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IS CANADIAN FARMLAND A GROWTH STOCK? THE FINANCIAL RISKS AND RETURNS FROM INVESTING CAPITAL IN CANADIAN AND ALBERTA FARMLAND, 1970-1986.

BY

© CATHERINE A. MAIN FREEMAN

A THESIS

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THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled **Is Canadian Farmland a Growth Stock? The Financial Risks and Returns from Investing Capital in Canadian and Alberta Farmland, 1970-1986.**, submitted by Catherine A. Main Freeman in partial fulfilment of the requirement for the degree of Master of Science in Agricultural Ecomnomics.

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Supervisor

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Date: 10 April 1988

ABSTRACT

During the period 1970 to 1986 Canadian and Alberta farmland can be characterized as a growth stock. Values of farm real estate have been rising more rapidly than the rate of inflation, displaying a form best described by a cubic polynomial function. Growth in farm real estate values has therefore not been constant, but has averaged 4.7%, representing an overall increase in real estate values of nearly 150% during the period.

As farm real estate prices have changed returns to capital invested in Canadian and Alberta farm real estate have been variable. While annual income from rent has remained a constant 0.7% of real estate values, returns in the form of capital gains in farm real estate values have ranged from a high of 19.5% in 1974 to a low of -11.3% in 1983 and were positive for only 9 out of the 17 years in the study. Despite this variability, real returns to equity capital invested in farmland averaged 4.0% from 1970 to 1986.

The variability in both farm real estate prices and returns during the period 1970 to 1986 left those who had capital invested in farm real estate facing several different types of risk. Unpredictable prices posed a risk to holding farm real estate as a single asset investment portfolio. It was found that diversification of a single asset portfolio somewhat reduced price risk. Uncertainty in the magnitude of returns had an impact of the financial position of the business. During 7 out of the 17 years in the study, business growth in Canada and Alberta was negative, even though in total, the aggregate farmer in Canada had a minimum of $5.99 worth of assets (and $5.00 in equity) covering every dollar of debt and farm assets were 85.5% equity owned.

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The first typed draft was cheerfully deciphered from pages full of scribbles and corrections by James Freeman. He also read and reread the initial drafts, helping edit, providing counsel and encouragement. He then dedicated long hours as my draftsman and helper despite the demands of his own hectic schedule. I cannot express how grateful I am for his help, his

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Last but not least, there was one old dog who sat with me through every hour during every stage of this project. I am grateful to Woody for his faithful companionship.

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1. INTRODUCTION

Canadian farmland is not sold on a stock exchange, nor does it appear on stock lists, but investment in farmland for the past forty years has been considered to be an excellent hedge against inflation and as an opportunity to realize positive capital gains. The potential of a profitable farm investment must seem enticing to an investor who comes across a magazine advertisement similar to one that appeared in the June, 1987 issue of **Cattleman**. In the advertisement, large tracts of deeded land were offered for sale. The land sale was purported to "present an excellent agricultural investment opportunity -- (due to) today's lower land values..." (p. 29). It could be questioned whether the concerns of a farmland investor may differ from or be similar to those of other investors. Investors in both farmland and more traditional types of investments expect that they will benefit in some designated way. In both cases the anticipated benefits must outweigh the economic and noneconomic costs of the investment.

In 1979, Emanuel Melichar of the Federal Reserve Board classified U.S. farmland as a growth stock. By doing so he implied that investment in farmland was similar to buying shares of, say, Xerox or IBM which are viewed as growth stocks. In a growth stock, capital appreciation is an appreciable component of the returns derived from owning these assets. This thesis is concerned whether the characterization of farmland as a growth stock also applies in Canada and in Alberta. Furthermore, if farmland can thus be characterized as a growth stock, how does this effect an investor's perception of his financial position before and after the transaction? How does this affect the farmer, who is primarily a businessman, trying to make

a profit from his assets?

This study will attempt to answer these questions by identifying, describing and measuring the changes over time in returns form farming activities and from ownership of Canadian and Alberta farmland. Melichar's model of growth accounting is applied and returns to real estate and farm assets are calculated for the years from 1970 to 1986. In addition, the repercussions of holding a large proportion of a family's wealth in a growth stock such as farmland are discussed in terms of impacts on the farm business.

With these objectives as a guide, Chapter 2 of this study contains an outline of the theoretical background to land valuation issues and discusses literature from this area. Then the methodology used for quantifying and qualifying growth is discussed in Chapter 3. In Chapter 4, the results of the spreadsheet analysis are presented. Finally, these data are used to analyze the impacts of changing asset values on farm level risk in Canada. The results are given in Chapter 5. It is concluded that the behavior of a growth stock such as Canadian farm land has profound impact on the characteristics of an investor's portfolio. In the case of the farmer, these impacts affect his business, his income and his family wealth.

2. BACKGROUND

The purchase or holding of farmland is an investment decision. Whether buying or holding land, the purchaser is willing to forego investing in an alternative capital investment in return for the benefits that he expects will accrue from the ownership of land. The seller may be willing to liquidate his capital held in the form of farmland if other forms of investment or monetary use have become more attractive or if it is felt that he can earn a fair salvage value. How much to pay for land and how much to sell land for are decided by the investors, whether buyer or seller, on the basis of certain macroeconomic and microeconomic criteria.

2.1 A MARKET FOR FARMLAND

The price of land is established in a free marketplace. In a perfectly functioning land market, pricing will be efficient if there are a large number of buyers and sellers, any one of whom does not influence the entire market; if there is perfect freedom of entry and exit; if the parcels are homogeneous so that prices differentiate only on the basis of quality and location; and if there is perfect knowledge in the marketplace.

However, there are conditions peculiar to land which impede efficient market functioning. Parcels of land are heterogeneous, differing in location and quality. Parcels sold in any one period, for example in a year, represent only a small proportion of land held. In addition, land is immobile and unstandardized. Where farmland is traded in relatively unorganized low-volume local markets or in cases where the transactions

themselves take years to complete, market information is not perfect (Robison et al. 1985).

Despite these inefficiencies in the farmland marketplace, there is competition for capital from both within and without the agricultural section. Within the sector, farmers who currently earn large enough returns to hold their capital in farming establish prices. Outside the sector, returns from alternate uses of capital establish a benchmark for returns to capital invested in farm real estate. The investor, in deciding the most profitable investment choice, will take such considerations into account. Factors such as high general inflation or a weak dollar which influence the performance of the entire economy also affect an investor's time value of money, perception of risk and the price he is willing to pay (Tweeten, 1980; Aplin et al. 1977; Castle and Hoch 1982).

2.2 SUPPLY AND DEMAND FOR FARMLAND

The price of a resource such as land is a function of supply and demand. The price will vary from region to region due to physical differences. Soil type, climate and management practices effect fertility, subsequent crop types and crop yields. Upward or downward shifts in productivity due to capital improvements such as irrigation, drainage or capital attrition through leaching, erosion or salinization will have a direct impact on the price an investor is willing to pay (Tweeten, 1966).

The price of land is generally affected more by demand factors than by supply side factors. Land is a resource that in aggregate is limited in

quantity. There is some disagreement regarding the degree of scarcity. Some researchers feel that the aggregate quantity of land is fixed because new land cannot be developed despite strong demand (e.g. Reinsel and Reinsel, 1979; Burt, 1986). They feel that the aggregate supply of land is unresponsive to changes in price and thus completely inelastic as depicted in Figure 2.1 by the vertical supply line S_1. Others, like Hughes et al. 1984, maintain that "the total supply of land is not fixed. Price increases for land can lead to land improvements, while price declines can lead to removal of farmland for other uses. It can be expected therefore that the supply of farmland in the U.S. has a small positive slope" (p.757). In Figure 2.1, S_2 is depicted with a small positive slope and available quantity (q_1 to q_2 in Figure 2.1) increases slightly with increased price (p_1 to p_2).

Taking either perspective, a classic supply function for land does not exist. At best, it can be described as very inelastic - at worst, totally inelastic. Therefore demand for land will be the major factor in determining the price (Burt,1986).

Reinsel and Reinsel (1979) give a list of macroeconomic factors which would give rise to increased demand for land. In brief these are:

1) Population growth increases the demand for space.

2) Inflation.
   a) Buyers see land as a hedge against rising prices.
   b) The returns to land may inflate more than the returns to other types of capital.

3) Changing access to financing and varying credit terms.
   a) Lower interest rates from concessional credit.
   b) Longer repayment periods.

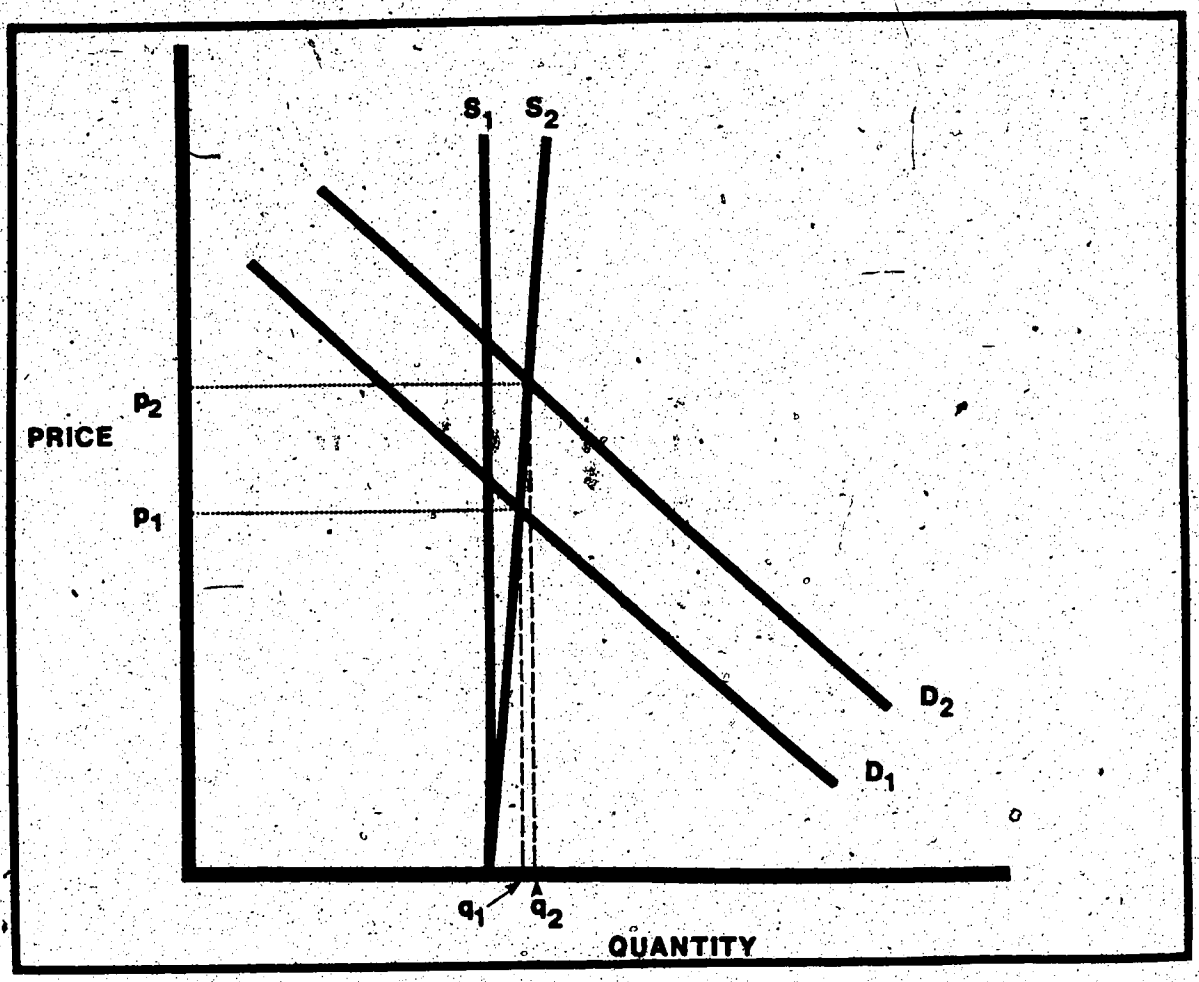


Figure 2.1 Theoretical supply and demand curves for aggregate farmland. While a classic supply curve for aggregate farmland does not exist, two descriptions of the aggregate relationship for supply of farm land are proposed. One views the curve as completely inelastic (S_1), the other sees the supply of farm land as very inelastic (S_2). Assuming an inelastic supply curve, the aggregate quantity of farmland supplied will respond only a very little (q_1-q_2) to increases in price (p_1-p_2). Price increases may be caused by a shifting of the demand curve for aggregate farm land (D_1-D_2).

c) Lower required down payments.
d) Government guarantees for marginal borrowers.

4) Taxation policies which favor different types of assets.
a) Production receipts.
b) Capital gains or land appreciation.
c) Real estate inheritance and estate taxes.

5) Increased demand for agricultural exports.

6) Preferential use or assessment of land.

7) Stabilization of farm incomes.
a) Increasing value of farm production.
b) Reducing risk of farm earnings.

As depicted in Figure 2.1, any of the factors listed above would shift demand for land to the right, from D_1 to D_2. Since farmers and nonfarmers "have different sources of income, use land in different ways, and might have different portfolio balancing preferences, their demands for land can shift over time in divergent ways". (Hughes et al. 1984, p.755). Their demand for land will be more elastic and responsive to changes in price if they can either find attractive substitutes for land (e.g. a technology which enables output to be produced at a lower cost per unit (Doll and Orazem, 1978)) or if a large percentage of their income is spent on land.

The different demands for land imposed by investors may be broken into three main types: productive, consumptive and speculative. Productive demand refers to the pressure exerted by economies of scale toward larger parcels of land as a means of achieving productive efficiency. Consumptive demand provides noneconomic benefits to the investor. Investor motivation to own land may be for: 1) a country residence or retreat; 2) an area for private recreation; 3) obtaining or maintaining a preferred lifestyle or 4) keeping land in a family (Pope and Goodwin, 1984; Pope, 1985). Speculative demand is generated by individuals who consider investment in land as a hedge against

the effects of inflation or for beneficial taxation policies (Shalit and Schmitz, 1982). Despite the problems of quantification of a myriad of economic and noneconomic factors, the marketplace brings all those motives to a common denominator -- the sum which each investor is willing to pay for these factors.

2.3 THE INVESTMENT DECISION

According to the assumptions of simple microeconomic theory, the goal of the firm is to maximize profits. However, this is not always the case for an investor in farmland. Aplin et al. (1977) state that "maximizing profit is not always synomynous with maximization of owner's wealth. Wealth maximization is a more inclusive goal than profit maximization. It takes into account earnings per dollar invested by owners and risk associated with these earnings as well as other factors which affect the value of the firm" (p.3).

Capital investment involves the estimation of future trends. These depend on the investor's individual attitudes to the risks and opportunities in investment (profitability), his financial position (feasibility) and his position in his life and business cycle. From investor to investor, expectations of the future will be heterogeneous because experiences and interpretations of the past differ. One consequence of this heterogeneity was identified by Brown and Brown (1984) who argue that it may be the extreme investor who establishes the price of land: the financially secure, the optimist or the risk taker; not the average investor with average expectations.

2.4 THE CAPM NET PRESENT VALUE APPROACH TO LAND VALUATION

A technique that is commonly used to estimate returns and to compare the profitability of alternative investments is the capital asset pricing model (CAPM). A simple CAPM model often utilized by land appraisers and land value researchers for its clarity of interpretation is the capitalization formula. It is represented by the mathematical relationship:

$$V = I/r \qquad \text{(Eq. 2.1)}$$

where V is the current value of land, I is the annualized earning generated by the land and r is the chosen discount rate. Conceptually, Equation 2.1 describes land values (V) as a function of the relationship between earnings generated by assets (I) and the opportunity cost of capital (r). If expected earnings rise, so will land values. If expected earnings decline, land values will decrease.

The assumptions underlying Equation 2.1 are that land is a durable and non-depreciating asset with a productive life that is infinite in length. Consequently, the stream of services which land provides continues into perpetuity. Long run expectations for returns and the cost of capital are assumed to be constant. The planning horizon is therefore assumed to be infinite. However, Barry et al. (1979) state that the capitalization formula has limited applicability over a time period of twenty years or less.

The net present value criterion of the CAPM is commonly applied to a future stream of cash flows in order to translate them into a current value. Examples of applications of this technique are found in case studies by

Barry (1980), Bauer (1983), Carter (1981), Castle and Hoch (1982), Dobbins et al. (1981), Melichar (1979), Reinsel and Reinsel (1979), Tweeten (1980) and White and Musser (1982).

Although the CAPM is widely used to estimate land values, there are reasons to caution against the unquestioning application of the model and its valuing technique. These are listed by Barry (1980) as follows:

1)Markets are assumed to be highly efficient so that expected returns quickly and fully reflect available information.

2)Transfer costs, tax obligations and indivisibilities are assumed not to exist.

