Declining Farmland Values: The Impact of Low Earnings Growth

By Marvin J. Painter, Ph.D.

Abstract

The standard discounted earnings model is applied to Saskatchewan farmland for the test period 1979 to 1999. Each of the components of the earnings model is estimated, based on information available to investors at that time. The estimates are used to predict farmland values for each year in the test period, which are then compared to actual farmland prices. The resulting comparison of predicted to actual farmland values implies that the discounted earnings model is a reasonably good predictor of Saskatchewan Farmland prices.

Introduction

There has been an on-going attempt to explain farmland pricing. Practitioners have been using the discounted earnings model, which usually applies an earnings multiplier to estimated sustainable earnings. This approach to farmland valuation is similar to valuation methods used in other industries to estimate business value. With publicly traded companies, the price-earnings (P/E) ratios can be an indicator of over or under-valued companies, if the P/E ratio is greater or less than the estimated earnings multiple, given current market and economic conditions. The long-term average P/E ratio for Canadian and US stock markets has been approximately 15. Similarly, with small to medium sized private companies, business valuators usually think in terms of earnings multiples between 3 and 7, depending on the business as well as economic and market conditions.

In valuing farmland, public companies or private companies, the main determinant of value is sustainable earnings. The other important variables are expected future growth in earnings and the required return of the investor. In this paper, the standard discounted earnings model is applied to Saskatchewan farmland for the test period 1979 to 1999. Each of the components of the earnings model is estimated, based on information available to investors at that time. The estimates are used to predict farmland values for each year in the test period, which are then compared to actual farmland prices. The resulting comparison of predicted to actual farmland values implies that the discounted earnings model is reasonably good at predicting farmland prices in Saskatchewan.

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The Discounted Earnings Model

The discounted earnings valuation model is:
(1)

$$V_0 = \frac{E0\ (1+g)}{K - g}$$

where:

$V_0 = E_0$ x EM

V_0 = the current market value of the asset.

E_0 = the expected annuity of future sustainable earnings in current dollars.

g = the expected average real growth in sustainable earnings.

k = the required return on investment, where k is equal to the real risk-free rate plus a risk premium. k is a combination of the opportunity investment returns (risk-free return) and the risk premium required for the uncertainty associated with the expected earnings from the asset.

EM = earnings multiple =

$$\frac{(1 + g)}{k - g}$$

Re-arranging equation (1) provides a breakdown of the rate of return k[1].
(2)

$$k = \frac{E0\ (1+g)}{V_0}$$

k = earnings (dividend) yield + capital gain yield[2]

Studies on farmland valuation by Melichar (1979) and Alston (1986) concluded that the discounted earnings model is representative of past farmland values. Melichar pointed out that the two critical factors in farmland valuation are first, the proper estimation of expected growth in earnings and second, the proper accounting for technological change so that a true estimation of earnings available to all sources of financing can be obtained. Alston's study concluded that capital gains to farmland are fully explained by the growth in earnings, as opposed to other factors such as inflation. Castle and Hoch (1982) correctly pointed out two common flaws in traditional valuation practices. First, expected growth is often ignored and second, the discount rate used is often the average farmland debt rate, which may not properly reflect the risk-adjusted opportunity cost to farmland investors. Wiesensel, Schoney, and Van Kooten (1988) showed that lagged land prices and current farm rents could explain 86% of land prices. Clark, Fulton and Scott (1993) applied a simplified discounted earnings model to US farmland prices, where the discount rate was held fixed over time. They concluded that the time-series representation of land prices and land rents are inconsistent, thereby implying that the simple asset-pricing model does not hold. Just and Miranowski (1993) studied US farmland prices from 1954 to 1986. They found that inflation and changes in real returns on capital were major explanatory factors in farmland price swings in addition to returns to farming. Painter and Schoney (1994) showed that the earnings multiplier for Saskatchewan farmland varied as low as 6.5 and as high as 43.5 over the period 1956 to 1990. Painter (2000) showed that Saskatchewan farmland had an average 3.97% earnings yield and an average 6.33% capital gain yield, for an average annual compounded rate of return to farmland of 10.11%, for the period 1970 to 1997.

