NPV_{std} + \frac{V_o\left[S - AF \times PVA_{term-m}\right] - SMC\left[AF \times PVA_{term-m} - (1+f)^m \times SP\right] + EC \times AF \times PVA_{term-m}}{(1+r)^m}$$

$$V_o \times DR \times (1+r)^m = \left[-EC - DR(SMC - EC) + NPV_{std}\right](1+r)^m + V_o\left[S - AF \times PVA_{term-m}\right] - SMC\left[AF \times PVA_{term-m} - (1+f)^m \times SP\right] + EC \times AF \times PVA_{term}$$

$$V_o \times DR \times (1+r)^m - V_o\left[S - AF \times PVA_{term-m}\right] = \left[-EC - DR(SMC - EC) + NPV_{std}\right](1+r)^m - SMC\left[AF \times PVA_{term-m} - (1+f)^m \times SP\right] + EC \times AF \times PVA_{term}$$

$$V_o\left[DR \times (1+r)^m - \left[S - AF \times PVA_{term-m}\right]\right] = \left[-EC - DR(SMC - EC) + NPV_{std}\right](1+r)^m - SMC\left[AF \times PVA_{term-m} - (1+f)^m \times SP\right] + EC \times AF \times PVA_{term-m}$$

$$V_o = \frac{\left[-EC - DR(SMC - EC) + NPV_{std}\right](1+r)^m - SMC\left[AF \times PVA_{term-m} - (1+f)^m \times SP\right] + EC \times AF \times PVA_{term-m}}{\left[DR \times (1+r)^m - \left[S - AF \times PVA_{term-m}\right]\right]}$$