3)Lending and borrowing rates are considered equal for risk-free financial assets.

4)Investors are assumed to be risk-averse, well-diversified and to hold homogeneous expectations that are fully characterized by means and variances over single period horizons.

Critics of CAPM voice concern regarding the application of the model to land values since:

1)The land market is inefficient because of the local, low-volume and immobile nature of land (Carter, 1981; Kost, 1968). In addition, the operators of inefficient units are often unaware of better, alternative uses of their resources and thus buy land.

2)Land does not fit into a well-diversified portfolio because it is illiquid and indivisible (Carter, 1981).

3)Land investors do not hold homogeneous expectations (Carter, 1981; Brown and Brown, 1984).

While there is little doubt that there are valid concerns about the applicability of the CAPM, it is important to assess whether or not the explanatory capacity of the CAPM is diminished by modifying or relaxing some of the basic assumptions. Few disagree that the CAPM forms an appropriate starting point for estimating the value of assets such as farm real estate. However, there is less unanimity in the specification of how the

expectations of future net cash flows are formed and the appropriate discount factor to use.

Subsequent sections will discuss the specification of the discount rate and the earnings stream under less rigorous assumptions and facilitate a more realistic and flexible application of the relationships represented by the capitalization formula.

2.5 DISCOUNT RATES

2.5.1 Simple Rates of Return

By rearranging the capitalization formula (Eq. 2.1) to:

$$r = I/V \qquad \text{(Eq. 2.2)}$$

the ratio of asset earnings to investment price is determined. As a simple rate of return, it is a variable sensitive to the magnitude and variations in earnings (I) and to changes in farmland prices (V). This simple rate is realized if there is no consideration of any outside factors.

2.5.2 Actual Realized Rates of Return: The Discount Rate

Tweeten (1981) cautions that the actual rate of return, which he defines as the rate which compensates savers for postponing consumption in the absence of price changes, may differ from the simple rate of return due to risk or to both tangible and intangible benefits of holding farmland. The actual rate of return is also referred to as the discount rate which reflects the cost of capital or opportunity cost of funds committed to the purchase of farmland (Boehlje and Eidman 1984).

2.5.3 A Complex Discount Rate for Equity Financing

If a sophisticated investor adjusts his discount rate to better reflect his environment, the adjustment might be based on the riskiness of land investment when compared to alternative investments, differences in expected rates of growth in earnings and differences in the noneconomic benefits associated with alternative investments (Boehlje and Eidman, 1984). The component parts of the more complex discount rate are specific to each investor. The choice of a discount rate must adequately reflect the fact that returns received early are of more value to the investor than returns received late, because he can reinvest early earnings at the cost of capital. Brown and Brown (1984) define an investor's perception of uncertainty as the differing probability estimates that decision makers have for future events.

When the simple rate of return is altered by including factors such as risk, earnings, growth, noneconomic benefits or taxes in addition to inflation the actual realized rate of return is no longer equal to the simple rate. For any time period t, the compound discount rate might be:

$$r = (1+rm)^t(1+rr)^t(1+ri)^t(1-rg)^t(1-rn)^t(1-rx)^t - 1 \quad \text{(Eq. 2.3)}$$

If this rate remains constant into perpetuity, the model becomes:

$$r = (rm + rr + ri - rg - rn - rx) \quad \text{(Eq. 2.4)}$$

where all rates are annual and:

r = the actual realized (effective) aggregate discount rate;

rm = the simple discount rate, cost of capital or real monetary interest rate;

rr = the risk premium for investment in land;

ri = the expected real inflation rate;

rg = the expected growth rate in earnings;

rn = the rate of noneconomic returns to ownership;

rx = the marginal tax rate; and

t = time, in years.

The relationships developed in Equation 2.4 imply that an investor is willing to accept an actual realized return to farmland that is less than the simple market rate (rm) if he is receiving or expects to receive growth in earnings from farmland (in income or in capital gains), if he values noneconomic benefits from land ownership (Kost, 1968) or if he has a low marginal tax rate. If, on the other hand, the investor faces rates of inflation or risk he will demand a realized rate of return which is higher than the simple discount rate (Doll and Widdows, 1981).

While making no stipulation as to magnitudes, one can appreciate the direction of the influence that each of the variables will have on farm land values if Equation 2.4 is incorporated into the simple capitalization formula (Eq. 2.1). The present value of land will increase if the aggregate discount rate decreases. This will occur, if:

1)The expected growth rate of earnings rises relative to inflation or alternative investment earnings.

2)The rate of return for noneconomic benefits of land ownership rises.

3)The marginal tax rate, which favors capital gains income above taxable cash income, increases.

4)Income taxes, property taxes or capital gains taxes decrease.

5)The real monetary interest rate, the general inflation

rate, or the risk premium for land investment falls. When tax or inflation factors are included, both cash flow earnings and discount rates must be adjusted (White and Musser, 1982; Robison et al, 1985).

Any of these exogenous influences on the returns to land might be incorporated into an individual's discount rate for long-run or short-run investment analysis. In practice, Burt (1986) argues that market participants will simply use an estimated long-run equilibrium real rate of interest as the discount rate in the capitalization formula. His justification is that investment in land is a long term investment entailing large transaction costs and thus all influences and considerations besides long-run real interest rates are inconsequential (p.12).

2.5.4 A Complex Discount Rate for Debt Financing.

In addition to the rate adjustments which are necessary for equity purchasers to evaluate Equation 2.4, several adjustments to the discount rate are used when debt capital finances the farm land purchase. Models presented by workers such as Dobbins et al. (1981) and Tweeten (1981) include adjustments for the required rate of return on equity. (rm in Equation 2.4), the interest rate on borrowed funds and the proportion of the purchase financed by debt and equity. Tweeten (1981) focuses on the difference between the simple discount rate as a measure of the rate of return on farmland (rm) and the cost of inflation adjusted debt capital. Tweeten terms this difference mew. The actual discount rate (r) can be adjusted to reflect the use of debt capital by:

$$r = [rm - (ri\mu L)/rm] \qquad \text{(Eq. 2.5)}$$

where L is the ratio of debt to equity and the other terms are as previously

defined for Equation 2.4.

The implications of a debt financing term such as the one defined in Equation 2.5 are twofold. First an investor is willing to accept a lower actual return on farmland (r) if he has underpriced or positively leveraged debt financing (Tweeten,1981). Secondly, as the ratio of debt to equity rises, the effective aggregate discount rate (r) falls causing land values to rise. This trend is exaggerated if the real monetary interest rate (rm) representing the rate of return on farmland exceeds the cost of debt capital. On the other hand, if the cost of debt capital exceeds the return from farmland, land prices will decline. The economic well-being of an investor will be enhanced by the purchase of an asset which promises a rate of return in excess of the estimated cost of capital (Alpin et al. 1977).

Concessional credit rates tend to increase mew and therefore exert upward pressure on land values. Tweeten (1981) suggests, however, that much of the impact of existing concessional credit has been realized and this will consequently have less impact in the future. Concessional credit that has been made available to farmers for the purchase of farmland gives farmers an advantage when bidding for land because these programs enable them to bid a higher price for farmland than nonfarmers.

2.6 EARNINGS FROM LAND OWNERSHIP

Returns to land investment come in several forms. An investor who owns land will receive annual returns in the form of rental payments; for holding land he may gain unrealized returns in the form of capital gains; from operating land he will receive a portion of his net farm income as a

return to the land's productivity.

Earnings have a direct impact on land values. From the simple capitalization formula (Eq. 2.1) it can be seen that as returns to land rise, land values will increase; if earnings decrease, land values will fall. The present value of land is a function of the stream of anticipated earnings. There are, however, two schools of thought concerning the behavior of these earnings. One school contends that land values are a function of rental returns alone (e.g. Dobbins et al., 1981); the other school believes that land values are a function of a stream of steadily growing earnings and result in both increased rent and capital gains or losses from appreciating or depreciating land values (e.g. Castle and Hoch, 1982).

2.6.1 Rent

The rental of farm real estate pays the landowner for the services of land and buildings used for farm production. Rent is commonly determined in one of two ways: crop share or cash rent. Crop share rent involves an agreement between landlord and operator under which, for example, the landlord would receive 1/3 of gross crop returns and in return would assist the tenant in a 1/3 split of some agreed variable costs (fertilizer and weed control) and payment of all real estate taxes. The tenant would receive use of the land and buildings, receive 2/3 of gross crop returns, pay 2/3 of the designated variable costs and pay 3/3 of any other costs incurred (Bauer, 1983; Burt, 1986). This arrangement spreads the production and price risks between the landlord and tenant. In return for taking a portion of the risk, the landlord has a chance of a better return than under a cash rental agreement.

Cash rent involves a pre-arranged cash payment based on a specific price per unit (per acre or per animal unit). While cash rents are less common than crop share arrangements, they are widely used in areas where pasture is rented for grazing livestock. The advantage of cash rents is that there is a clear cash outlay for rent and therefore knowledge of rental values is more precise than are the estimates for crop share rents. Cash rents tend to be lower than crop share rents to compensate cash rent tenants for facing production and price risks alone. Cash rents therefore tend to underestimate overall returns to farmland (Tweeten, 1981).

Many factors influence rental values; the common feature however is that these factors all have an impact on farm level profits. On either a crop or cash basis, rental values are parcel specific (Vantreese et al. 1986) and therefore potential for profit is as heterogeneous as the natural resources of farm land -- soil fertility, mineral resources, climate and location. Rental values will change in response to profits generated by technologies which increase the efficiency of input combinations or decrease per unit cost of outputs (Doll and Orazem, 1978). They will also reflect any changes in farm product prices due to increases in foreign exports or domestic demand for agricultural products (Tweeten, 1980).

From the analysis of land values and cash rental values between 1961 and 1978 in ten midwestern U.S. states, Tweeten (1981) concluded that "farmland earnings have kept pace with sharply rising land prices in recent years. Based on reasonable expectations of future land earnings, current land prices are justified by prospective future earnings from land used for farming alone. It is not necessary to introduce explanations such as speculation, urban encroachment or tax hedges, to justify the current value

of farmland" (p. 20). Using cash rents for leased farmland from eight of the same ten midwestern U.S. states in the period from 1963 to 1983, Alston (1986) drew conclusions that are similar to Tweeten's. In an investigation of rents and land values from 1960 to 1977 in Tippecanoe County, Illinois, Dobbins et al. (1981) found empirical evidence that variation in cash rents explained 94% of the variation in land values. Burt (1986) came to similar conclusions looking at crop share rents and land values from a select homogenous group of Illinois farmers using data from 1961 to 1981.

Using more general aggregate U.S. farmland data from 1910 to 1985 and a more dynamic capitalization model, Featherstone and Baker (1987) suggest that the price of land (farm assets) adjusts until the rate of returns to land is equated with the opportunity cost of investing in land along a time path of adjustments which consists of a series of shocks and reactions. They describe a dynamic "price bubble" adjustment in real asset values, real returns to assets and the real interest rate during the period from 1973 to 1984. They conclude that this bubble was largely driven by a shock to returns in 1973 and that real interest rates had only a very small influence on returns during the period.

2.6.2 Rent and Capital Gains

If rental values were increasing and in addition if they were perceived to be steadily growing, they could be incorporated into the simple capitalization formula (Eq. 2.1) as:

$$V = [(1 + I_g)/(r_m - r_g)] * Ir \qquad \text{(Eq. 2.6)}$$

where:

V = land values.

I_r = annual return (rent).

I_g = capital gains due to a growth in current earnings.

r_m = discount rate; real money interest rate.

r_g = expected growth rate in earnings.

If growth in rental earnings was expected to be constant and perpetual, this factor would be expressed by the capitalization model of Equation 2.7. Growth in earnings based on different assumptions than these are discussed in subsequent sections.

Introducing growth as both a growth in earnings (I_g) and a corresponding growth rate in the discount rate (r_g) causes land values to become very sensitive to even small rates of growth. "Capital gains themselves result from capitalization of a growing rent stream" (Featherstone and Baker, 1987, p., 533).

Capital gain returns occur when there are market changes in the value of a land owner's property. Capital gains include only price changes due to capital appreciation; they do not include changes in price due to changes in land quality or inflation. A capital gain increase in land value will increase the purchasing power of the land holder's net worth so that he could increase his consumption without reducing his net worth (Huff and Cusack, 1972). It is a return, though unrealized, to the land owner for simply holding his land while the market changed.

While unrealized, annual capital gains are considered to have value for several reasons. Firstly, capital gains serve to reduce risk by decreasing the degree to which equity is leveraged. Secondly, the gains

provide reserves of equity which increase financial flexibility and the potential for business expansion (Plaxico and Klethe, 1979). Thirdly, unrealized capital gains take the place of savings and retirement funds which would have to be set aside if equity were not increasing. This increased equity serves as potential collateral for additional borrowing (Brinkman, 1981). Although capital gains are not realized annually, consideration of them is necessary to properly evaluate rates of return on investment in farm capital (Boyne, 1964; Brinkman, 1981).

Negative capital gains have the opposite effect of positive gains. Capital losses erode equity. The business will experience the consequent rise in financial risk as borrowing power shrinks and equity becomes ever more highly leveraged. The loss of real wealth will shrink the value of savings stored in the form of farmland. When capital gains are negative, the purchasing power of the land holder's net worth will decrease. He would have to decrease his consumption (business uses of equity or family withdrawals) in order to maintain the same level of net worth.

The difference between rent and capital gains is that while rent is an annual income return or flow which the landowner can expect for the productive services of his property, capital gains are a stock return to a landowner for holding property as the market value changed.

While rent may not always represent a cash income (i.e. for the owner/operator, rent is not cash income), it is usually a positive return. Capital gains, however, represent a return which can be either positive or negative.

2.6.3 Inflation

If the economy was in a stationary competitive equilibrium where all prices for assets and commodities inflated at the same rate as the general inflation rate, land prices in real terms would in effect, remain constant. However, in a dynamic economy, one in which inflation is not neutral (White and Musser, 1982), land rents and land values which increase in excess of the general inflation rate will experience what is termed "real" value increases (Feldstein, 1982; Tweeten, 1981). Appreciation of asset values will result in an increase in the purchasing power of the land owner's net worth which can be viewed as an increase in real wealth. Real and nominal dollar values will be discussed further in Methodology 3.1.3 and used in deriving the results given in Chapter 4.

2.7 CAPITAL GAIN

2.7.1 Capital Gains in a No-Growth Model

Adaptations of the Net Present Value (NPV) models for land valuation by inclusion of a growth variable vary somewhat in their scope and limitations. In a non-growth model these capital gains would be considered as an unanticipated occurrence or windfall. In the NPV method of evaluating investments there are several ways of handling a one time capital gain and growth in net worth. The most general model and the one which requires the fewest assumptions is of the form:

$$V_0 = P_0 + R_1/(1+r) + R_2/(1+r)^2 + \ldots + R_n/(1+r)^n + P_1/(1+r)^n \qquad \text{(Eq. 2.7)}$$

where:

V_0 = the present value of the asset.

P_0 = the present purchase price.

R_1 .. R_n = the net earnings per period n accruing from the ownership of the asset. Note that n does not necessarily denote a uniform time series.

P_1 = the salvage value to be earned after time period n.

r = the discount rate.

This model accommodates uneven earnings, different planning horizons and an expectation for either a capital gain or loss realized at the end of the planning period upon disposal of the asset -- a one time capital gain. The model is based on the premise that the value of net earnings today is worth more than it would be in the future due to investment potential.

Using similar assumptions, Plaxico and Klethe (1979) examine the capital gains return expected over the length of a finite planning period (n):

$$V_0 = \{(P_n - P_0)(1-T_c)\} \; / \; \{[1+D(1-T)](1+Z)\}^n \qquad \text{(Eq. 2.8)}$$

where:

V_0 = the present value of an asset.

P_0 = the present purchase price.

R_n = the sale price of property at the end of the planning period.

T = the marginal tax rate.

T_c = the marginal tax rate on capital gains.

D = the discount rate.

Z = the general inflation rate.

The model of Plaxico and Klethe is limited, however, because it does

not consider the income stream derived from land ownership in the form of net rent. When both sources of income are considered, a simple derivation using the general model offered by Brealey and Myers (1981) is helpful, for it demonstrates the components which influence an investor's perception of the present value of land. If land were to be held for one year its price would be a function of the rent and the capital gains which were realized:

$$P_0 = (DIV_1 + P_1) / (1 + r) \qquad \text{(Eq. 2.9)}$$

where:

P_0 = the present value of land

P_1 = the salvage value of the land at the end of one year.

DIV_1 = the dividend or rental income gained.

r = the discount rate.