Saskatchewan Farmland Valuation Model

The discounted earnings model is applied to Saskatchewan farmland earnings for each year between 1979 and 1999 to estimate an annual predicted farmland value. In each year, past information is used to estimate the components of the discounted earnings model in order to simulate an investor's situation. The predicted values are then compared to actual values to determine whether the model can be used to explain farmland pricing.

Data

Saskatchewan farmland returns are calculated for the period 1956 – 1999[3]. The return on investment to farmland ownership is based on a standard crop share lease agreement, which provides one-third of the gross receipts to the lessor (farmland owner) up to 1985, after which the crop share is reduced to one-quarter. The reduction in crop share to the lessor was a market reaction to increasing input costs without corresponding increases in commodity prices. The lessor is then responsible for paying property taxes and depreciation on farm buildings. The crop share lease agreement represents the most common form of rental agreement in Saskatchewan over the past 45 years.

The net annual lessor dollar return in year t (NLR_t), is calculated as:

(3)

$$NLR_t = \frac{1}{3}\sum_{i=1}^{n} P_{it}W_{it}Y_{it}\ \phi_t - PT_t - DB_t - M_t\psi\tau$$

where:

$$\text{Net } P_{it} = P_{it} - T_{it} - E_{it} \qquad (4)$$

and,

$$W_{it} = \frac{A_{it}}{\sum_{i=1}^{n} A_{it}} \qquad (5)$$

P_{it} = the price per tonne in year t for commodity i.

T_{it} = the transportation charge per tonne for commodity i in year t. This is based on an average of Thunder Bay and Vancouver transportation costs, which includes the farmer's share only.

E_{it} = the elevator, handling, and dockage removal charge per tonne by the grain handler, for commodity i in year t.

A_{it} = the number of seeded acres for commodity i in year t.

Y_{it} = the average yield in tonnes per acre for commodity i in year t.

ϕ_t = the adjustment factor for the proportion of farmland that is cropped in year t, taking into account the amount of fallow, sloughs, road allowances, unimproved pasture, and any other non-tillable farmland.

PT_t = the average property tax per acre in year t.

DB_t = the average depreciation on buildings per acre in year t (based on the aggregate Saskatchewan farm building depreciation in each year).

M_t = the implied management fee per acre in year t, calculated as 6% of the total farmland operating return in each year.

τ = the income tax adjustment factor which applies to lessors in Saskatchewan. The tax adjustment factor is applied to the lessor's net operating return before tax to reflect the difference between the taxation of dividends and ordinary income. is estimated to be .85, based on the comparison of Saskatchewan tax rates for dividends and ordinary income.

n = the number of commodities (14), where the commodities included are winter wheat, spring wheat, durum wheat, oats, barley, rye, flax, canola, hay, mustard, sunflowers, lentils, peas, and canary seed.

The annual return on investment to farmland ownership, r_{Ft}, is calculated as:

(6)

$$r_{Ft} = \frac{NLR_t + V_{Ft} - V_{Ft-1}}{V_{Ft-1}}$$

where:

NLR_t = the net lessor return per acre in year t.

V_{Ft}, V_{Ft-1} = the average values of farmland per acre in years t and t-1, respectively.

As illustrated in Table 1, the average annual Saskatchewan farmland nominal operating yield for the period 1956 to 1999 is 4.3%, with a standard deviation of 2.9%. The average capital gain yield for the period is 6.2%, with a standard deviation of 11.2%. Combining the operating and capital gain yields, the average annual compounded rate of return on farmland is 10.3%, with a standard deviation of 13.2%.

Estimating Predicted Farmland Values

Predicted farmland values are estimated for the period 1979 – 1999, each year using information from the previous 23 years. For example, the predicted farmland value in 1979 is based on farmland return and price information from the period 1956 – 1978. To estimate predicted values, estimates are derived for sustainable earnings, Et, the required return on investment, kt, and the expected growth in earnings, gt.

