A MODEL OF LAND BID VLAUES IN TIMES OF MARKET EXUBERANCE

*Professor R A Schoney**
*Liao (Barbara) Xing***

Department of Bioresource Policy, Business and Economics
University of Saskatchewan

Abstract

Historically, market exuberance can be a major problem in farmland pricing. The objective of this paper is to examine possible underlying mechanisms that result in irrational market exuberance for teaching and extension. Price expectations are examined as a possible underlying cause and rejected. Based on extensive experience with farmers, two alternative bid models are developed based on future farmland values: exogenous and endogenous ending farmland prices. Both models are based on a capital investment model of a farm business which includes farm business financing, cash flows, income taxes and a finite time horizon. The latter requires assets to be valued and tax implications calculated. The exogenous model assumes that ending farmland values are a function of current market values inflated to a future value. The endogenous model assumes that ending farmland values are a function of the bid value itself inflated to some future value. Both models require the use of an algorithm such as Goal Seek© to find the appropriate bid price. A case farm is set up and the bid prices estimated under a range of expected future land inflation rates. As expected, the exogenous model does not display irrational market exuberance; the endogenous model does when the inflation rate approaches the after-tax cost of capital and the bid value becomes infinite. Hence, in times of extreme market exuberance the result is "the more that is bid for land, the more it is worth". This shows the caution (and discipline) that must be used in times of rapidly inflating land prices.

Keywords: Farmland valuation, bid values, market exuberance

Sub Theme: Farmland valuation in times of rapid land inflation

Introduction

Like many other agricultural areas, Saskatchewan farmland values have ridden a roller coaster of ups and downs, particularly when values are converted to 2010 dollars (Figure 1). From 1973 to 1980, there was an explosive growth in land values and some might say a time of market exuberance. However, the events of the early 1980's caught up with the land market and by 1982, farmland values started to plummet. This was followed by a period of prolonged stagnation before starting to increase again in 2007.

This paper is based on experiences of working with over 200 farmers in workshop settings through much of the 1980's and early 1990's and continues experience with smaller groups of farmers since then and experiences teaching students agricultural finance and land appraisal. We start with the standard land capitalization model and expand it to include 10 a more comprehensive model of farm business costs and returns and 20 a finite time horizon where land resale value becomes a major component of its net present value. Because future land sale prices are an important component, two bid models are constructed: one in which future resale land values are completely exogenous to the farm net returns and the other which endogenizes future land resale value. In the latter bid model, market exuberance in terms of future farmland price increases can create a market bubble that mirrors past events.

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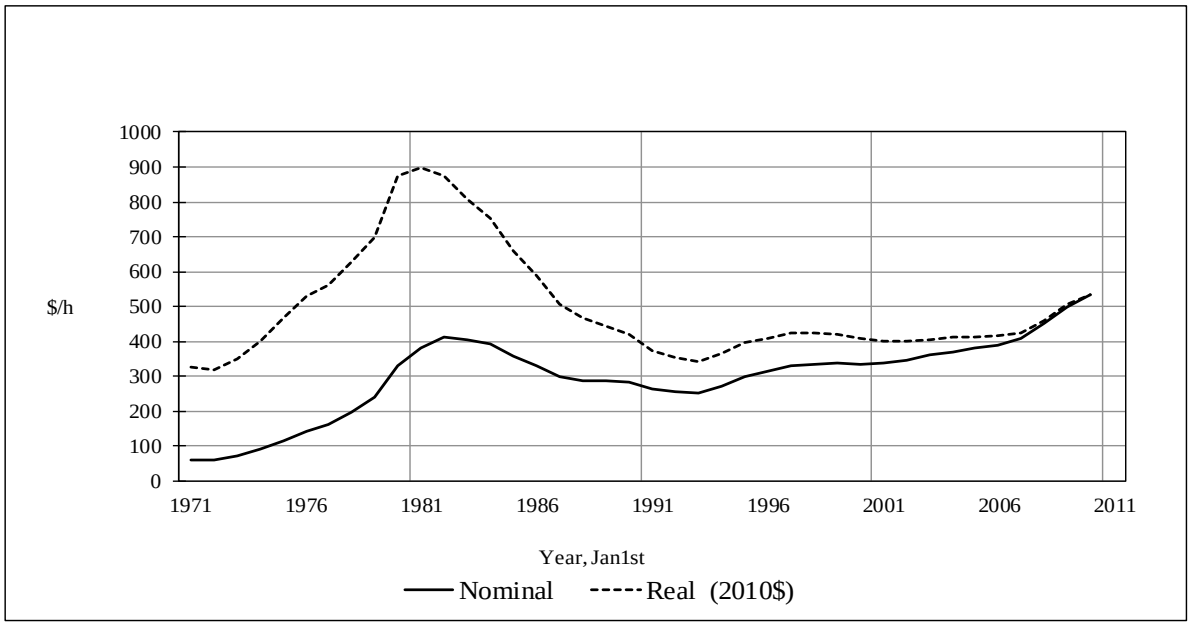