If the land were kept for two years, the present value would be:

$$P_0 = DIV_1/(1 + r) + (DIV_2 + P_2)/(1 + r)^2 \qquad \text{(Eq. 2.10)}$$

If the land were held until year H, the present value becomes:

$$P_0 = DIV_1/(1 + r) + DIV_2/(1 + r)^2 + \ldots + (DIV_H + P_H)/(1 + r)^H \qquad \text{(Eq.2.11)}$$

As H approaches infinity, a reasonable assumption, since land could conceivably remain productive throughout time, the present value of its terminal value approaches zero. If an infinite planning horizon is assumed, the present value of land can be expressed as a perpetual stream of cash rents in the form:

$$P_0 = SUM(DIV_t / (1 + r)^t) \qquad \text{(Eq. 2.12}$$

This formulation does not explicitly exclude capital gains. It has been derived from the assumption that the present value of land is a function of income from both rent and capital gains with the additional restriction that the planning horizon of the investor is infinite. Doll and Widdows (1981) rationalize this assumption as follows: "At the end of t periods the asset may be sold and the sale value discounted back to the present. But the sale value is determined by the earnings from time t + 1 into the future. Each time the asset is sold, earnings are again extended into the future, and hence, without limit" (p. 730).

If the further assumption that there will be equilibrium in the long run so that constant expectations of returns and discount rate will prevail is placed on the model, the Brealey and Myers model can be simplified to:

$$P_0 = DIV / r \qquad \text{(Eq. 2.13)}$$

This is essentially the capitalization formula of Equation 2.1. The capitalization formula therefore includes the concept of capital gains, but does so under very restrictive assumptions of an infinite planning horizon and long run equilibrium. In addition, Melichar (1979) notes that changes in variables DIV or r will result in a new equilibrium value of P_0. The amount of change in P_0 is a capital gain.

2.7.2 Capital Gains in NPV Growth Models

In contrast to the assumption of one time capital gains in non growth models, capital gains in growth models are expected to occur annually throughout the planning period, even during intervals of equilibrium.

A NPV model used by Plaxico and Klethe (1979) describes the present value of land in which unrealized capital gains are viewed as the only income stream. The form of this model is:

$$V_l = SUM[(P_i - P_{(i-1)})(A)]/(X)^i + [P_n - P_o(1-A) - (P_n - P_o)T_c]/(X)^n \quad \text{(Eq. 2.14)}$$

where:

V_l = the present value of land.

P_i = the current price of land.

P_o = the current price of land.

P_n = the salvage value of land.

A = $(0 < A < 1)$ is the proportion of increase in equity per year due to the price increase.

X = the compound discount rate used in the model.

T_c = the marginal tax rate on capital gains.

The A variable and its interaction with annual capital gains represents an attempt by Plaxico and Klethe to isolate the annual increase in equity caused by land value increases within the time frame of a finite planning horizon. This annual unrealized equity gain is assumed to be available as a financial reserve or as an equity base for expansion. The model is limited in application because it neglects annual rental income.

Bhatia (1971) provides several alternative suggestions for methods of specifying annual capital gains. However, instead of using several different models and methods of capital gains specification, many researchers have elected to utilize the various NPV growth models.

Castle and Hoch (1982) use a model in which rent increases by a real amount each year. Their model is of the form:

$$V = (R + C)/(1 + I) + (R + 2C)/(1 + I)^2 + \ldots + SUM(R + sC)/(1 + I)^s \quad \text{(Eq. 2.15)}$$

where:

R = rent
C = annual real increase in rent
I = the discount rate.
s = year

Not only does this model use real annual rental increases but it condenses into the form:

$$V = (R + C)/I + (C*I)/I \quad \text{(Eq. 2.16)}$$

This form is significant because it implies that the present value of land is a function of (R + C)/I, the capitalized annual rental income and (C + I)/I, the capitalized value of capital gains due to increases in rent. An assumption that limits this model is that there is an infinite planning horizon and therefore the terminal salvage value approaches zero. In addition, it is assumed in the long run, equilibrium will prevail so there are constant expectations of rent, annual increase in rent and an appropriate discount rate.

The form more commonly used describes a constant growth trend in earnings as a rate instead of the real amount used by Castle and Hoch (1982). In a constant growth model there may be year to year deviations in actual returns, but as long as the expected returns grow at a constant rate over a time period that approaches infinity, the model is applicable (Brealey and Myers, 1981). The model is of the form:

$$P_0 = DIV_1 / (r - g) \quad \text{(Eq. 2.17)}$$

Vandeveer (1985) also used this model and concluded that during the

period from 1960 to 1982, the expected growth in earnings (g) became an increasingly important component of annual land value changes in Louisiana.

If the growth in returns is assumed to be constant and perpetual, the form of the NPV model becomes:

$$P_0 = DIV_1 * (1 + g)/(r - g) \qquad \text{(Eq. 2.18)}$$

Melichar (1979) uses this form of the growth model to explain growth in U.S. aggregate farmland values from 1950 to 1978.

If the form of the growth model is further constrained by the assumption that expectations are perpetually stable, that is, in the long run there is equilibrium, the form becomes:

$$Pet = (1 + g)/(r - g) * DIV(1 + g)^t \qquad \text{(Eq. 2.19)}$$

It is this form of the growth model that Melichar (1979) uses to conclude that "the substantial capital gains experienced over most of (the period 1956-1978) were on the whole no greater than those that would have been expected to occur at equilibrium" (p. 1090). Doll and Widdows (1981) suggest that the treatment of growth in returns in Equation 2.19 is too limiting because it does not allow the flexibility of assuming the investor may annually reformulate growth rates and earnings as does the equally useful Equation 2.18.

2.7.3 Capital Gains in the Farm Accounting System

Capital gains have traditionally been included along with net farm income in estimating returns to farming. However, farm accounting is not

dapted for inclusion of annual unrealized capital gains. Asset values found in the balance sheet are usually listed at cost. Farm accounting systems are often unable to handle both economic and accounting measures of return. Instead, these systems are generally designed to deal with income from sales, rentals, outside income contributed to the farm, wages, contract earnings and similar entries. Farm accounting systems do not easily accommodate capital gains.

Within the farm accounting system, assets are defined on the basis of their lifetime. This lifetime is viewed at a snapshot in time. However, in economic systems, assets like land are defined by the value of a stream of returns. While these are concepts are unreconcilable, in practice the different valuations made from within the two systems may be confused if they are not clearly distinguished while examining such issues as changing land values.

Aukes (1985) clearly defines the difference between accounting income and economic returns by saying that accounting income is an actual entity (e.g. cash receipts), an *ex poste* measure based on market transactions and prices, whereas economic income is a predicted value or an *ex ante*, personal concept. Because the two measurements are of incompatible magnitudes, they are not additive and therefore cannot be used interchangeably. An investor who is determining the relative profitability of alternative investments based on the CAPM should only use an economic measure of income. Accounting income is the appropriate measure to use when establishing the financial feasibility and the ability of the investor to make cash payments once he has identified his most profitable investment alternative.

In practice, capital gains are often ignored in the accounting system. The financial statements are drawn up on the basis of the historic, undiscounted purchase values. New acquisitions, reflecting their respective current market prices, are introduced with the purchase of land and are then locked into the financial records at that value. This method is simple since there are no adjustments to be made in the accounts or in the financial statements. Its defenders point out that capital gains are a return which is not captured until the asset is traded and these therefore should not be included in annual accounting of the farm business. However, the procedure could mislead a farmer into thinking that his borrowing capacity is considerably less than if current market values were used to evaluate his assets. The advantage of this method is that the growth of his business is isolated from growth in the value of his assets.

An alternative method of accounting for capital gains in farm financial statements is by updating asset values at fixed time intervals to reflect market values. On the other hand, this method might lead a farmer to conclude that he can carry a higher and higher debt load as land prices rise, leaving him increasing vulnerable to fluctuations in the value of land. Another problem is that with this method alone the farmer cannot distinguish between asset growth and business growth so that he can determine his debt servicing ability. Debt servicing is linked to business growth but not to asset growth.

A third method attempts to overcome the problems associated with the previous two methods by simply combining them. From one set of farm accounts, two sets of financial statements are derived, one reflecting asset purchase value, the other a current market value. Using these two sets of

information, a farmer can determine his business growth, thereby enabling him to assess both his debt servicing ability and his debt incurring capacity. However, this method may be time consuming because of the continual need to update current land value records. In addition it does not resolve the basic conflict between farm accounts which record the flow of income and assets which generate a stock return.

2.8 GROWTH STOCKS

Brealey and Myers (1981) define a growth stock as a stock purchased in expectation of capital gains. It is the future growth of earnings rather than the annual return which is of primary importance. In contrast, an income stock is purchased for its level of dividend or annual return. For example, on a farm level, Melichar (1979) has classified U.S. farmland as a growth stock while a herd of beef cattle would be seen as an income stock. Melichar (1979) concludes: " farm real estate is a 'growth stock' best and most easily owned by those who can tolerate its low annual return in the first few years after its purchase" (p. 1091).

2.8.1 Financial Market Growth Stock vs. Land Growth Stock

Whether capital is invested in a stock market growth stock or in land, it has similar characteristics: low rates of annual return and real wealth gains due to asset appreciation. However both the stocks and the investors are quite different. Stocks in the Standard and Poor 500 list of blue-chip stocks had price/earnings (P/E) ratios that ranged between 13 and 20 in the first 10 months of 1987. P/E ratios for stock market growth stocks were much higher at 38 for Microsoft and 55 for Homestake Mining. In contrast to

these P/E ratios, the average farm real estate P/E from 1970 to 1986 has been 45 (calculated from Statistics Canada values for value of aggregate farm real estate divided by the value of aggregate rent. The resulting P/E quotients are listed in Table 5.3 and discussed in Chapter 5, section 5.3 titled Financial Risk.).

The investors in these two different growth stocks would typically be in different financial circumstances. The urban investor, using a broker to make the transaction, often pays for his purchase with cash or equity capital. The farmer, dealing directly with the seller, his banker and his lawyer would typically make the transaction using a large percentage of debt capital. Both stocks are sold through a bidding process.

The urban investor would often be buying a stock market stock as part of a diversified investment plan. He could own the growth stock, a small business, some inventories, a portion of mutual fund, some savings bonds, insurance, term deposits, and a house. Having his capital investments diversified and a relatively small proportion of his assets tied up in a growth stock would buffer him from financial risk if its value were to decline.

The farmer on the other hand, typically has two-thirds of his capital in his farmland growth stock. His capital is also invested in machinery, crop inventories, livestock, term deposits and insurance. While his capital may be invested in as many different types of assets as his urban counterpart, holding such a large proportion of his capital in one stock will have two effects. First, the farmer places himself in a position where he has potential for large capital gains if asset values rise. He also

leaves himself vulnerable to substantial real wealth losses if asset values fall. Second, the greater the percentage of his capital which he holds in the form of a growth stock, the less capital he will have available for investment in income producing types of capital. A farmer's choice of portfolio mix therefore will predicate his returns.

2.8.2 Melichar's 1979 Study

Melichar's 1975 and 1979 studies were conducted with aggregate U.S. farm-level data for the period from 1950 to 1978. Melichar reconstructed an annual balance sheet. He adjusted this for inflation based on the arguments of Hoover (1962) and Boyne (1964) and for net investment based on Grove (1960) in order to derive an estimate of the magnitude of real capital gains accruing to farmers from price changes in their assets. Using the most restrictive forms of growth models detailed in Equations 2.19 and 2.20, Melichar compared his estimate of annual real capital gains to aggregate annual net farm income from which he had subtracted an imputed value for returns to operators' labor and management. From his work Melichar concluded that:

> 1)The origin of recent real capital gains could be traced to a rising annual return to assets.
>
> 2)"A farm economy characterized by rapid growth in the real annual return to assets (would) tend to experience large annual real capital gains and a low rate of return to assets" (1979, p. 1085).

Although the main focus of Melichar's 1979 work was to discuss the relationship between capital gains and current income, the idea that U.S. land is a growth stock is appealing because it lends a fresh perspective to many current farm issues. If, as Melichar (1979) suggests, land is a growth

stock then many of the problems within the farm sector such as cash flow difficulties, rising debt, financial barriers to entry-level farmers, or the "attraction of farm estate for persons of large wealth or high income" (p. 1091) can all be attributed to a common root. While these same conditions exist in the agricultural sector in Canada, Canadian farmland has not, as yet been characterized as a growth stock.

3. METHODOLOGY

3.1 THE MODEL

3.1.1 Growth: Changes in Land Values

The simplest method of determining whether or not farmland is growing in value is to subtract its beginning value from the end of the year value. The difference is the growth in land values. Only one set of readily available data is needed for the calculation.

However, this method does not facilitate discretization of land value growth into its different sources. These include:

1)Capital gains on farm real estate.

2)Investment in technology or improvements which increase the value of land. These include breaking or clearing, the purchase of irrigation systems, electrical systems, fencing or drainage systems.

3)Growth in the farm business through increased inventories, decreased debt, increased cash or other liquid assets.

4)Inflation in the general economy.

In other words, this method would tend to overestimate growth by including sources other than capital gains.

3.1.2 Growth: Changes in Net Worth

Melichar (1979) solved the dilemma of accounting for growth in farmland values by using a combination balance sheet and income statement as the basis for his analysis of the growth in U.S. farm net worth which he used as proxy for U.S. land values. Adopting this strategy, a Canadian

counterpart was designed for this study. There are three distinct parts to the model: the balance sheet, the net investment section and the income statement.

Year by year changes in net worth represent a growth in farm assets. These changes can be readily observed in a financial balance sheet which itemizes assets and liabilities. The value of the owner's net worth on a specific date is calculated by subtracting the value of liabilities from the value of assets at that time.

The balance sheet model used in this study is designed to accommodate available Canadian data. It classifies assets by type instead of by liquidity as is more commonly done. Farm assets are broken into several categories:

1)Farm real estate, a fixed asset which includes the value of land and buildings located on at least one acre and generating at least $250 of agricultural gross sales annually. This is reported in the census.

2)Machinery and vehicles, including implements, machinery, motor trucks and automobiles.

3)Livestock, including livestock, poultry and fur-bearing animals.

4)Other assets, including all current assets such as farmer's stocks, bonds, feed inventories, supply inventories, and crop inventories as well as a small percentage of intermediate and long term non-farm assets.

Liabilities have not been itemized. Ideally, the balance sheet would include a breakdown of current and long term debt; however these data were not available.

In order to isolate changes in net worth which are attributable to real capital gain in farmland values, several adjustments needed to be made (Melichar, 1979). This was done in the investment section. Annual changes in new investment, changes in inventories and changes in levels of liquid

assets or liabilities must be subtracted from net worth. Net investment in real estate and machinery consists of capital expenditures less depreciable allowances and accidental damage (Melichar, 1979). The net worth after these adjustments is then representative of nominal or current dollar capital gains.

Theoretically, the adjustments that isolate increases in net worth are a refinement of the farmland capital gains calculation. However, the values required to make these adjustments are not available in Statistics Canada or Taxfiler data. The only available series are offered by the Farm Credit Corporation (FCC) in a form which are only nominally compatible with the Statistics Canada data.

Year by year changes in returns are recorded in the income statement. Usually an income statement is a summary of all income and expenses. For the purposes of this study, only several specific incomes and expenses were included: 1)gross farm rent, which includes both cash and share crop rents; 2)gross farm income which includes cash receipts for agricultural products, income in kind, supplementary payments and value of inventory changes; 3)net farm income, specified as gross farm income minus operating and depreciation charges; 4)interest on debt, the only expense itemized.

It is important to note that net farm income includes only very specific types of income. It does not represent a farmer's total net income since it does not include income from sales of capital assets, pension monies, rental income, interest, or wages. Published data from Statistics Canada shows that in 1976 farm income was 33% of total income; in 1978 it was 26% (Agriculture Canada, 1981, p.53). Therefore neither gross farm

income nor net farm income measure the total returns which a farmer receives and upon which his well being depends.

Gross farm rent, as published by Statistics Canada, includes cash and share crop rental income. In order to use gross farm rent as a representative return from farm real estate, a rental value must be extrapolated from the number of acres rented to the total number of acres farmed. The mathematical adjustment is explained in Appendix 1.3.31. The resulting return, imputed rent, is an estimate of the annual cost to the farmer which is paid to a landlord (or in essence to himself if he is an owner/operator) for the use of the productive services of farmland throughout the year. What is a cost on one side of the ledger becomes a return on the other side. Imputed rent is therefore used instead of gross farm rent as a return to farm real estate.

Annual changes in rates of return can be calculated using various sources of income listed in the income statement and comparing these to asset values. These rates of return are, in turn, used to assess:

1)Income generating capacities of capital assets.

2)Asset earnings compared to asset prices.

3)Current income returns compared to annual unrealized capital gains.

4)Returns imputed for management, labor and equity.

5)The magnitude of the economic returns expected as annual returns and capital gains are accumulated.

The completed model, including a balance sheet, net investment calculations, an income statement, plus some analysis is displayed in Appendix 1: Table A1.1 contains Canadian aggregate data, Table A1.2 contains aggregate data for Alberta and Table A1.3 describes each variable as it is

used.