Step 1: Estimating Sustainable Earnings, E_t

The method used to estimate sustainable earnings is based on a rationale expectations approach. It is assumed that the most recent actual sustainable earnings will have the most weight in determining an estimate of future earnings. The method used to estimate sustainable earnings in year t is as follows:

(7)

$$E_t = (5/15)\ E_{t-1} + (4/15)\ E_{t-2} + (3/15)\ E_{t-3} + (2/15)\ E_{t-4} + (1/15)\ E_{t-5}$$

Table 1: Investment Returns on Saskatchewan Farmland (1956 – 1999)

Year	Operating Yield	Capital Gain Yield	Total Yield
1956	8.1%	9.1%	17.2%
1957	3.6%	0.0%	3.6%
1958	3.3%	4.2%	7.5%
1959	3.8%	4.0%	7.8%
1960	6.6%	0.0%	6.6%
1961	1.5%	11.5%	13.1%
1962	6.5%	6.9%	13.4%
1963	9.4%	12.9%	22.4%
1964	4.3%	14.3%	18.6%
1965	5.5%	17.5%	23.0%
1966	7.8%	14.9%	22.7%
1967	3.1%	14.8%	17.9%
1968	2.4%	6.5%	8.9%
1969	3.4%	-7.6%	-4.2%
1970	4.3%	-1.6%	2.6%
1971	4.0%	-1.7%	2.4%
1972	6.0%	1.7%	7.7%
1973	15.5%	18.3%	33.8%
1974	10.5%	26.8%	37.2%
1975	8.9%	30.0%	38.9%
1976	6.5%	21.4%	27.9%
1977	4.9%	14.1%	19.0%
1978	5.8%	22.2%	28.0%
1979	4.4%	21.7%	26.1%
1980	4.4%	37.8%	42.2%
1981	3.5%	15.1%	18.6%
1982	3.0%	8.1%	11.1%
1983	2.7%	-1.9%	0.8%
1984	2.1%	-3.0%	-0.9%
1985	1.1%	-9.2%	-8.1%
1986	1.5%	-7.0%	-5.5%
1987	1.5%	-10.2%	-8.7%
1988	1.2%	-4.0%	-2.8%
1989	1.7%	0.0%	1.7%
1990	1.8%	-0.7%	1.1%
1991	1.9%	-6.7%	-4.8%
1992	1.9%	-4.9%	-3.0%
1993	2.4%	-2.0%	0.4%
1994	3.3%	5.7%	9.0%
1995	3.7%	14.6%	18.3%
1996	3.6%	5.0%	8.6%
1997	2.6%	1.0%	3.6%
1998	2.5%	-0.3%	2.2%
1999	2.3%	-2.2%	0.1%
Average	4.3%	6.2%	10.3%
Standard Deviation	2.9%	11.2%	13.2%

Estimated sustainable earnings for 1979 (the first year for which a predicted farmland value is calculated) is a weighted average of the previous five years of actual earnings. This assumes that farmers and/or investors cannot predict commodity prices or yields so past earnings are the best predictor of future earnings. Table 2 provides the estimated Et for the test period 1979 – 1999.

Step 2: Estimating the Required Real Rate of Return, Kt

To estimate the required return on farmland, k, in year t, the average risk premium is calculated for the previous 23 years and then added to the real risk-free rate in year t-1. For example, to estimate k1979, first the average risk premium is calculated for the period 1956 – 1978 by discounting the nominal total farmland returns (Table 1) by the annual nominal risk-free rate (average 3-month treasury bill yield). Then the average risk premium is added to the real treasury bill yield for 1978 to obtain k1979. This is meant to be a proxy for how an investor would determine the required rate of return on farmland in year t. Estimated kt combines the most recent risk-free rate (opportunity cost) and a premium for risk, based on past farmland returns. In summary, the required real rate of return on farmland investment in year t is estimated as follows:

(8)

$$K_t = (1 + rr_{ft-1})(1 + k_{rpt}) - 1$$

Where:

rr_{ft-1} = the real risk-free rate, as measured by the average real 3-month t-bill rate in year t-1. rrft-1 is calculated by discounting the nominal t-bill rate in year t-1 by the average rate of inflation in year t-1.

k_{rpt} = the average annual risk premium on farmland ownership over the preceding 23 years (for k1979, the years 1956-78 are used, for k1980, 1957-79 are used, and so on).