Figure 1: Farmland and Building Value per hectare, Saskatchewan

The Bid Value Approach

The bid value approach (or the income approach in appraisal terminology) is based on the NPV of the stream of future earnings (Klemme & Schoney, 1984; Weisensel et al, 1988).

——— (eq 1)

Where R_t is the rent attributable to farmland, r is the discount rate and t is time. If rents are constant over time, this can be simplified to the familiar capitalization formula:

—— (eq 2)

Where E (R_0) is the economic rent derived from expectations of future income and expenses and expressed in real terms. The following sections will discuss the role of expectations in setting economic rents.

The Role of Price Expectations

Land purchase decisions are based on future expectations and, as suggested by Brown and Brown (1984), land prices are determined by those buyers with the most optimistic expectations. The key question to answer is: how does the typical investor develop his/her expectations? Keynes suggests how expectations might be formed:

> *"… it is sensible for producers to base their expectations on the assumption that the most recently realized results will continue, except in so far as there are definite reasons to expect a change" (p.51)*

According to Keynes, expectations are based on all available information. While the entrepreneur realizes that it is unlikely that the future will unfold exactly as expected, the decision maker still does the best he/she can, given present information. Actual land prices are seldom exactly equal to projected land prices because farmers' expectations about prices and, therefore, farmland prices are slow to adapt, resulting in sticky farmland prices. For example, a decrease in commodity prices, and hence economic rents, results in a decrease in the economic bid price for land according to the

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above simple capitalization formula. However, farmland prices may never attain the new price level unless farmers are convinced that the new commodity prices will prevail over time.

Sulewski, Spriggs and Schoney (1994) studied the relationship between farmer price expectations at seeding time and the subsequent prices they actually achieved. They found that a relatively simple, declining 2-year moving average fit both producer wheat price (which is mostly board marketed) and canola price (which is producer marketed) expectations relatively well. The role of price expectations in forming Saskatchewan farmland values has been investigated by Weisensel, Schoney and Van Kooten (1988). They found that a rational expectations model using the previous year's land price and crop share rents generally traced Saskatchewan farmland values reasonable well. However, their data included the period 1950 to 1985 but did not include later times of high government payouts. Their procedure has been updated and is shown in Figure 2. Farmers' expected land net rents are based on a 5-year, weighted moving average value of the landlord's crop share. The latter value is based on actual crop yields and prices less property taxes and adjusted for income taxes. The expected land rent is then capitalized into an estimated farmland value. This procedure generally tracks actual land values but it misses the market exuberance of the late 1970's because of government payouts. Hence, a simple expectations model still does not generate the kind of market exuberance displayed by Saskatchewan farmland markets in the 1970's. The familiar capitalization models are too simple to adequately describe modern land valuation. In the following section, the land value bid model is expanded to more closely resemble a capital investment model in terms of capturing cash flows, income taxes and by endogenizing ending farmland value, a model of market exuberance is created.