3.1.3. Growth: Real Capital Gains

To make an annual comparison of growth, the influences of changes in purchasing power must be accounted for. The Consumer Price Index (CPI) is commonly used as the discounting factor for expressing nominal dollars in real or constant terms. The purpose of this adjustment is threefold:

1)It serves as an economic indicator of the inflation free dollars or rates.

2)It serves as a means to calculate constant, real dollar income.

3)It is used to determine changes in the purchasing power of the dollar.

Henceforth in this study, adjusted dollar terms for any value or rate will be referred to alternately as "real" or "constant". Unadjusted dollar terms will be referred to as either "nominal" or "current".

3.1.3.1 The Consumer Price Index

The Consumer Price Index (CPI) is a Laspeyres, weighted price index measure of the price changes of a fixed basket of consumer goods (Mason, 1982). Use of the CPI as a composite index of commodities and services used by farmers originated with the use, from 1913 to 1970, of a rural index called the Family Living Index. This index included food , clothing, fuel, household equipment, and health maintenance costs, as well as miscellaneous items such as insurance, telephone and tobacco. In 1970, the Family Living Index was replaced as a farm index by the CPI since the consumption of both urban and rural families were becoming increasingly similar.

The method by which values were deflated from nominal to real dollars was:

(Current money value)/CPI x 100 = real money values (Eq. 3.1)

The result was a constant dollar value which can be compared over time with other time series data. The base year for the CPI adjustment was 1981 where 1981=100.

3.1.3.2 Two Methods of Calculating Real Capital Gains

There are at least two ways to approach the calculation of real capital gains. One, the method used by Melichar (1975) and referred to in this study as the Melichar method, first determines nominal capital gains from nominal dollar data and subsequently adjusts them by the change in purchasing power to give real capital gains. The other, is the method derived for use in this study and henceforth referred to as the CMF method, first converts every data series into real dollar values and then calculates real capital gains. Both of these methods have been used in the current work. Conceptually and in their application there are no differences between these procedures although there are some technical dissimilarities.

In Melichar's method of calculation, the calculation of real capital gains from nominal gains can be mathematically expressed as:

$$RCG_{n+1} = \{[(NW_{n+1}-NW_n) - NI_n] - NW_n(-1)[(CPI_{n+1}-CPI_n)/CPI_n]\} \times 100 \quad \text{(Eq. 3.2)}$$

where:

RCG_{n+1} = real capital gain

n+1 = the current year estimate as of December 31.

n = the previous year estimate as of December 31.

NW = net worth.

NI = net investment.

CPI = the Consumer Price Index.

The first term in Melichar's equation $[(NW_{n+1} - NW_n) - NI_n]$ represents nominal capital gains. It is composed of $(NW_{n+1} - NW_n)$, the change in net worth which has occurred over the year, and (NI_n), the net annual investment. The second term in Equation 3.2, $[NW_n(-1)[(CPI_{n+1} - CPI_n)/CPI_n]]$, conceptually is the annual change in purchasing power of the net worth. The first term minus the second term (nominal capital gains minus annual changes in purchasing power of the net worth) renders real capital gains.

However, in the mathematical calculation of annual changes in purchasing power (real dollar values) of the net worth, the Melichar method adjusts only the beginning of the year net worth values by changes in the purchasing power of the dollar instead of accounting for these changes at both the beginning and end of the year. It also does not adjust any of the individual components of net investment by changes in purchasing power over time. The CMF method makes both of these adjustments.

The CMF method calculates real capital gain directly from data adjusted to reflect real dollar values. It can be expressed as:

$$RCG_{n+1} = [(100/CPI_{n+1}\ NW_{n+1} - 100/CPI_n\ NW_n) - (100/CPI_{n+1}\ NI_{n+1} - 100/CPI_n\ NI_n)] \quad \text{(Eq. 3.3)}$$

This method transforms each variable into constant dollars by using the CPI. By taking $(100/CPI_{n+1}\ NW_{n+1} - 100/CPI_n\ NW_n)$, the annual change in real net worth year by year and subtracting from this $(100/CPI_{n+1}\ NI_{n+1} - 100/CPI_n\ NI_n)$, the annual change in real net investment, an annual estimate for real capital gains is calculated. Each variable is consistently transformed into constant dollar form.

The differences between the CMF and Melichar methods of calculating real capital gains cause small variations in the estimates of real growth rates in farm assets and real capital gains estimates for farm assets. These estimates are slightly higher calculated by the CMF method than by the Melichar method. The magnitude of this difference is discussed in Results section 4.2.2.1.

3.2 THE DATA

The data considered best suited to estimating the rate of real capital gains to Canadian farm real estate and to farm assets were census data series collected by Statistics Canada. These data are readily available to the public, are broad in geographic coverage and are detailed in farm related statistics. As used in the models described in Section 3.1, the data are secondary in nature, are a time series and are at the aggregate level for both federal and provincial information.

3.2.1 Secondary data

Statistics Canada data series are widely available and are easily utilized for a study of this kind; as these data are well organized in publications and data bases. Initially, the raw data were collected by

Statistics Canada from farmers across Canada who responded to the census survey. This survey is conducted every five years, concurrently with the national census on the second and seventh years of every decade. Between the most recent census and the coming census year, preliminary figures are released. These yearly estimates are corrected retroactively once the new census has been compiled. Only the corrected, published values have been used in the current work.

All data are reported in dollars. Due to the magnitude of the values, every series is stated in thousands (000) of dollars. The value listed for assets is based on estimates by farmers of the current market value. Actual incomes and liabilities have been reported in their current dollar values.

The secondary data used in this study were gathered for purposes other than evaluating capital gains. There are several sources of nationwide farm financial data: Taxfiler data, Farm Credit Corporation (FCC) data, national farm surveys and other Statistics Canada farmer data. Statistics Canada data were chosen because they report a broader range of information relevant to the entire study than do the other sources even though all had specialized areas of interest that are very clearly reported, including several that contain pertinent information on the farm business.

The choice of relevant variables was as important to this study as the source of data. Except for the new investment and other liquid assets categories, Statistics Canada proved a rich resource for background and peripheral information for continuity in form and length of reporting history. However, even within the Statistics Canada farm series, there was a concern that the sample farm population may have fluctuated in its

definition for each census, although there was no way to control potential problems such as this.

3.2.2 Time Series Data

As the purpose of the present study was to observe a pattern of growth in farm real estate and farm asset values over time, the data were by necessity time series in nature, involving an observation of some unit over different points in time. The observation of farms' financial position is made for each year on December 31 on the basis of farm balance sheet and income statements. The unit which is observed in time is an elusive national aggregate farm business based on the sum of individual responses to a particular survey.

When attempting to isolate the cause of changes in value over time in agriculture, the omnipresent influence of technical change must be accommodated. An attempt was made to compensate for the effects of technical change by limiting the time period covered by the study. It is assumed that technical change will have had an insignificant impact on asset values over the period between 1970 and 1986. This time span has been one of the most dynamic periods of farm asset appreciation in the past century.

3.2.3 Financial Data

Financial data are the means by which growth in farm assets is observed. During the search for balance sheet and income statement data, several weaknesses in the Statistics Canada data became apparent:

1.) Statistics Canada does not report any of its financial information in the form of a balance sheet. They do report a farm operating income statement. Several series (current, liquid assets,

current liabilities, and family withdrawals) are not available.

2)Because the design of a balance sheet is not the purpose for which the data were gathered, there are inconsistencies in the values reported.

3)Data on the adjustment to net worth through new investment, are not available in a form consistent with other data used in the study.

The compromises made in this study because of these data shortfalls can be summed up as follows:

1)In cases when several valuation dates are reported, the one used is the one closest to December 31 for that year. If only one valuation was made for a date other than December 31, it was assumed that this adequately reflected the end of the year valuation. Specific valuation dates for data from Statistics Canada are given in Appendix 1.3.

2)Since data on current assets and liabilities are not available, no empirical assessments of impacts on cash flow can be made.

3)Two important data series, those for new investment and other assets, were based on from FCC data, adjusted to approximate the scale of national data, and incorporated into the model. See Appendix 1.3 for the details of this adjustment.

The value of farmer's other assets are based on data in the annual FCC publication, **Farm Credit Statistics**. These are reported in the table "Average assets, liabilities and net worth after loan per farm unit". This series includes farmers' stocks, bonds, feed supplies, crop inventories, current assets and a small percentage of non-farm long and medium term assets. These data were adjusted from a per-farm basis to a Canada or Alberta wide aggregate by multiplying the per farm figure by the number of census farms. Making this adjustment assumes that the asset holdings of all Canadian farmers are are of the same composition as are those of FCC borrowers.

The data series on farmers' new investment reported in the FCC table entitled "FCA Loans Approved, by Purpose of Loan" was taken as the basis of

new investment for the purposes of this study. The improvements listed by the Farm Credit Statistics are for building, breaking, leveling, irrigation and drainage. To convert the value of these improvements by FCC clients to an aggregate estimate for all Canadian farms, the values of the improvements were divided by the total number of loans approved (from the same FCC table); the quotient was then multiplied by the number of census farms in Canada as reported by Statistics Canada. Making this adjustment assumes that expenditure on farm improvements associated with new investment by all members of the general farm population is the same as for FCC borrowers. The figure does not include public monies which have been spent on agricultural improvements.

In addition to the adjustments involved in imputation of data from FCC data series described above, the Statistics Canada data series have been adjusted to exclude values from Newfoundland. These data were not consistently reported during the period from 1970 to 1986. For example, Newfoundland values for total net farm income, value of inventory change and interest on farm debt have only been reported since 1972; the value of capital has only been reported since 1976 and outstanding farm debt has only been reported since 1981. Values for the Yukon and Northwest Territories are not reported in any of the survey data reported in this study.

3.2.4 Aggregate Data

The data reported in this study represent an aggregation of values for all farmers in the census across Canada or Alberta. Since the data are not available on a cross-sectional basis, financial heterogeneities between farm businesses cannot be detected and attributed to differences in enterprise,

location, size, management, entrepreneurial or other skills of a farm owner. For example, the study does not incorporate ways to detect differences in business growth rates, estimate returns or profitability between a 10 acre potato farmer in Prince Edward Island or a 10,000 acre cattle rancher in British Columbia. Rather, interpretation of the results can be made only on a sectorial level.

Aggregation is expected to smooth out heterogeneities in the data, so discussion of the results is in terms of aggregate levels and trends in the data. Nonetheless, it is anticipated that awareness of national and regional trends may be valuable in identifying some of the impacts of changing land and farm asset values on the farm business.

3.3 LIMITATIONS

If the data or the conceptual base of an analysis is incorrect, misspecified or inconsistent it will result in wrong, incomplete or inconsistent conclusions (Heady, 1961). In view of the large body of data from different sources, it is possible that the major limitations to the study may be from errors of data observation and specification rather than errors of conceptualization.

3.3.1 Observational Error

> "People responding to official questionnaires often lie, out of fear of government scrutiny or desire to mislead the competition. 'Nothing like this occurs in nature' - economics is notorious for using second hand data, collected for other purposes, whose logic may be legal or bureaucratic rather than economic. The profits reported on balance sheets may have little to do with real profits. Many official statistical series are completely incompatible with one another" (Kuttner, 1985, p. 79).

Errors of observation such as those referred to by Kuttner include

those that may have occurred during the initial transcription or initial documentation and the final transcription into the data set of this study. The bias which observational error may have introduced into the study cannot be identified.

3.3.2 Specification Error

Specification bias may arise due to the need to compromise or use less than ideal methods or variables. This need stems from a lack of pertinent data or from incorrect or inadequate variables. As a result of the need to compromise, assumptions are made, approximations are substituted for actual figures and methods are adapted.

Possible specification problems of the data used in the study are outlined in this chapter (Chapter 3: Methodology) and in Appendix 1.3. In addition, Appendix 1.3 details the adjustments made in the data to overcome the problems of data compatibility discussed in this chapter.

3.3.3 Conceptual Error

In agricultural economics, as in other evolving fields, there is often disagreement among the discipline's authorities concerning current issues. Theories on farm land evaluation and appreciation have been subject to scrutiny and discussion for some time. By taking Melichar's (1975) methods as a model for this study, the results may be biased toward many of Melichar's basic interpretations.

4. RESULTS AND DISCUSSION

4.1 IS CANADIAN OR ALBERTA FARMLAND A GROWTH STOCK?

Despite shorter term fluctuations, for the past 60 years, the value of Canadian farm real estate have tended to exhibit an upward trend. However, since 1970, much volatility in the land market has been noted. This section of the study focuses on growth in farm real estate values, identifies the functional form of these changes and explains different methods of quantifying the growth rate.

4.1.1 Real Estate Values, 1926 to 1986.

Since 1926 when Statistics Canada began annual reporting of land and building values, farm real estate has been changing in value. Figure 4.1 shows these changes in value both in current year dollars and constant (1981) dollars. (The values are listed in Appendix Table 2.1). The constant dollar value of Canadian farm real estate rose from $25.3B (Billion) to $63.0B in the interval between 1926 and 1986. The largest increase took place during the last 17 years, from 1970 to 1986. The value of Canadian farm real estate in 1971 was 39.8% of its peak 10 years later. By 1984, however, farm real estate values had fallen to the same levels as in 1978; by 1986 values had fallen to their 1976 levels. Over the past several years, farm real estate values in Canada have fallen at the same rate as they previously rose to the 1981 peak (Figure 4.1). However, the 1986 constant

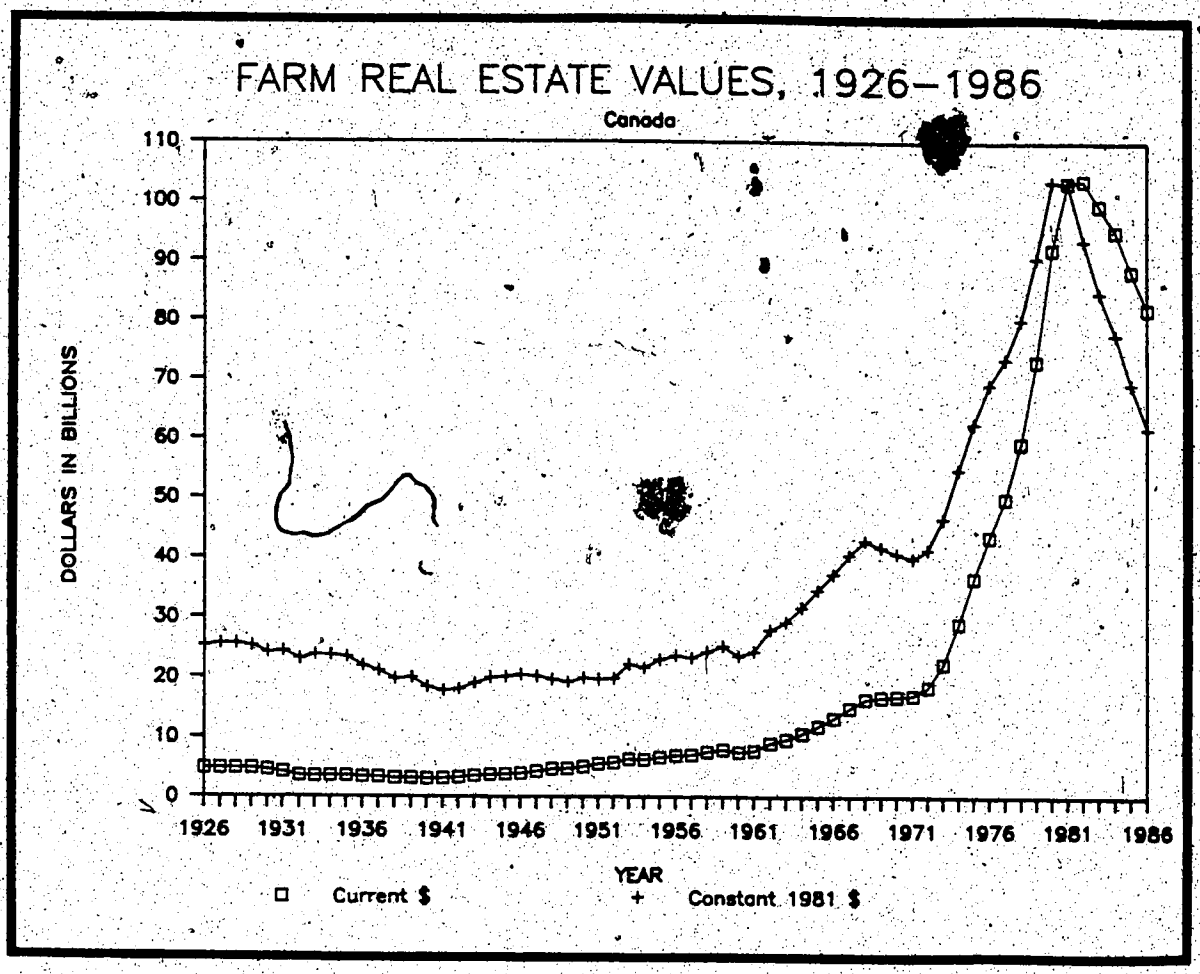


Figure 4.1 Farm real estate values, 1926-1986. Aggregate Canadian farm real estate values expressed in both nominal and real dollar values, illustrating the changes in land values which have occurred between 1926 and 1986. Canadian values include figures for all provinces and territories. The real dollar values were found by adjusting the nominal levels by the average Consumer Price Index (CPI) where 1981=100. The source of farm real estate data is Statistics Canada Cat. No.21-603E and are listed in Appendix Table A2.1.

dollar values were still 1.5 times higher than the 1970 level.