(9)

$$k_{rpt} = \left[\prod_{\tau=-23}^{-1} \frac{1+k_{at}}{1+r_{ft}} \right]^{1/23}$$

where:

r_{ft} = nominal risk-free rate in year t.

k_{at} = actual nominal return on farmland ownership in year t.

Table 2: Estimated Et, kt, and gt (1979 – 1999)

Year ($)	Et ($)	kt	gt	Predicted Value ($)	Actual Value
1979	8.05	9.3%	5.2%	208	241
1980	8.30	11.7%	8.2%	261	332
1981	9.15	12.9%	10.2%	366	382
1982	10.14	14.8%	12.1%	428	413
1983	10.85	12.8%	10.2%	455	405
1984	11.14	13.6%	10.9%	449	393
1985	10.35	15.8%	13.2%	445	357
1986	8.20	13.4%	11.1%	397	332
1987	6.81	11.4%	9.4%	363	298
1988	5.80	9.1%	7.1%	319	286
1989	4.71	9.1%	7.5%	307	286
1990	4.60	9.2%	7.6%	308	284
1991	4.79	9.0%	7.3%	305	265
1992	4.96	4.2%	2.3%	271	252
1993	5.02	6.5%	4.5%	263	247
1994	5.46	4.8%	2.6%	253	261
1995	6.43	7.1%	4.6%	273	299
1996	7.68	6.7%	4.1%	311	314
1997	9.01	4.0%	1.2%	318	317
1998	9.11	2.0%	-0.8%	314	316
1999	8.86	2.7%	-0.1%	316	309

Table 2 provides the estimated kt for the period 1979 – 1999.

Step 3: Estimating Expected Real Growth, gt

Expected real growth is based on the estimates of Et and Kt, using the relationship outlined in equation (2), which states that the expected return k is composed of an expected operating (dividend) yield plus a capital gains yield, where the capital gains yield is equivalent to the expected growth in earnings. Therefore, gt, the expected real growth in year t, is estimated as follows:

(10)

$$g_t = k_t - \frac{E_t}{V_{at-1}}$$

where:

k_t = the estimated real return to farmland in year t.

E_t = the estimated sustainable earnings to farmland ownership in year t.

V_{at-1} = the actual farmland value (price) in year t-1.

Table 2 provides the estimated gt for the period 1979 – 1999.

Results

Each of the three variables, Et, kt and gt, have been estimated based on information known to the investor at year t. These estimates are used to calculate a predicted farmland value, Vt, using the standard discounted earnings model as shown in equation (1). Table 2 illustrates and compares the predicted values, Vt, with the actual farmland values, Vat, over the test period 1979 to 1999. Figure 1 illustrates the comparison of actual and predicted farmland values. Based on the visual comparison, it appears that the discounted earnings model is reasonably good at predicting farmland values in Saskatchewan.

Testing the Results

A simple least-squares regression was performed, where actual farmland value is the dependent variable and predicted farmland value is the independent variable, for the test period 1979 – 1999. The resulting beta of .63 was significant at the 99% confidence level and the regression equation had an R^2 of 73%. This implies that the predicted farmland value, which is a function of expected earnings, expected growth, and the expected return on investment, is an important determinant of the actual price paid for farmland.

Figure 1: Comparison of Actual and Predicted Farmland Values in Saskatchewan (1979 – 1999)

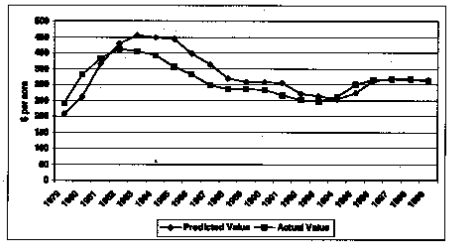


Figure 2: Comparison of Actual and Predicted (lagged one year) Farmland Values in Saskatchewan (1979 – 1999)