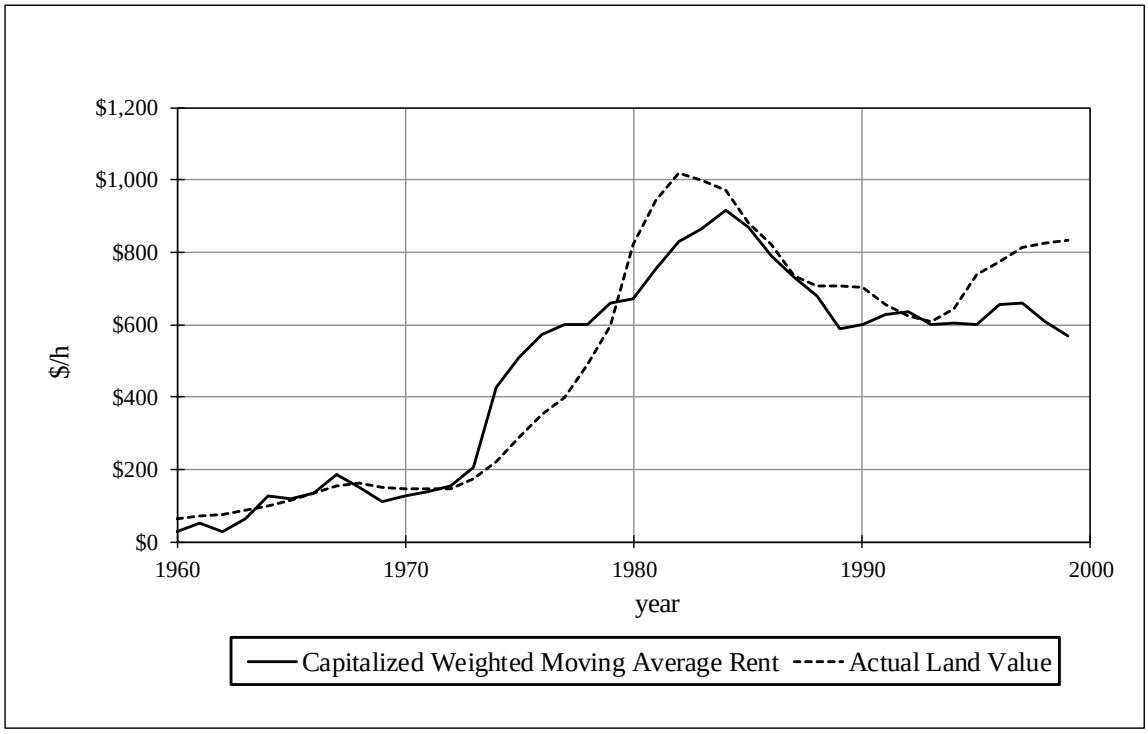

Figure 2: Capitalized Weighted, Moving Average Rent versus Actual Land Values

Bid Values based on the Capital Investment Model

In our experience, most farm-investors treat land investemnt in a much broader context of the whole farm. This means that cash flows are critical in setting financila feasibility and debt versus equity capital is therefore critical. Liekwise, income taxes are an important component. Further, farmer-investors face a finite time horizon and there is a disposal of assets.

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In the following model, the land value is imputed as the residual to land aftre all of the other business costs are covered. The discount rate is based on *i*, the after-tax cost of equity captial with the appropriate risk premium, *n* is planning horizon, I_0 is the initial investment amount including captial outlays and capital reserves but exlcuding farmland, B_0 is the amount externally financed (borrowed), NOI_t is net operating income, T_t is farm business income taxes due, P_t is principal payments, FL_t is family living withdrawals, R_t is machine replacement net of trade-ins and CCARecapture is recapture of excess depreciation, TX is the tax rate, SV_n is the ending value of all non-land assests and Landn is the future resale or ending vlaue of farmland and *p* is the taxable portion of capital gains from farmland.