4.1.2 Growth in Real Estate and Other Farm Assets

Growth in asset values can be simply defined as a change in value at a rate different than the general inflation rate (Huff and Cusack, 1972; Tweeten, 1981). Indexing the value of farm assets, liabilities and returns relative to their respective 1981 constant dollar values gives for each a percentage change in value regardless of original magnitude or of general inflation rates. Table A3.1 in Appendix 3 reports the resulting indexed values of various farm assets and farm incomes as a percentage of their constant dollar value in 1981.

Scrutiny of values for farmland, farm real estate (farmland and buildings) and total farm assets indicates that composition has had an effect on the different rates of growth in value that can be observed in Figure 4.2. Land values have grown more rapidly than has the value of farm real estate (land and buildings) which in turn has grown more rapidly than total farm asset values (land, buildings, machinery, livestock and liquid assets).

Note that if the trend in the growth rate was horizontal for any variable depicted in Figure 4.2, this would indicate that the rate of growth had been equal to the rate of general inflation. Real estate values, farm land values and the value of total farm assets changed at a rate very close to the rate of inflation during the two periods of 1970 to 1971 and 1980 to 1981. However, other than during these four years, all three variables have exhibited rates of change -- both positive and negative -- that have varied

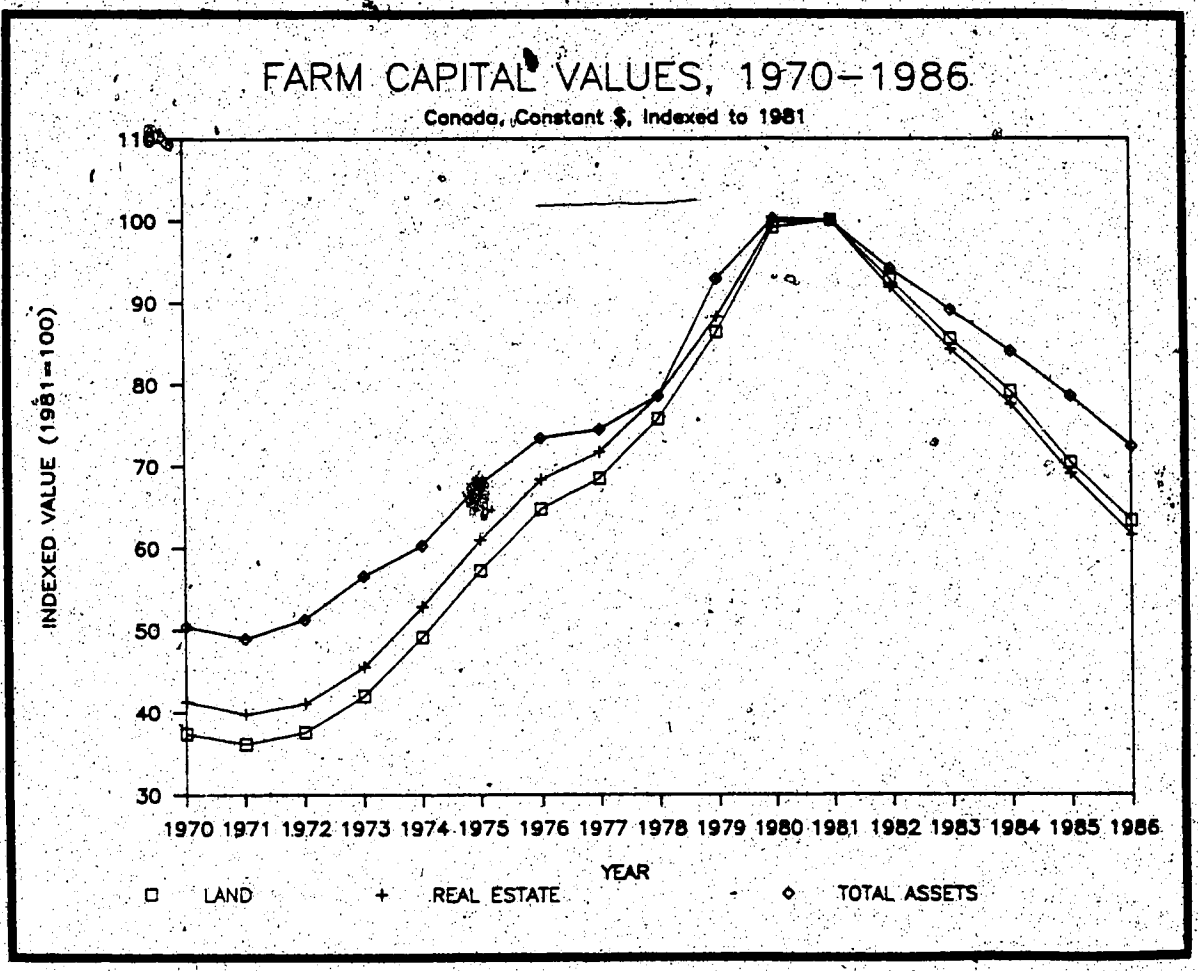


Figure 4.2 The value of farm land, farm real estate and total farm assets, 1970-1986. Aggregate Canadian values of land alone (land), land and buildings (real estate) and farm assets (total assets) are expressed as a percentage of their 1981 value in order to compare trends irrespective of differences in magnitude. Note that land rose more steeply than real estate or total assets, while farm real estate fell the most rapidly from its 1981 high. Values expressed as indexes in constant 1981 dollars. Source: Statistics Canada Cat. No. 21-603E; also listed in Table A1.1.

from the rate of inflation. Periods during which asset values were increasing in value more rapidly than was the general inflation rate occurred from 1971 to 1981. Declines occurred in 1970 and from 1981 to 1986.

Figure 4.2 illustrates the constant dollar, index of values of farm real estate, farmland and farm assets. The data on which this figure is based are found in Appendix 3. The similarity in direction shapes and amplitude of each of the three curves is reflective of an overlap in asset composition. In Canada, land averages 65.2% of total farm real estate and 41.8% of total farm assets. Farm real estate averages 64.0% of total farm assets. Asset composition in Alberta shows a similar pattern: land value averages 71.3% of farm real estate value and 47.9% of total farm asset value. Farm real estate averages 67.2% of total farm asset values.

In the seventeen year interval from 1970 to 1986, there have been 9 years of positive growth, 6 years of negative growth and 2 years of no growth in the values of farm real estate. Overall there has been an increase in farm real estate values of nearly 150 percent (2.41 times) over the 17 year period of study. Based on these observations, growth in farm real estate in both Canada and Alberta has been consistently different than the general inflation rate. These growth rates suggest that farmland may be characterized, at least qualitatively, as a growth stock.

4.1.3 The Best Fitting Functional Form.

In order to describe the historical patterns in farm real estate values and the change in values of real estate between 1970 and 1986, a best fitting functional form was found by applying polynomial regressions to the

time series data of constant dollar farm real estate values. The first derivative of that line, the functional growth in farm real estate, was also calculated to determine whether or not it would closely match the actual growth in real estate calculated from Statistics Canada data. Figure 4.3 illustrates the relationship between the actual and regression predicted estimates of farm real estate values and growth in farm real estate values.

The functional form which best described the historic trend of the real value data was a cubic polynomial (of the general form: $y = ax^3 + bx^2 + cx + d$). This equation was:

$$y = -81790t^3 + 1683626t^2 - 4169927t + 41376146 \qquad \text{(Eq. 4.1)}$$

where:

y = farm real estate values. $R^2 = 0.97$

t = time in years

The implications of finding this form as the best fit function are threefold. First, it means that the historical pattern in farm real estate values is cubic. Second, it means that the growth in farm real estate values during the period 1970 to 1986 has been quadratic. Third, it means that the historical rate of growth in farm real estate values has been linear. What these three findings therefore suggest is that while the CAPM capitalization formula ($V = I/r$) estimation of land values is linear, historical trends (1970 to 1986) in farm real estate values have followed a cubic pattern.

Each of the three functional forms, cubic, quadratic and linear, imposes different mathematical constraints in describing the historical growth in constant dollar farm real estate values. Use of a linear trend describes the average change in farm real estate values over the period from

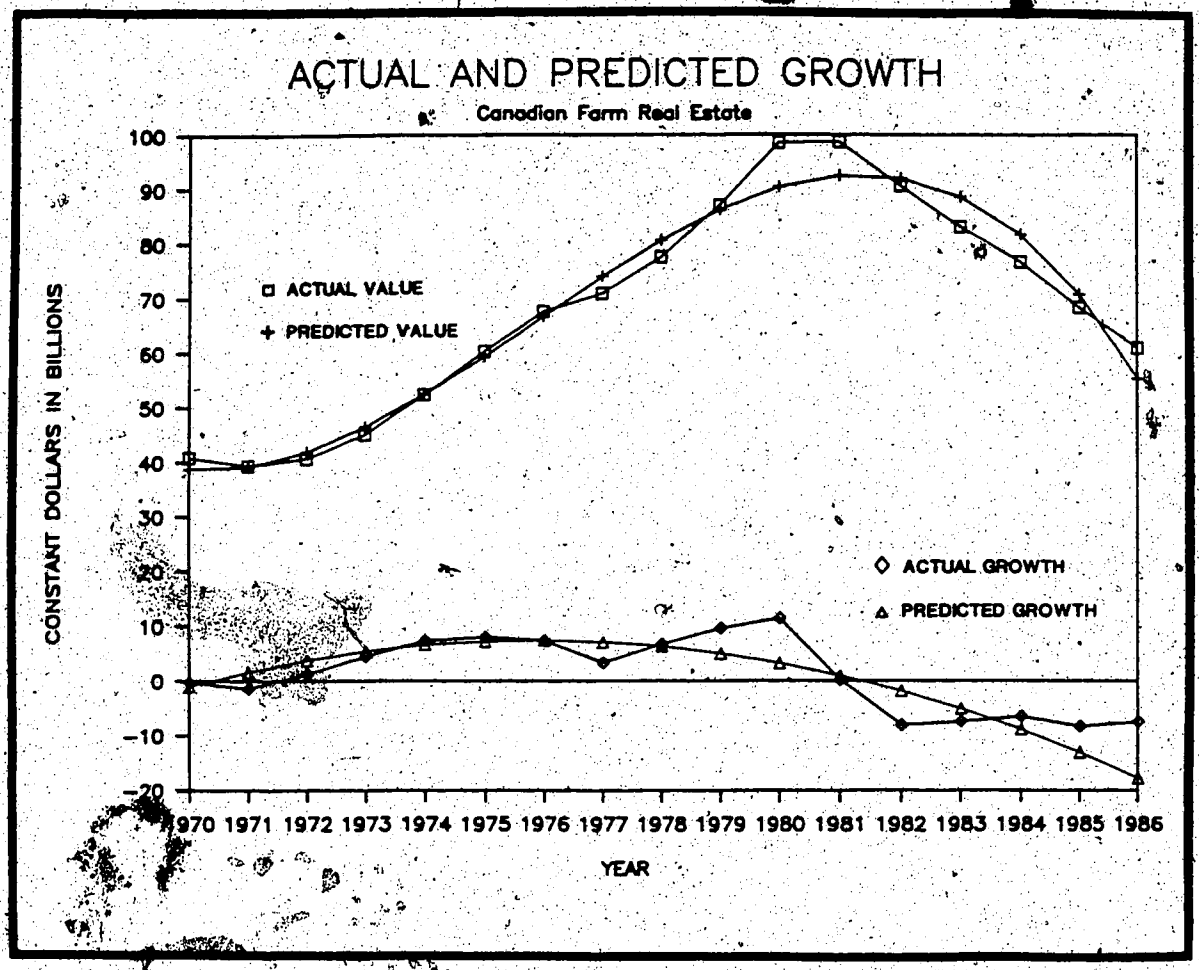


Figure 4.3 Actual and predicted values of farm real estate, 1970-1986. Actual values of farm real estate and those predicted by a polynomial (cubic) regression are shown for the time period that this regression was fitted. In addition, the actual values of growth in farm real estate and those calculated by taking the first derivative of the cubic form are shown beneath farm real estate values. The actual values of farm real estate (Canadian farm land and buildings) are found in Statistics Canada Cat. No. 21-603E and are listed in Table A1.1. The regression analysis is discussed in Appendix 4. The real dollar growth in farm real estate values is listed as real capital gains on real estate in Table A1.1.

1970 to 1986. When the linear model was fitted to the historical data from 1970 to 1986, the model only explains a maximum of 53% of the variation in farm real estate values. In this case, the rate of growth in farm real estate is constant, a feature that fails to describe the substantial rise and fall in values which were experienced in both Canada and Alberta from 1970 to 1986. Similar difficulties apply with the use of the quadratic form. In this case 77% of the change of farm real estate values is explained by the functional form. Implicit in the use of a quadratic model is that the growth in farm real estate is linear and that the rate of growth increases or decreases by a constant value. In contrast, the cubic model which best describes the historical pattern in farm real estate values from 1970 to 1986, implicitly suggests that growth in farm real estate values is quadratic in form and the rate of growth in farm real estate values during the study period is linear and thus not constant over time. Further details are discussed in Appendix 4. However, such functional forms are only descriptive of the pattern of historical values and therefore they do not aid in predicting future economic trends.

Actual growth rates, calculated by taking the difference between the land value at the end of one year minus that at the end of the previous year, indicate that the minimum real value for farm real estate was in 1970, following several years of negative growth in the late 1960's. The maximum real value for farm real estate was in 1981. This heralded the decline in land values seen in the early 1980's. Capital gains were experienced during 9 years out of the period from 1972 to 1981 while capital losses were experienced during 7 years of the study (in 1970 and from 1981 to 1986). Overall, rates of growth in Canadian farm real estate values were constant

and negative for 4 years during the 17 year period. This was from 1982 to 1984 and in 1986. In one year (1981) growth in values of Canadian farm real estate was zero.

4.2 ANNUAL GROWTH MEASURES

The quantification of growth in Canadian farmland actually involves the calculation of three types of growth. These include growth in farm real estate, growth in farm assets and growth in farm equity. All three focus on slightly different areas of the return to investment.

Growth in farm real estate is what an investor might use to estimate annual changes in real estate values simply by subtracting the value of the land value in one year from the previous year's value. However, since 64.0% of Canadian farm capital is tied up in farm real estate, changes in real estate value will also be closely related to growth in farm assets and farm business growth.

Growth in farm assets is the combination of changes in asset values due to new capital investment and to capital gains. Growth in farm equity, measuring changes in net worth, is commonly recognized as a measure of business growth. However, it is not always clear whether this growth in equity occurs as a result of asset growth or because of other changes in net worth.

Table 4.1 summarizes and Figure 4.4 illustrates the estimated growth in each of the three measures. In addition, nominal and real growth rates were calculated; the former is listed in the upper half of the table, the latter in the lower half. For the purpose of comparison, both Melichar's

CANADA:

YEAR	GROWTH IN REAL ESTATE (NOMINAL)	GROWTH IN EQUITY (NOMINAL)	GROWTH IN FARM ASSETS (NOMINAL)
1970	0.007	0.037	-0.039
1971	0.010	0.010	-0.023
1972	0.085	0.109	0.077
1973	0.212	0.216	0.183
1974	0.305	0.201	0.223
1975	0.283	0.236	0.188
1976	0.187	0.145	0.157
1977	0.148	0.107	0.152
1978	0.186	0.138	0.159
1979	0.234	0.319	0.224
1980	0.258	0.212	0.205
1981	0.123	0.115	0.108
1982	0.003	0.018	0.011
1983	-0.041	-0.023	-0.028
1984	-0.044	-0.027	-0.031
1985	-0.070	-0.033	-0.053
1986	-0.072	-0.052	-0.051

YEAR	GROWTH IN REAL ESTATE[a] (REAL)	GROWTH IN EQUITY[b] (REAL)	GROWTH IN FARM ASSETS[c] (REAL) CMF method	GROWTH IN FARM ASSETS[d] (REAL) Mellchar
1970	-0.008	0.022	-0.055	-0.054
1971	-0.037	-0.037	-0.069	-0.072
1972	0.032	0.056	0.024	0.021
1973	0.109	0.112	0.085	0.050
1974	0.162	0.089	0.088	0.075
1975	0.153	0.128	0.058	0.048
1976	0.121	0.081	0.080	0.089
1977	0.049	0.011	0.048	0.047
1978	0.095	0.051	0.064	0.064
1979	0.124	0.201	0.105	0.095
1980	0.132	0.080	0.078	0.089
1981	0.001	-0.005	-0.018	-0.027
1982	-0.082	-0.068	-0.080	-0.083
1983	-0.083	-0.065	-0.073	-0.073
1984	-0.079	-0.063	-0.068	-0.068
1985	-0.109	-0.073	-0.094	-0.095
1986	-0.109	-0.090	-0.090	-0.091

Table 4.1 Measures of growth in the farm sector between 1970 and 1986. Three measures of growth are calculated: growth in farm real estate values, growth in the value of equity in farm assets and growth in the value of farm assets. The growth rates are all calculated from aggregate, nominal and real dollar values of Canadian and Alberta data.

a) Real estate values, consisting of land and buildings, are found in Statistics Canada Cat. No. 21-603E. They are listed in Appendix Tables A1.1 and A1.2 and described in Appendix1.3. Growth in real estate is the annual change in real estate value calculated by: [(end of year value/beginning of year value) - 1].

b) Equity values are calculated by subtracting annual aggregate values of total farm liabilities from annual aggregate values of total farm assets. These are listed in Appendix Tables A1.1 and A1.2 and described in Appendix 1.3. Growth in equity is the annual change calculated by : [(end of year value/ beginning of year value) - 1].