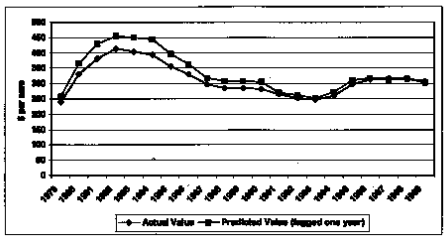


Figure 1 illustrates that predicted value seems to lag actual farmland values. A regression was performed using predicted values that were lagged one year. For example, the actual farmland value for 1979 was compared to the predicted value for 1980. In this scenario, since the 1980 predicted value is based on all prior information, including information from 1979, it is assumed that the investor sets the 1979 price with some knowledge of earnings, interest rates, and growth in 1979. An example of this is a farmer who is selling or buying land in the fall of the year after harvest is completed. The farmer would have a good indication of yields and commodity prices for that year and would include that information in the ask or bid price for the farmland. The regression using lagged predicted values provided a beta of .78, significant at the 99% confidence level, with an R^2 of 97%. Figure 2 illustrates the comparison of actual and predicted farmland values, where the predicted values are lagged one year.

Discussion of Results

Saskatchewan farmland has done reasonably well over the past 30 years (for 1970 – 1999 the average total investment yield was

Table 3: Comparison of Average Investment Returns: Saskatchewan Farmland, Canadian and US Stock Markets (1970 – 1999)

Time Period		1970 - 1999	
	Sask Farmland	Canadian Equities	US Equities
Dividend Yield	3.9%	2.9%	2.8%
Standard Deviation	3.1%	0.9%	0.9%
Capital Gain Yield	5.6%	7.2%	9.3%
Standard Deviation	12.8%	18.0%	16.0%
Total Yield	9.3%	10.1%	12.2%
Standard Deviation	15.0%	18.3%	16.1%
Time Period		**1980 - 1999**	
	Sask Farmland	Canadian Equities	US Equities
Dividend Yield	2.4%	2.5%	2.8%
Standard Deviation	0.9%	0.7%	1.1%
Capital Gain Yield	1.3%	7.4%	14.0%
Standard Deviation	10.9%	17.1%	13.2%
Total Yield	**3.6%**	**10.0%**	**16.9%**
Standard Deviation	11.7%	17.2%	13.2%
Time Period		**1990 - 1999**	
	Sask Farmland	Canadian Equities	US Equities
Dividend Yield	2.6%	2.1%	2.0%
Standard Deviation	0.7%	0.4%	0.6%
Capital Gain Yield	0.8%	7.0%	16.1%
Standard Deviation	6.1%	20.6%	14.5%
Total Yield	**3.4%**	**9.1%**	**18.1%**
Standard Deviation	6.8%	20.7%	14.4%

9.3%) in providing an investment return to its owners. However, most of the gains occurred in the 1970's and since the early 1980's, Saskatchewan farmland has not performed very well as an investment. Table 3 provides a comparison of yields for Saskatchewan farmland and Canadian and US stock markets. Since 1983, Saskatchewan farmland values have been in decline, which is further illustrated in Table 2 with the declining expectation of real growth. Based on the methodology used to estimate predicted farmland values, the current expected real growth for Saskatchewan farmland is zero or slightly negative.

The discounted earnings model can be used to predict future farmland values under different scenarios. The scenario chosen here is where current average commodity yields and prices do not significantly change in the future (yields and prices will fluctuate but in this scenario, returns per acre remain flat) and governments in Canada and Saskatchewan do not increase subsidies or transfers to Saskatchewan farmland owners. This scenario is one where there is zero or negative real growth in future NLR (net lessor return per acre) each year. Based on the discounted earnings model methodology described earlier, where the future NLR is fixed at the 1999 level ($7.35 per acre) and k and g are based on past averages, average Saskatchewan farmland values will continue to decline over the next 20 years. The model is used to project forward to 2019 and, as shown in figure 3, Saskatchewan farmland values under this scenario will decline from the 1999 level of $309/acre to approximately $158/acre in 2019.

Due to the poor returns to farmland ownership over the last 20 years and the current poor expectations for earnings growth, farmland as an investment does not appear to be very attractive. Besides poor commodity prices, which are keeping the NLR low, another concern is the shifting emphasis to investment in technology. If future yields and commodity prices are enhanced due to technology improvements, such as better seed varieties, fertilizers, chemicals, and equipment, then incremental returns will likely flow to the investors in that technology (manufacturers and lessees), not to the investors in land (lessors). Therefore, if prices and yields grow due to technological advancement, we may still see a static NLR (return to lessor) as the lessees demand an ever-increasing crop share. Land itself will become relatively less significant in food production and technologies relatively more significant. The lowering of the crop share to lessors will be helped along by the fact that many 'baby-boomer' farmers are nearing retirement. As more and more lessors enter the market, lessees will be in a better position to retain a larger share for their management and labour efforts as well as for financing new technologies. Hence, lower farmland values.