(eq 3)

Our model incorporates many of the components key to investment analysis: cash flows, income taxes and borrowing. However, it also introduces end of period issues such as income tax recapture of excess depreciation, ending valuation of farmland and possible capital gains in appreciated land values. In this simple model, we assign a resale value outside of, or exogenous to, our model. This introduces a conundrum which complicates our world considerably: an ending value to the very asset that we are trying to value. In the following section, we introduce two approaches to assigning an ending value to farmland.

Bid Value to Land-Exogenous Resale Values

The simplest approach is to estimate a market value independent or exogenous from our own bid value. This is estimated as the market clearing value at the time of bid and then inflated to the future value for resale. The future land inflation rates are generally set as the same inflation rates in net farm income. In sensitivity analysis, key variables such as future prices and interest rates are often varied. These changes also affect the future resale value of farmland and there is no easy way to reflect these changes. This approach has serious drawbacks in that future farmland values are too isolated from changes in assumptions.

Bid Value to Land-Endogenous Resale Values

Alternatively, we can try to endogenize the land value by arguing that the same forces that influence farm income also affect land purchasers' expectations *n* years in the future. However, this makes the model potentially explosive as the following sections will demonstrate.

During periods of rapid price increases, speculation becomes a problem and buyer psychology asserts itself. Common expressions heard during the early days of the farmland bubble were "If I don't buy it now, I won't be able to afford it next year!" Closely associated with this sentiment is the irrational feeling that *"the more that is paid for an asset, the more it is worth."* This is the characteristic of the second approach, where the future resale value is based on the land inflation rate, *a* and the Bid_{en} value itself[31]:

(eq 4)

[31] Note that a series of annual income tax equations are used to generate T and are too complex to be shown here

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In the following equation, it is assumed that p = 0 or no capital gains taxes on land in equation 4 in order to simplify the equation. Collecting all of the Bid_{en} terms and moving them to the left hand side and simplifying the equation gives the following:

(eq 5)

The numerator is the present value of the cash flow stream excluding land sales. The denominator acts like a multiplier and become critical: as a approaches i, Bid_{en} explodes and approaches infinity. When $\boldsymbol{a > i}$, Bid_{en} turns negative and the bid value becomes irrational in an economic sense.

Exogenous versus Endogenous Resale Values in Times of Exuberance

In order to demonstrate these two approaches, typical costs and returns as well financial parameters are defined for a typical Saskatchewan farm in Table 1. For our typical farm, the pre-tax cost of equity capital (or discount rate) is set at 8.50% and using the assumed tax rate of 35.0%, this results in an after-tax cost of 5.53%. Farm net operating income, income taxes paid and cash flows are generated based on a spreadsheet which incorporates both the exogenous and endogenous bid price approaches.[32] In the case of both the exogenous and endogenous resale values, the Excel© Goal Seek © is used to find the land bid value which makes the NPV of the total investment from equations 3 or 4 equal to 0. The results are displayed assuming no taxes on capital gains from appreciation in farmland values (figure 3).

Table 1: Land Value Parameters

Variable	Value	Variable	Value
Total Tillable Hectares	1,214	**Income Taxes:**	
Working Capital	$332,420	Tax Rate (*Tx*)	35.0%
Depreciable Amount	$692,430	Depreciation Rate	25.0%
Livestock	$0	First year depreciation	50.0%
Land Purchase Mkt Value	$1,500,000	**Machinery Replacement**	
Starting Year	2010	Actual Depreciation Rate	8.0%
Planning Horizon (yrs)	30	Net Replacement Rate	8.0%
Equity Capital:		**Operating Income:**	
Pre-tax Cost	8.50%	Gross Returns	$593,393
After-tax cost (*i*)	5.53%	Fixed and Variable Cash Costs	$332,430
		Labour/Fam Liv Wthdwls (*FL*)	$51,600
Debt Financing:		**Inflation Rates:**	
Borrowed (*B*)	$774,680	Inflation Rate on Non Land Items	1.00%
Interest Rate	6.50%	Land Inflation (*a*)	1.00%
Loan Life	25		