Table 4.1 continued.

ALBERTA:

YEAR	GROWTH IN REAL ESTATE (NOMINAL)	GROWTH IN EQUITY (NOMINAL)	GROWTH IN FARM ASSETS (NOMINAL)
1970	-0.009	0.030	-0.042
1971	-0.001	0.005	-0.038
1972	0.174	0.149	0.141
1973	0.250	0.248	0.210
1974	0.346	0.241	0.254
1975	0.284	0.234	0.171
1976	0.186	0.157	0.154
1977	0.178	0.130	0.165
1978	0.193	0.169	0.178
1979	0.417	0.455	0.377
1980	0.282	0.237	0.236
1981	0.104	0.078	0.086
1982	0.010	0.038	0.010
1983	-0.060	-0.040	-0.049
1984	-0.070	-0.069	-0.059
1985	-0.060	-0.036	-0.054
1986	-0.080	-0.032	-0.059

YEAR	GROWTH IN REAL ESTATE[a] (REAL)	GROWTH IN EQUITY[b] (REAL)	GROWTH IN FARM ASSETS[c] (REAL) CMF method	GROWTH IN FARM ASSETS[d] (REAL) Melichar
1970	-0.023	0.015	-0.057	-0.057
1971	-0.047	-0.042	-0.085	-0.087
1972	0.117	0.094	0.084	0.082
1973	0.144	0.142	0.103	0.095
1974	0.199	0.105	0.110	0.102
1975	0.172	0.127	0.061	0.053
1976	0.120	0.093	0.086	0.086
1977	0.077	0.033	0.057	0.058
1978	0.101	0.078	0.080	0.081
1979	0.290	0.325	0.242	0.235
1980	0.153	0.112	0.103	0.097
1981	-0.015	-0.038	-0.041	-0.045
1982	-0.076	-0.050	-0.085	-0.086
1983	-0.101	-0.081	-0.094	-0.093
1984	-0.104	-0.103	-0.096	-0.094
1985	-0.099	-0.076	-0.096	-0.096
1986	-0.117	-0.071	-0.098	-0.099

c) Growth in farm asset values, a measure of capital gain in farm asset values, is calculated by subtracting net investment from annual changes in owner's equity (i.e. net worth) of farm assets. The results of these calculations are listed in Appendix Table A1.1 and A1.2 and described in Appendix 1.3.

d) CMF and Melichar methods of calculating real capital gain in farm asset values differ in a minor technicality of discounting dollar values by the CPI. These two methods are discussed in Chapter 3.

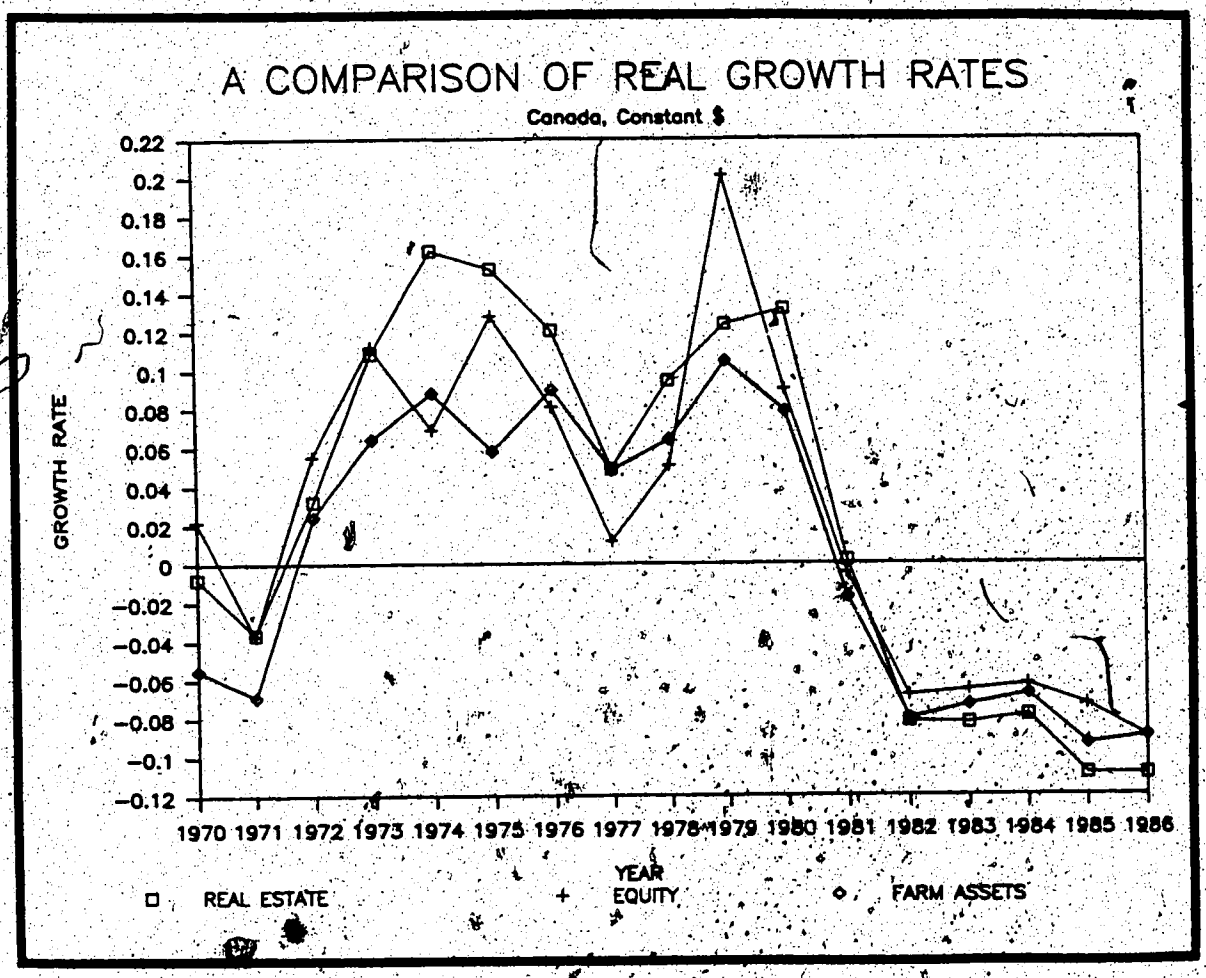


Figure 4.4 Growth rates in real dollar values of Canadian farm real estate, equity in farm assets, and total farm assets from 1970 to 1986. Despite being measurement of very different aspects of farm growth, these variables displayed similar growth rates over the seventeen year period. Growth in farm real estate was taken as annual difference in the real value of land and buildings; equity in farm assets as annual changes in net worth of real estate, machinery, livestock and liquid assets; and growth in farm assets (net worth minus net investment) as a measure of the real capital gain in farm assets. These values are listed in Table 4.1. and are derived from aggregate Canadian data.

(1979) formulation of farm asset growth and the CMF estimate (discussed in Chapter 3: Methodology, section 3.1.3.2) were also calculated.

4.2.1 Farm Real Estate

Table 4.1 shows that the annual rate of growth in nominal values of Canadian farm real estate ranged from a high of 30.5% in 1974 to a low of -7.2 in 1986. In Alberta, the rate of nominal growth ranged from a high of 41.7% in 1979 to -8.0% in 1986. For four years, 1983, 1984, 1985 and 1986, nominal growth in farm real estate was negative. In addition, in Alberta, 1970 and 1971 were also years of negative nominal growth.

In real terms, the annual growth rate in Canadian farm real estate ranged from a high of 16.2% in 1974 to a low of -10.9% in 1985 and 1986. In Alberta the high growth rate was 29.0% in 1979 and the low was -11.7% in 1986. In both Canada and Alberta, real dollar annual farm real estate capital losses have been from 8% to 11% during the four years of falling values, 1983-1986. The rates at which capital losses are occurring have increased in each successive year.

The real rates of growth in Canadian farm real estate were roughly half of the nominal rate. They were also roughly 2% to 3% less than were the real annual aggregate capital gain or loss from farm real estate in Alberta.

4.2.1.1 Nominal and Real Growth

When nominal rates of growth in farm real estate values (shown in Table 4.1) follow the trends in real growth but are 1/3 to 5 times higher than real growth rates, an investor who does not make adjustments to exclude

the effects of inflation will suffer from "money illusion", the magnitude of which is apparent in Figure 4.5. By using nominal instead of real growth rates for either future or past estimations of returns, he would consistently overestimate rising growth rates and underestimate falling growth rates. At the peak of high growth rates for farm real estate, nominal rates overestimate real growth rates by 53% to 70%. At the trough in growth rates, when growth rates were their most negative, nominal rates of farm asset growth underestimated real growth rates by 1.5 times.

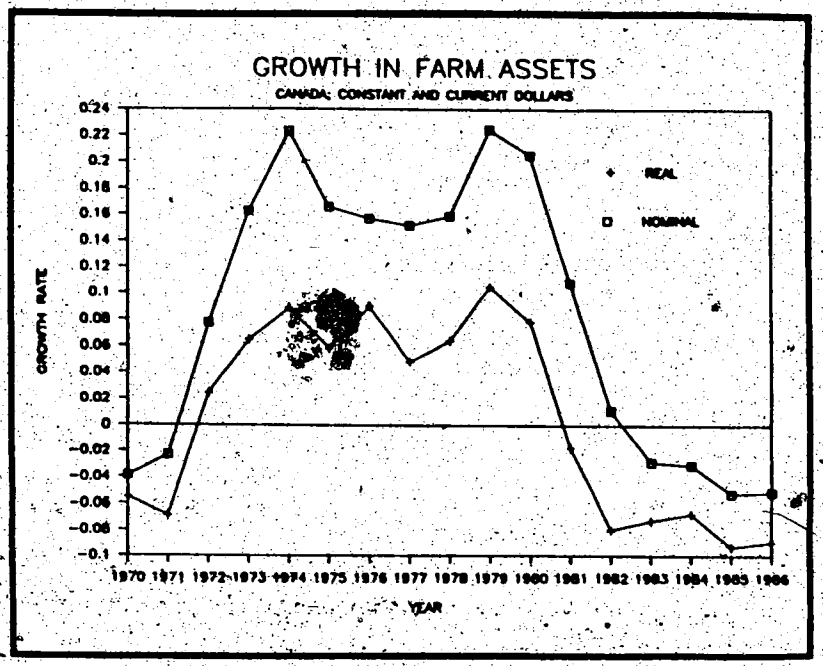
Figure 4.5 graphically illustrate the magnitude of these deviations in real and nominal growth rates for values of Canadian farm real estate as well as farm assets and aggregates farmers' equity in farm assets.

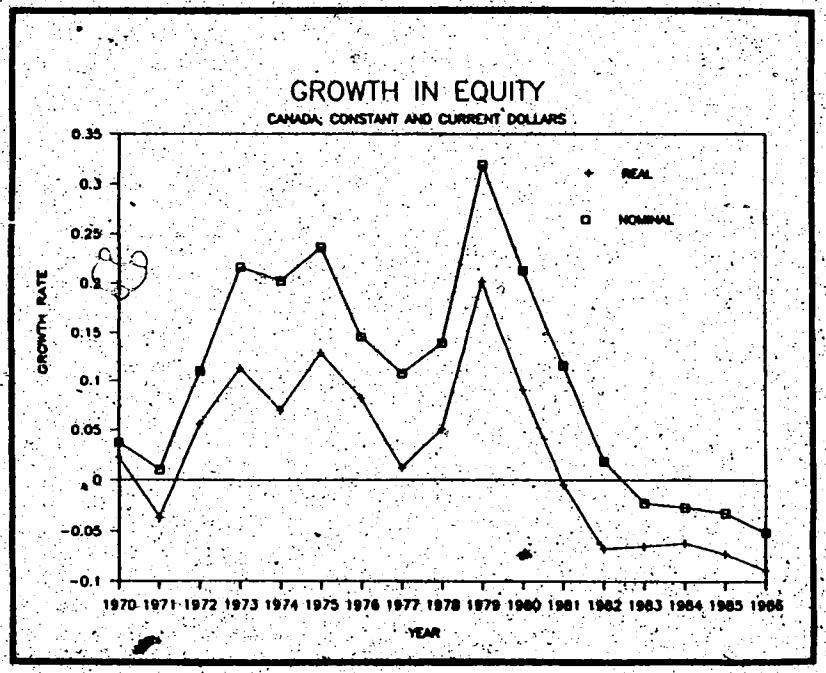
4.2.1.2 Growth in Real Estate in Canada and Alberta

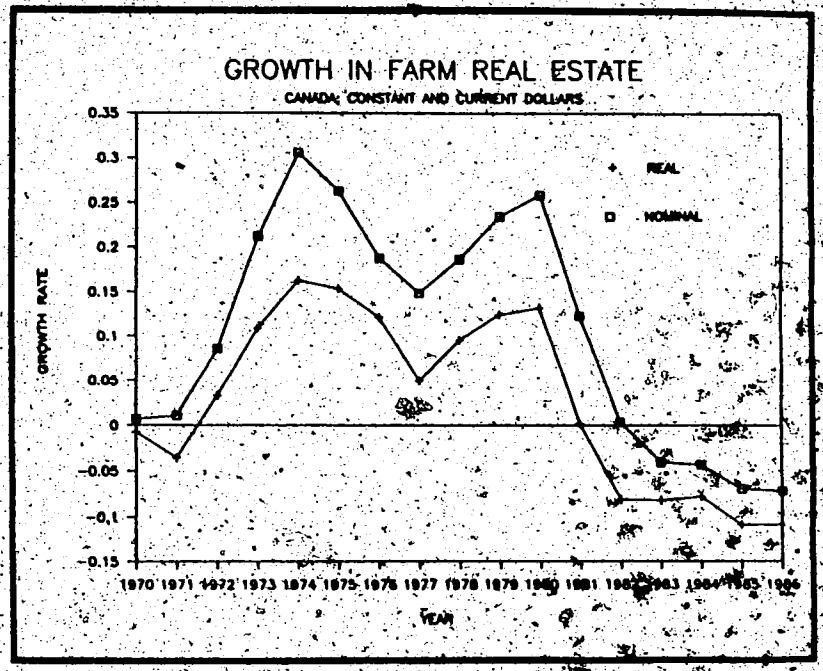
Rates of growth in farm assets, farm net worth and farm real estate exhibited higher highs and lower lows in Alberta than for Canada as a whole. This volatility in the data for Alberta likely occurs because the Alberta data represents only a sample of the data for the Canadian aggregate figures and are therefore less influenced by the smoothing effects of aggregating nationwide groups of farming enterprises.

The Alberta values may have been more influenced by the effects of local economic and geographic differences that would not have been felt in the total farming population. For example, growth in farm real estate peaked in Canada in 1974. In Alberta this peak did not occur until 1979. In addition, Alberta may have been experiencing more volatile agricultural growth than was the rest of the country due to its unique resource-based

Figure 4.5 Real and nominal dollar rates of growth in Canadian farm assets, 1970-1986. Shown are the rates of growth in farm real estate (the annual change in value of land and buildings), equity in total farm assets (the annual changes in net worth of real estate, machinery, livestock and liquid assets) and farm assets (the annual change in net worth minus net investment as a measure of capital gain in farm assets). Individual trends in growth rates in aggregate Canadian values for each of the three growth measures were graphed directly from values listed in Table 4.1. The magnitude of potential "money illusion" which occurs if real and nominal dollar values are not clearly distinguished becomes apparent when these dollar terms are plotted together.







economy and much dependence on grain prices, both factors which exhibited dramatic swings between 1970 and 1986 that could have had more effect on the provincial situation than on the national aggregate farm balance sheet.