This scenario has serious implications for farmland investors. Figure 4 illustrates the relative future farmland and stock market investment values, based on the scenario described above. Farmland and stock market price indices start at 100 in 1969[4]. The US stock market price index projection is based on growing the 1994 US price index value by 6% compounded annually until 2019. Between 1969 and 1994, farmland was able to better or match the stock markets in terms of price appreciation and growth. However, after 1994, Saskatchewan farmland could not keep up. If, as depicted in figure 4, Saskatchewan farmland values continue to decline over the next 20 years and stock markets continue to average at least 6% capital gain yields, current farmland investors will have to seriously consider whether they should sell farmland and invest in other assets.

Figure 3: Predicted Saskatchewan Farmland Values - NLR fixed at $7.35/acre (2000 – 2019)

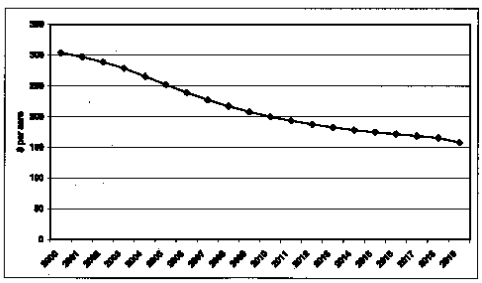
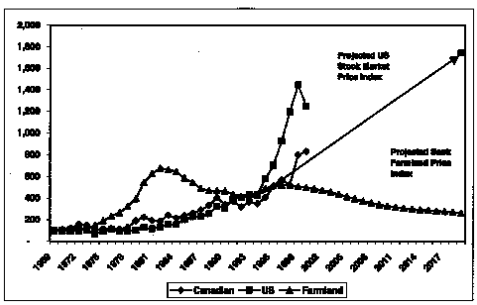


Figure 4: Comparison of Price Indexes (1969 = 100): Saskatchewan Farmland, Canadian and US Stock Markets (1969 – 2019)



Conclusions

The discounted earnings model does a reasonably good job of predicting Saskatchewan farmland prices over the past 20 years, when current and recent past commodity prices and yields are used to estimate sustainable earnings, and when long-term averages are used to estimate the expected return on investment and expected growth.

The farmland valuation model indicates that, if the net lessor return does not significantly increase in the future (that is, if the current level of the NLR is the sustainable level) then Saskatchewan farmland prices will continue to decline, as they have since 1983. The reason for this, based on the discounted earnings model, is twofold. First, the NLR, in real terms, is at a very low level historically and second, if the NLR remains stagnant, that implies negative real growth (low earnings multiplier). Low sustainable earnings combined with a low earnings multiplier produces low farmland values.

If farm earnings increase in the future, there is no guarantee that a share of the increased earnings will go to landowners. If the earnings increase is due to technology improvements such as seed varieties, fertilizers, or equipment, then the incremental earnings may go to those who have invested in the technology and not to the investor in the land. Hence, farm earnings could increase while farmland prices continue to decline.

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Endnotes

[1] Whereas required k is the minimum acceptable return on investment and is a function of opportunity cost and risk,expected k is the rte of return actually expected by the investor using V0 as the investment. In market equilibrium, required k is equal to expected k and the price of an asset is equal to its value.

[2] Note that the expected capital gains yield is equivalent to the expected growth in sustainable earnings.

[3] The data used to calculate frmland returns is available from a number of sources, including Statistics Canada, Agriculture and Agri-Food Canada, Canada Grains Council, Canadian Wheat Board, Candian Grain Commission, Canadian Transportation Agency, Farm Credit Corporation, Saskatchewan Crop Insurance Corporation, and Saskatchewan Agriculture and Food.

[4] Note that these are price indexes only and do not include operating or dividend returns.