In the case of bid values based on exogenous future farmland prices, the bid value increases at a gently increasing rate with increased land inflation rates. Using the base land inflation rate of 1.0% the Bid_{ex} value is $908 per hectare. Increasing the land inflation rate to 4% increases the Bid_{ex} to $1,369 per hectare. While the Bid_{en} values are roughly similar at $790 and $1,604 per hectare respectively, for land inflation rates of 1% and 4%; beyond the latter point, the explosive nature of the Bid_{ex} is readily apparent. As rate of land inflation, a approaches the after-tax cost of equity capital, as it might in times of extreme market exuberance, Bid_{ex} becomes infinite and the result is that "the more that is bid for land, the more it is worth." However, in our spreadsheet model, equity capital is differentiated from borrowed capital so that the cost of borrowed capital also influences the point where the bid value explodes. Because the cost of borrowed capital is less, this decreases the land inflation rate where the bid value explodes – here it is approximately 5.0% (figure 3).

[32] This spreadsheet is available from the authors on request

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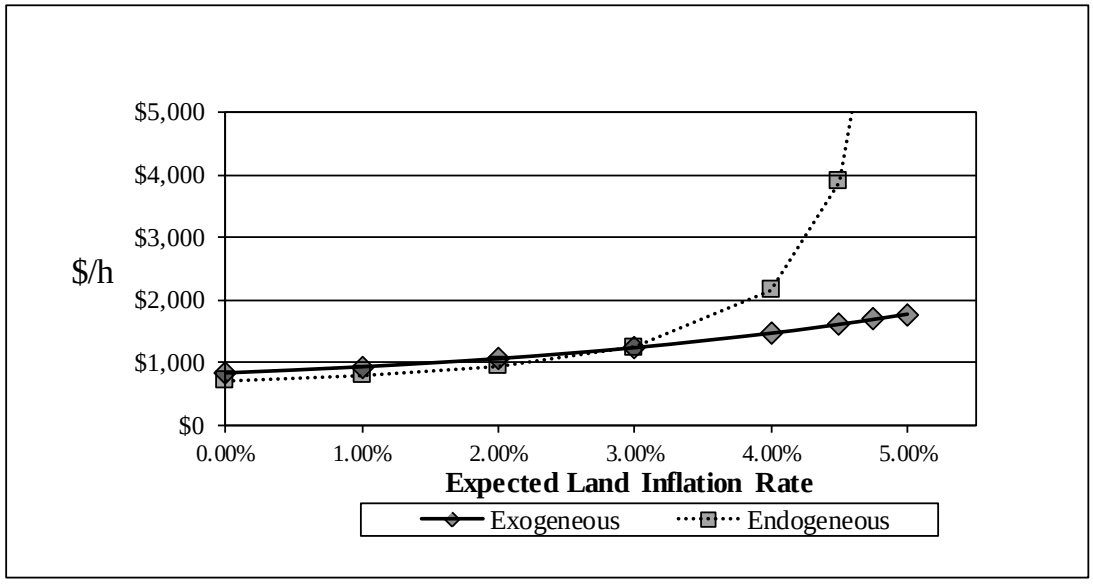

Figure 3: Bid Values by Type of Resale Value, No Capital Gains

Impact of Capital Gains Taxes on Land

Because of exemptions[33] and tax-deferred roll overs to the succeeding generation[34], many farmers do not anticipate capital gains on land as having any real impact on their bids. However, if these exemptions are revoked, or the farm property exceeds the exemption allowance and/or rollovers are excluded, then capital gains can become a major consideration. In order to demonstrate the impact of capital gains exclusions, bid values are recalculated assuming that capital gains are taxable. Currently, 50% of capital gains are taxed so that the bid values are recalculated assuming that 50% of the capital gain is taxed at the end of 30 years (figure 4). Capital gains taxes on land tend to dampen considerably the response of the bid value to future and price increases. In the case of Bid_{ex}, bid values can still explode, but at a slightly higher land inflation rate.