4.2.2 Farm Assets

From Figure 4.4, it is apparent that annual growth in farm assets has been consistently less than growth in farm real estate. Farm assets and farm equity closely follow trends in farm real estate. Each series shows 9 years of positive growth and 8 years of negative growth. Both 1974 and 1979 were years of large increases in the value of farm assets in both Canada and Alberta.

For the five years from 1982 to 1986, farm assets actually grew at a less negative rate than farm real estate. During this period, growth in farm assets was buoyed by growth in value of its non-real estate components.

4.2.2.1 Methods of Calculating Growth in Farm Assets

The results of two techniques for calculating farm asset growth are shown in the bottom half of Table 4.1. As was discussed in Methodology 3.1.3.2, the conceptual base of the CMF and Melichar techniques is identical. These techniques differ only slightly due to a technicality in the discounting adjustment. As can be seen in Figure 4.6, the empirical differences in the two techniques were found to be negligible.

Using CMF method of discounting, annual rates of nominal farm asset growth in Canada ranged from the high levels of 22.4% in 1979 and 22.3% in

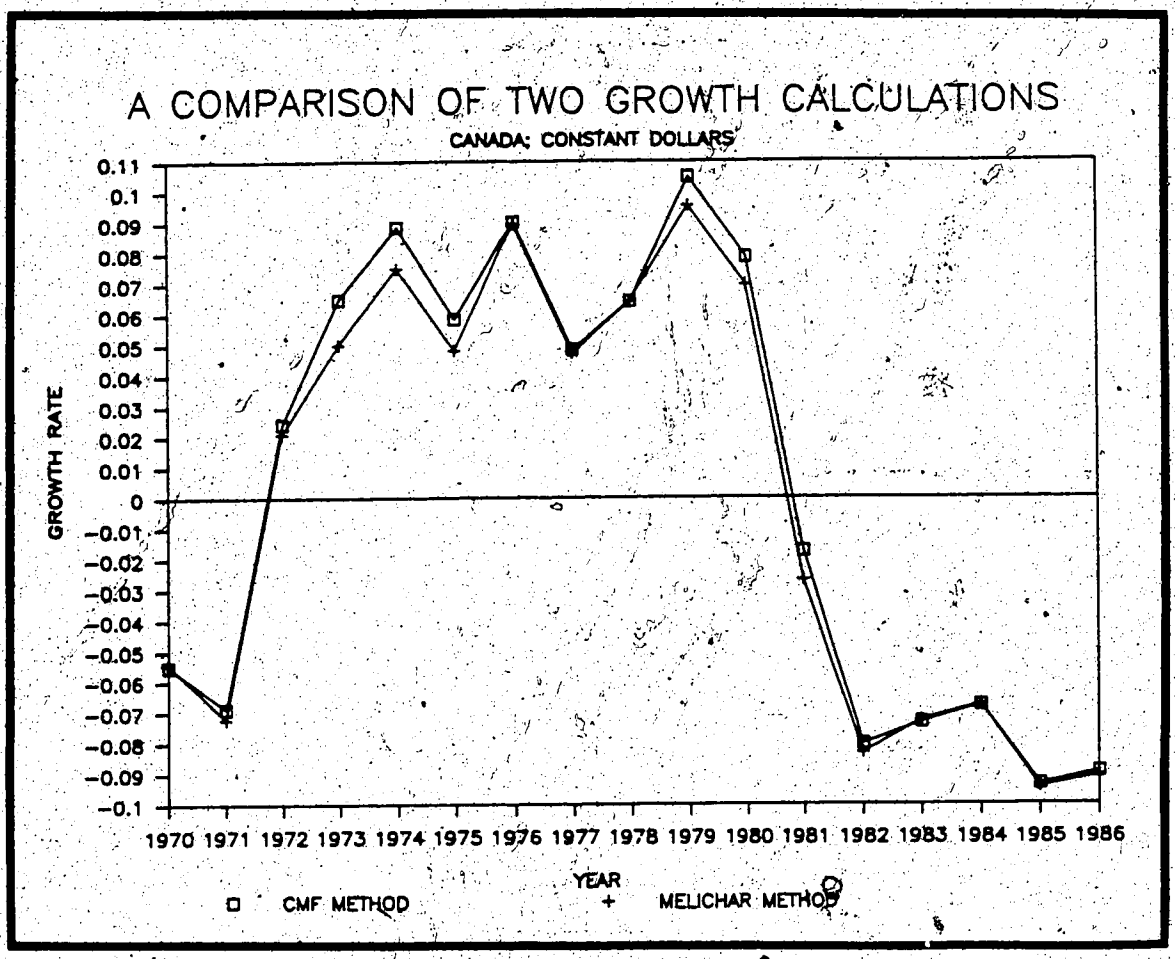


Figure 4.6 The CMF and Melichar methods of calculating growth rates in Canadian farm asset values. The growth rates shown represent real capital gains in the aggregate value of farm assets between 1970 and 1986. The CMF method uses real dollar data to calculate real capital gains as farm net worth minus net annual investment. In the Melichar method, nominal dollars are used to calculate nominal gains and are then adjusted by the CPI to real dollar terms, yielding real capital gains. The technical difference between these two methods is that the CMF method discounts all variables similarily whereas the Melichar method does not discount the begining of the year net worth or the components of net investment (discussed in Chapter 3, section 3.1.3.2). However, it is clear that only small differences exist in the values calculated by each of the methods. Values for both variables are listed in Table 4.1.

1974 to a low of -5.3% in 1985. The results for Alberta were a nominal high of 37.7% experienced in 1979 which ranged to a period low of -5.9% in both 1984 and 1986.

Trends in farm asset value growth were nearly as variable as nominal growth rates during the seventeen years covered by the study. In Canada the rate at which farm assets grew in value ranged from 10.5% in 1979 to -9.4% in 1985. In Alberta real rates of growth in farm assets were similar to those in Canada but the timing of their high-low peak values was different than in Canada. The high rate of farm asset growth (of 11.0%) was experienced in 1974, not 1979 as in Canada. The low (of -9.8%) was one year later in Alberta than in Canada (1986 vs. 1985). Negative growth, even at half of this rate, had not been experienced since 1970 and 1971. However, in Alberta, it was -8% to -10% per year for four years from 1982 to 1986.

The results for Canada using the Melichar discount technique deviate by 1.0% of the CMF method results with the exception of 1973 where the Melichar growth for farm asset values was 1.5 percentage points less than the CMF estimate. For Alberta, the two estimates reported in Table 4.1 are nearly identical. It can be clearly observed in Figure 4.6 that the Melichar model consistently resulted in slight underestimates of capital gains and slight overestimates of capital losses as compared to the CMF method. However these differences are very small.

4.2.2.2 Using Farm Assets as a Proxy for Farm Real Estate

Farm assets were used as a proxy for farm real estate by Melichar (1979) who justified this assumption on the basis that the latter comprised 80% of U.S. farm assets. In Canada the situation is clearly different.

First, farm real estate observed in Canada (Figure 4.4) averages 74.0% of farm asset values. In Alberta the farm assets are only 67.2% real estate. The assumption that farm assets are composed almost entirely of farm real estate is therefore untenable in both Canada and Alberta. Secondly, using growth in farm assets as a proxy for growth in farm real estate would tend to underestimate growth in Canada and Alberta by roughly one third. An underestimation of this magnitude would tend to bias the estimation of existing growth rates in farm real estate values.

4.2.3 Growth in Farm Business Equity

Trends in equity growth may be seen in Figure 4.6. For 10 years of the study period, specifically in 1970 and from 1972 to 1980, growth in equity was positive. For another 7 years including 1971 and from 1981 to 1986, real dollar equity has been declining in the Canadian sector at rates that range from 6.5% to 9.0% per year.

The value of equity in farm assets influenced by many factors. Changes in farm equity, both positive and negative, are considered as either business growth or business decline. In a working paper, "A Partial Solution to the Current Problem in Agricultural Credit", Aukes (p.3) lists the following reasons for negative business growth:

1. Falling asset (land) prices.
2. Large interest payments on debt other than operating debt.
3. Below par performance of a farm manager in terms of production and marketing.
4. Unanticipated production difficulties such as drought or an early frost.
5. Unusually high family withdrawals of capital from the business.

It is likely that many of these factors have likely had a role in the negative business growth exhibited in both Canada and Alberta. In 1971, for example, the aggregate farm business experienced a decline which was associated with the lowest asset values evident during the entire 17 year period. In the period 1981 to 1986 negative business growth was again associated with falling asset values. Also evident during these six years were interest payments on debt in real dollar terms which had reached their peak in 1981; real gross farm incomes which had fallen between 1982 and 1984; and drought in Alberta from 1983 to 1985.

During the 10 years that farm business grew, farm real estate values appeared to be a major controlling factor. Kay (1981) lists several other reasons for stimulated business growth:

1. Rising asset (land) values.
2. Additional capital investment.
3. Personal capital added to the business by the owner (i.e. an off-farm income, gifts, inheritances).
4. The business generates a profit which is reinvested in the business.

In a growing business, the value of net worth should be increasing without the benefit of inflating real estate values. In 1979 this situation clearly occurred. As can be seen in Figure 4.5, 1979 was a year of both record growth in both farm equity and farm real estate values. However, in that one year equity in Canadian farm businesses grew by 21.1% (in Alberta growth was 33.4%) while farm real estate values grew by only 13.3% (in Alberta by 30.1%).

Farmers wanting to know if their management efficiency or increased

productivity contributed to business growth would often have been be frustrated to find that these factors are indistinguishable from the influence of real estate appreciation and depreciation. Contributions of rising real estate values to net worth can disguise an unproductive or inefficient farm business during years of positive real estate growth and rapidly erode equity in years of negative growth. Keeping an "at cost" base balance sheet instead of an "at market" base is one way of distinguishing between the two sources of growth in net worth.

Despite different purposes and origins, the growth rate reported in Table 4.1 share some common features. Farm equity, real estate values and assets growth all occur within the same order of magnitude except during the three years of 1970, 1971 and 1975. During the periods of falling growth rates (1981-1984), the three rates are very similar.

The growth rates illustrated in Figure 4.5 show a bimodal pattern with the first peak occurring in 1974, a trough in 1977, a second peak in 1979-1980 and another trough in 1982. Both farm asset and farm real estate growth rates were trimodal -- peaking twice between 1973-1976 and again in 1979-1980. However, these growth rates were still very similar to the trends in equity.

From Figure 4.5 positive and negative growth rates can be seen exhibited simultaneously by all three types of indicators. Negative growth increased at an increasing rate in 1970-1971, 1981-1982 and 1984-1985. Positive growth rates occurred at increasing rates from 1971 to 1974 and 1977 to 1979, while changing at decreasing rates from 1974 to 1977 and 1979 to 1979. While the general trends in each indicator were similar, the

individual indicator used as a measure of growth is critical to the delineation of a specific growth rate. The different measures may vary by as much as two to three times between lowest and highest estimate of growth rates in farm real estate, farm assets and farm equity.

4.3 RETURNS TO OWNING FARM REAL ESTATE

An investor's decision whether or not to purchase or hold a growth stock depends on the perception of an acceptable rate of return. It is also influenced by his need for long term, intermediate term or short term returns on the investment. The total return to investment in a growth stock such as farm real estate is composed of the two parts that were previously discussed, current returns and capital gains (section 2.6.2).

4.3.1 Annual Returns to Farm Real Estate

Low rates of annual return are characteristic of growth stocks. From the calculated rates of return in capital gains, annual income and overall realized return reported in Table 4.2, it can be seen that Canadian real dollar imputed rental return to farm real estate averaged 2.3% of farm real estate values over the period 1970 to 1986. Imputed rent, the annual return to ownership on farm real estate, ranged from a high of 3.0% in 1974 to a low of 1.8% which applied in 1982. In the years from 1984 and 1985 the the annual return rose slightly to 2.0%.

In Alberta aggregate rental returns were similar. These rental returns averaged 2.1% of farm real estate values, ranging from a high of 3.5% in 1973 to a low of 1.4% in 1981-1982.

RISK ANALYSIS:	AVERAGE	VARIANCE	STTD	COEF. OF VARIATION
1.AS RELATED TO FUNCTIONAL FORM ASSUMED				
REAL PRICE RISK: NO GROWTH[a]	66523051	390877057709147	19770611	0.291
REAL PRICE RISK: CONSTANT GROWTH[b]		3295221010031999	57404016	0.161
2.RETURN RISK: SINGLE ASSETS				
RENTAL INCOME	461813	12532834225	111950	0.141
NOMINAL CAPITAL GAINS ON REAL ESTATE	3842729	4951589609148	7036751	1.779
REAL CAPITAL GAINS ON REAL ESTATE	1158707	433268529688005	6582314	7.812
RENT AND REAL CAPITAL GAIN	1629831	43190817812578	6571972	2.009
GROSS FARM INCOME	15291012	2273308	2273308	0.081
GROSS INCOME + REAL CAPITAL GAIN ON ASSETS	13820133	586281067742	2421324	0.117
MONEY MARKET (REAL INTEREST RATE)	0.003	0.001	0.028	0.030
(NOMINAL INTEREST RATE)	0.077	0.001	0.028	0.105
3.RETURN RISK: 2 ASSET PORTFOLIO				
ONLY ANNUAL RETURNS	5834121	1.00E+11	316433	0.072
ANNUAL AND CAPITAL GAIN RETURNS	1194744	2.00E+13	4475116	1.977

Table 5.1 Risk analysis of owning farm real estate. The variations in both price (value) of real estate and the returns accruing from land ownership were analysed for aggregate Canadian values over the period 1970 to 1986 using the statistical measures of average, variance, standard deviation and coefficient of variation. All four measures are detailed in Appendix 5; the former three measures are reported in ('000) dollars.

a) Real dollar price variation about the mean.

b) Real dollar price variation about the linear trend.

The extent of variation in the money market appears to be of similar magnitude to variations in annual return to aggregate farm real estate and farm assets as a whole. The coefficient of variation for the Canadian chartered bank's non-chequing nominal interest rate was 10.5%, and this return exhibited an average yield of 7.7% per year. However, when expressed in real dollar terms the standard deviation in the money market is only 3.0% of its mean yield of 0.3% per year from 1970 to 1986.

5.1.2 Risk Related to Price of Farm Real Estate

Variations in returns to farm real estate are directly related to farm real estate values which were in a state of flux from 1970 to 1986. Real estate values varied by 29.1% (see Table 5.1) of their mean values during the period of study. Choice of the arithmetic mean for this calculation, however, implies that the functional form of change over time in real estate values is constant and without growth. In a situation with high constant growth, a large degree of risk could be calculated based on a high degree of variation from the mean. In many cases an investor is interested in quantifying the amount of risk associated with realizing a particular pattern of returns. Usually this could be depicted as a linear growth pattern. As was shown in Section 4.1.3, however, even a linear model poorly describes the trend in land values between 1970 and 1986, and a no growth model is inaccurate. However, if one assumes a linear relationship in farm real estate values and a constant growth in values, the variation of standard deviation of the actual annual data time path and the predicted linear form (not the average form) is 16.1% -- down from 29.1%. It is therefore apparent that prediction of farm real estate values at the level of even a first level polynomial would decrease the perception of the price

risk faced by an investor. In so doing a coefficient of variation of [illegible] is calculated for Canadian real estate.

5.1.3 Real Estate in the Farm Portfolio

There are two main strategies for managing price risk in real estate values. The first involves including in the initial assessment of the purchase value (present value) a risk adjusted discount rate and thus discounting future values at a higher rate than would be the case with a non-risk discount rate. However, more important to an investor than changes in real estate values themselves are the actual returns that might be expected. To manage risk in returns from investment in farm real estate, a good strategy is to diversify price risk by including farm real estate as part of a portfolio of invested capital.

In this section of the analysis, farm real estate was assumed to be part of a two asset portfolio. Such a portfolio, comprised of farm real estate and of non-real estate farm assets (including: livestock, machinery, crop and cash inventories, as well as other assets), was intended to simulate a typical farm holdings. The farm real estate portion was assumed to be the actual average of 64% of the aggregate Canadian farm asset portfolio, with non-real estate assets comprising the rest.

When considering only annual returns, the coefficient of variation for the Canadian farm portfolio was found to be 7.2%. Outside the farm portfolio the two components of annual return had higher variances: rent, which comprised 64% of the returns had a coefficient of variation of 14.1%, and gross farm income, which comprised 36% of the returns had variation from

its mean of 8.1%.

The variation in annual returns from this typical farm portfolio depend on whether or not capital gain from appreciating values of farm real estate and other farm assets is [redacted] as a return along with annual income. Examining only annual returns provides a limited perspective on the risk faced by an investor holding farm real estate. When returns from both annual and capital gains sources were included, the coefficient of variation for the same portfolio was 198%. Although this increase in the variability of returns about a mean return value is startling, it must be kept in mind that the magnitude of the returns which include capital gains also changes. On average the return doubles. However, averaging tends to leave little impression of the highs and lows of capital gains and capital losses experienced during the seventeen years of the study (shown in Table 4.2 and discussed in Section 4.3).