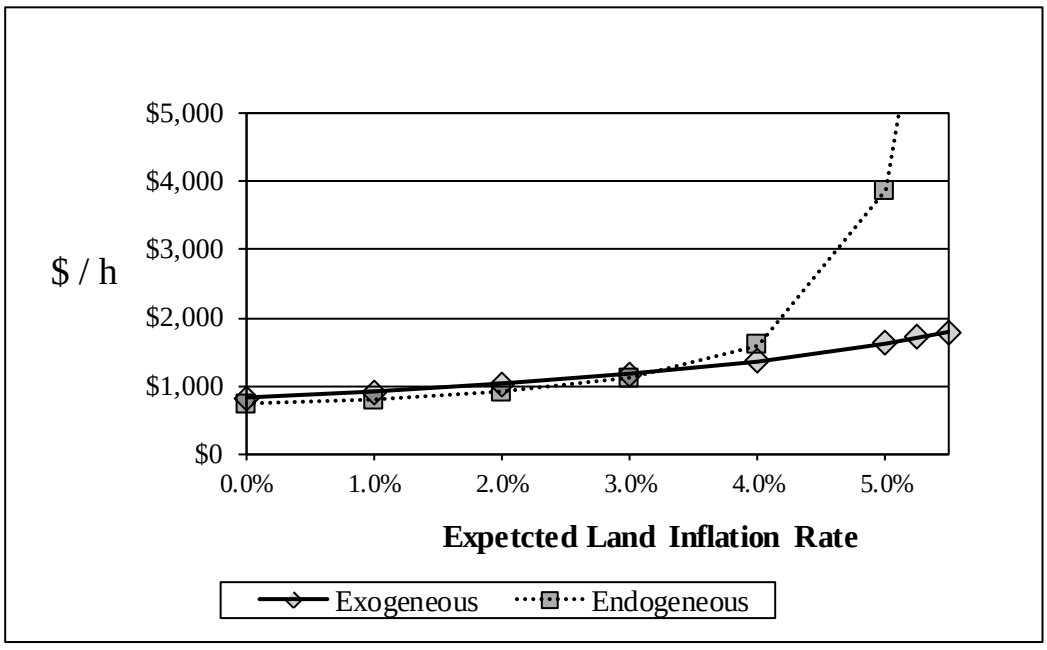

Figure 4: Bid Vlaues by Type of Reslae Value, 50% Captial Gain Taxes

[33] The lifetime capital gains exemption is $750,000 for dispositions after March 18, 2007. (Canada Revenue Agency. 2010. p12)

[34] A living parent can rollover farm property to a child with capital gains taxes differed to a future date. (Canada Revenue Agency. 1996. p2)

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Evaluation and Conclusions

The bid approaches have long been used in farm management and have great appeal as part of an overall assessment of farmland value. Spreadsheets allow the incorporation of many more variables into the bid values and these variables can vary over time. In addition, the use of goal-seek type algorithms allow bid values to be conveniently solved. The endogenized resale bid model has great appeal because the same information used to value farm income is also used to provide the ending land value. This implicitly assumes that future investors will face the same economic environment. In normal practice, the inflation rate on future farmland values is set at the same rate as the overall inflation rate in farm income. However, if market exuberance starts to enter the market, increases in farmland values can exceed those associated with farm income. The danger of prolonged market exuberance manifesting itself in land inflation rates exceeding farm income increases can be well demonstrated: at some point bid values explode to infinity and the market becomes unstable. This is an important teaching principle to university undergraduate students and to investors. Finally, note that Canadian income tax rules can exacerbate the market exuberance problem by effectively shielding capital gains from taxation; introducing taxation of 50% of appreciated value considerably dampens bid prices.

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