If the variation in overall returns to farm real estate inside the portfolio were considered relative to the returns which might have been expected outside the farm assert portfolio little difference would be observed. The coefficient of variation for farm real estate outside the farm portfolio including both current and capital gains returns was 201%. This is compared, to a coefficient of variation of 198% inside the farm portfolio. Therefore, whether inside or outside a farm portfolio, investment in farm real estate leaves the investor vulnerable to liquidity risk in the face of large price changes in real estate and low gross incomes. Other authors have observed that liquidity risk may render remedial business adjustments unfeasible (Featherstone and Baker, 1987, p.544).

5.2 BUSINESS RISK

Business risk defines the exogenous risk to the firm after enterprise choices, production choices and capital structure of the firm have been set in place (Collins, 1985). For example, the price variations experienced in the farm land market present a business risk to those owning or holding farm real estate. Analysis of business performance ratios was undertaken to assess the potential impacts of annual price variations on the financial performance of the farm business. Within the limitations of aggregate financial data, trends and average benchmark values were delineated.

Measures of the financial fitness of the farm business, solvency, capital efficiency, liquidity and profitability, are typically drawn from the balance sheet, income statement, and cash flow statement. Data to complete the former two statements were available from the Statistics Canada data base, (and listed in Tables A1.1 and A1.2), however there was no information on current assets or current liabilities. Liquidity ratios from the latter statement therefore could not be determined. Table 5.2 reports solvency, efficiency and profitability measures of financial fitness for Canada and Alberta aggregate farms from 1970 to 1986.

Usually, as was the case in the results of this study, values expressed in nominal and real dollar terms are considerably different from each other in value. However when ratios such as the business ratios are calculated between values during the same year, nominal and real dollars have no influence on the resulting rate.

Table 5.2 Financial ratios for the hypothetical aggregate Canadian and Alberta farm reported over the period 1970 to 1986. Dollar terms, real or nominal, have no differentiating impact on the financial ratios.

CANADA:

	SOLVENCY RATIOS:[1]			EFFICIENCY RATIOS:[2]	
YEAR	1.CAPITAL RATIO[a] A/L	2.EQUITY RATIO[b] E/A	3.LEVERAGE RATIO[c] L/E	1.TURNOVER[a] A/GI	2.SCALE[b] GI/A
1969	8.39	0.843	0.186	6.03	0.166
1970	6.69	0.851	0.176	6.51	0.154
1971	6.43	0.844	0.184	6.05	0.165
1972	6.89	0.851	0.176	6.00	0.167
1973	7.01	0.857	0.166	5.02	0.199
1974	7.15	0.860	0.163	5.12	0.195
1975	7.34	0.864	0.158	5.44	0.184
1976	7.27	0.862	0.159	6.27	0.159
1977	7.10	0.858	0.164	6.91	0.145
1978	6.96	0.856	0.168	6.72	0.149
1979	7.67	0.870	0.150	7.44	0.134
1980	8.21	0.878	0.139	8.20	0.122
1981	8.04	0.876	0.142	7.38	0.135
1982	7.56	0.868	0.152	7.87	0.127
1983	6.97	0.857	0.167	8.09	0.124
1984	6.72	0.851	0.175	7.40	0.135
1985	6.40	0.844	0.185	6.87	0.146
1986	5.99	0.833	0.200	6.30	0.159

PROFITABILITY RATIOS:[3]

YEAR	1.PROFIT PER BUSINESS[a] (ROA) (NFI+INT-ROI-ROM)/A	2.PROFIT FOR OWNER/OPERATOR[b] (ROE)(1) NFI/E	3.PROFIT FOR OWNER[c] (ROE)(2) (NFI-ROI-ROM)/E	4.BANK RATE: NOMINAL INTEREST ON SAVINGS[d]	4.BANK RATE: REAL INTEREST ON SAVINGS[e]	5.PROFIT FOR LENDER[f] (ROL) INT/L
1969	0.056	0.064	0.054	0.060	0.060	0.068
1970	0.048	0.052	0.043	0.082	0.047	0.083
1971	0.050	0.058	0.048	0.045	-0.004	0.058
1972	0.052	0.059	0.049	0.040	-0.011	0.057
1973	0.081	0.098	0.084	0.054	-0.039	0.080
1974	0.075	0.087	0.086	0.085	-0.038	0.092
1975	0.071	0.082	0.071	0.070	-0.025	0.069
1976	0.051	0.057	0.047	0.078	0.019	0.074
1977	0.039	0.042	0.034	0.060	-0.035	0.070
1978	0.043	0.046	0.037	0.071	-0.013	0.077
1979	0.038	0.038	0.030	0.101	0.003	0.094
1980	0.030	0.027	0.020	0.112	0.000	0.101
1981	0.041	0.036	0.028	0.154	0.033	0.134
1982	0.032	0.027	0.019	0.115	0.022	0.113
1983	0.024	0.021	0.014	0.069	0.024	0.088
1984	0.030	0.027	0.019	0.077	0.039	0.091
1985	0.036	0.036	0.027	0.081	0.017	0.093
1986	0.048	0.051	0.042	0.060	0.018	0.080

1. Solvency.

   a. Capital ratio = assets/ debt. This measures the amount of assets availible to cover total debts.

   b. Leverage ratio = debt/ equity. This measures the proportion of ownership controlled by the owner and lender.

   c. Equity ratio = equity/ assets. The equity ratio measures the proportion of assets owned by the owner.

2. Capital efficiency.

   a. Turnover = assets/ Gross Farm Income (GFI). This is the number of years needed to turnover the price of assets one time with income produced on the farm.

   b. Scale = GFI/ assets. The amount of money earned per dollar of assets.

3. Profitability.

   a. Return on assets (ROA) = Net Farm Income (NFI)/ assets. ROA measures the net earnings of both owner and lender in relation to the total capital invested in the business.

   b. Return on equity (ROE) = NFI + interest / assets. This is an earnings measurement of the return to owner/ operator.

   c. An alternate form of ROE is expressed as ROA = NFI + interest $-Ro_i - Ro_m$ /assets. The latter form measures the return to owner.

   d. Bank rate: Nominal. The typical current dollar interest rate on non-chequing savings deposits posted in the 5 largest Canadian chartered banks. A more detailed description of this variable is given in Appendix I.3.

   e. Bank rate: Real. The rate of interest on non-chequing savings deposites expressed in real dollar terms.

   f. Return to lender (ROL) = Interest paid on debt/ liabilities. This measures the profits made by the lenders on business loans.

ALBERTA:

SOLVENCY RATIOS:[1]

YEAR	1. CAPITAL RATIO[a] A/L	2. EQUITY RATIO[b] E/A	3. LEVERAGE RATIO L/E	EFFICIENCY RATIOS:[2] 1. [illegible]	2. SCALE C/TA
1969	7.17	0.861	0.162	7.45	0.134
1970	7.55	0.868	0.153	7.95	0.126
1971	6.71	0.851	0.175	7.58	0.132
1972	6.90	0.855	0.170	7.17	0.139
1973	6.93	0.856	0.169	6.08	0.164
1974	7.17	0.861	0.162	9.28	0.158
1975	7.63	0.869	0.151	6.67	0.150
1976	7.67	0.870	0.150	7.72	0.129
1977	7.85	0.873	0.146	9.17	0.109
1978	7.87	0.873	0.146	8.46	0.118
1979	9.50	0.895	0.118	9.90	0.101
1980	10.39	0.904	0.107	10.66	0.094
1981	9.54	0.895	0.117	9.69	0.103
1982	8.91	0.888	0.128	10.74	0.093
1983	8.60	0.875	0.143	11.17	0.090
1984	7.98	0.864	0.157	10.22	0.098
1985	8.92	0.856	0.169	9.57	0.105
1986	8.62	0.849	0.178	8.19	0.122

PROFITIBILITY RATIOS:[3]

YEAR	1.PROFIT FOR BUSINESS[a] (ROA) (NFI+INT-ROI-ROM)/A	2.PROFIT FOR OWNER/OPERATOR[b] (ROE) NFI/E	3.PROFIT FOR OWNER[c] (ROE) (NFI-ROI-ROM)/E	4.BANK RATE: NOMINAL INTEREST ON SAVINGS[d]	4.BANK RATE: REAL INTEREST ON SAVINGS[e]	5.PROFIT FOR LENDER[f] (ROL) INT/L
1969	0.045	0.049	0.040	0.080	0.080	0.074
1970	0.038	0.041	0.033	0.082	0.047	0.072
1971	0.038	0.042	0.033	0.045	-0.004	0.062
1972	0.047	0.052	0.043	0.048	-0.011	0.067
1973	0.070	0.082	0.072	0.054	-0.036	0.058
1974	0.083	0.071	0.061	0.085	-0.036	0.076
1975	0.057	0.094	0.054	0.070	-0.025	0.073
1976	0.038	0.040	0.032	0.076	0.019	0.079
1977	0.022	0.021	0.014	0.080	-0.035	0.074
1978	0.034	0.035	0.027	0.071	-0.013	0.080
1979	0.030	0.026	0.022	0.101	0.003	0.109
1980	0.028	0.023	0.018	0.112	0.000	0.108
1981	0.029	0.023	0.017	0.154	0.033	0.134
1982	0.021	0.015	0.010	0.115	0.022	0.112
1983	0.014	0.010	0.005	0.089	0.024	0.079
1984	0.014	0.009	0.003	0.077	0.039	0.087
1985	0.006	0.015	0.008	0.081	0.017	0.089
1986	0.009	0.011	0.004	0.080	0.016	0.076

5.2.1 Solvency

In general, solvency indicates the ability of a business to meet its long-term financial obligations. Three ratios drawn from the balance sheet are used to measure solvency: the capital ratio, the leverage ratio and the equity ratio.

The capital ratio, a ratio of assets to liabilities, shows the financial position of a business assuming that all assets were to be liquidated to cover liabilities. Table 5.2 shows that, in aggregate, Canadian farmers had a maximum of $8.21 worth of assets to cover each dollar of debt at the peak levels of solvency in 1980, while in Alberta farmers had $10.39. During the period 1970 to 1986 the minimum amount of aggregate assets per dollar of debt in 1986 was $5.99 in Canada and $6.62 in Alberta.

The leverage ratio shows the proportion of a business's capital provided by the owner versus the obligation to creditors due if business debts were to be immediately liquidated. Over the 17 year period from 1970 to 1986, both Canadian and Alberta farmers have, in aggregate, maintained a very modest leverage ratio. Table 5.2 shows that on average, this has been 16.6% for Canadian farmers and 14.9% for Alberta farmers. That is, the aggregate debt of the Alberta farm sector was, on average, one seventh of the value of aggregate farm equity. The Canadian aggregate farm sector has, in aggregate, an average $1.00 of debt for every $6.02 of equity.

As may be seen in Table 5.2, the aggregate Canada and Alberta farm sectors were more highly leveraged in 1971 than in any subsequent year. This marked decline corresponds to the general upward trend in land values observed from 1970 to 1986. Thus, contrary to popular thinking, while in

aggregate, Canadian farmers have taken on more debt, this debt is covered by more assets than in the early 1970's.

The increasing trend in overall farm debt since the early 1970's occurred in a period when there was a similar proportional rise in the estimate of current market values of on farm machinery stocks. Before 1973 farm machinery was only 55% of its 1981 value, while aggregate farm debt was around 65% of its 1981 value. Both machinery values and farm debt moved upward sharply throughout the mid and late 1970's, peaking in 1981, when the value of machinery began to decline, while the value of debt remained approximately constant (see Table A3.1). The proportional change in debt and machinery value on farms is remarkably similar, suggesting that much of the new debt assumed after the "grain heist" of the early 1970's was invested into machinery purchases and that the buying of new equipment ended abruptly in the early 1980's.

The equity ratio shows the proportion of every dollar of asset that is owner equity. Lee et al. (1980) state that equity ratios under 40% to 50% are often carefully watched by lenders. Of little concern would be an aggregate farmer who owns a large proportion of his assets. In Canada an average of 85.8% of aggregate farm assets are owner equity; in Alberta this ratio averages 87.1%. As the other solvency ratios have shown, a hypothetical aggregate farmer is in a very strong financial position and has considerable capacity to increase debt load.

In calculating these ratios, it was found that:

1) From the aggregate balance sheet, it appears, at least in the aggregate, that Canadian farmers, including those in Alberta, are

solidly solvent. They are modestly leveraged and tend to own most of their assets.

2) During the period of rising land prices in the 1970's, solvency measures for the Canadian and Alberta aggregate farm sector remained remarkably stable.

3) As asset values rose, so did the aggregate debt capacity and actual value of liabilities. However the ratio of assets to liabilities and equity to liabilities fell over the period from 1970 to 1986.

4) In aggregate, Alberta farmers have been more conservative than their national counterparts in maintaining a solvent business.

5.2.1.1 Owning a Growth Stock: The Impact on Solvency

A business's ability to cover its long term debts with capital improves as farm real estate values rise. In addition, the greater the proportion of positively growing stock in the farm portfolio, the stronger is the business's capital position. However, during times of depreciating real estate values, the business will experience lowered levels of solvency as the margin of capital covering debts decreases. This is especially so if the business was highly levered.

Borrowing potential rises and falls with real estate values. It is also sensitive to the proportion of the farm investment portfolio held in farm real estate. Investing in a farm portfolio in which a large portion of capital is in farm real estate has been a risky but very easy way to build equity. The experience of the 7 years from 1970, suggests that simply holding the positively growing stock will increase equity and overall

growth can be maintained without increasing production or product marketing. The risks to the business are that if growth in farm real estate becomes negative, equity will be eroded even though the business is maintained as before.

5.2.2 Efficiency

Ratios showing trends in income to investment are taken from the income statement and balance sheet in order to monitor the financial efficiency of the farm business and to detect the efficiency and effectiveness with which the capital of a business is being put to use to generate gross income. Two financial ratios are commonly used to measure financial efficiency. These are turnover and scale.

Turnover, the ratio of the value of total farm assets to gross farm income, is a measure of how quickly capital is regenerated by gross income. As shown in Table 5.2, the real capital turnover time in Canada ranged from 6.0 years in 1973 to 11.2 years in 1983. The turnover time in Canada averaged 6.7 years The increase in the years needed to turnover farm capital suggests that capital became less efficiently used since it would have taken twice as long for gross income to accumulate in 1983 than in 1973. It would have taken Alberta farmers one year more to turnover the total farm capital values in 1973 and 4 years longer in 1983 than for Canadian farmers as a whole. Alberta farmers must therefore face making less efficient use of their capital than Canadian farmers.

Financial scale compares the size of the business when measured by gross income to its size when measured by asset values. Mathematically,

scale is the inverse of turnover. It measures the effectiveness of capital for the generation of income. As listed in Table 5.2, Canadian farmers, in aggregate, had an average $1.00 of capital for $0.15 they generated in real gross income. In Alberta, farmers generated $0.12 of gross income of every dollar of capital held. As real estate values rose during the period of study, the efficiency of capital in generating income decreased. As real estate values fell in 1985 and 1986, the negative trend in this measure of efficiency appears to have reversed.

From an examination of of the two measures of financial efficiency cited here, the following were noted:

1) The aggregate farm business in Alberta and Canada became less financially efficient between 1973 and 1984. The use of capital was both less efficient and less effective; its ability to service debt on capital was diminished. These trends were primarily due to rising asset values, although fluctuations in gross income contributed to this trend.

2) The number of years required to turn over capital once relative to gross farm income doubled between 1973 and 1983 for both Canadian and Alberta farmers. When turnover is high, capital is only slowly freed for other uses.

3) Such decreases in financial scale suggest that farm gross income became increasingly less effective in paying off asset values as real estate values rise.

4) The margin of gross income which is available for debt servicing and family withdrawal decreased between 1973 and 1986 for both Canadian and

Alberta farmers.

5.2.2.1 Owning a Growth Stock: The Impact on Financial Efficiency

A farm investment portfolio in which a large portion of the capital is is invested in a growth stock such as farm real estate has a negative impact on the financial efficiency of the farm's business. In addition, the larger the proportion of the growth stock in the portfolio mixture, the more limited its income generating capacity. Thus, when a farmer is assembling an asset portfolio, the choice of both the type of capital invested in whether growth or nongrowth, and the proportion of each type in the portfolio are decisions which affect the ability to generate income.

5.2.3 Profitability

Rate of return on assets, rate of return on equity and rate of return to lender are ratios which measure income profitability relative to investment. Capital gains contribute a considerable return to investment for owning or holding farm land. However, since returns from capital gains are not realized annually, they are not considered an income return and are not included as a measure of business profitability. Table 5.2 lists all three of these ratios in real dollar values for both Canada and Alberta.

Simple calculations of returns to assets (ROA) and returns to equity (ROE) can be adjusted to more accurately reflect uncommitted profits by subtracting returns to family labor and return to management from net farm income. Using an unadjusted evaluation of net farm income to calculate ROA and ROE will provide underestimates of ROA or ROE. Figure 5.2 shows only

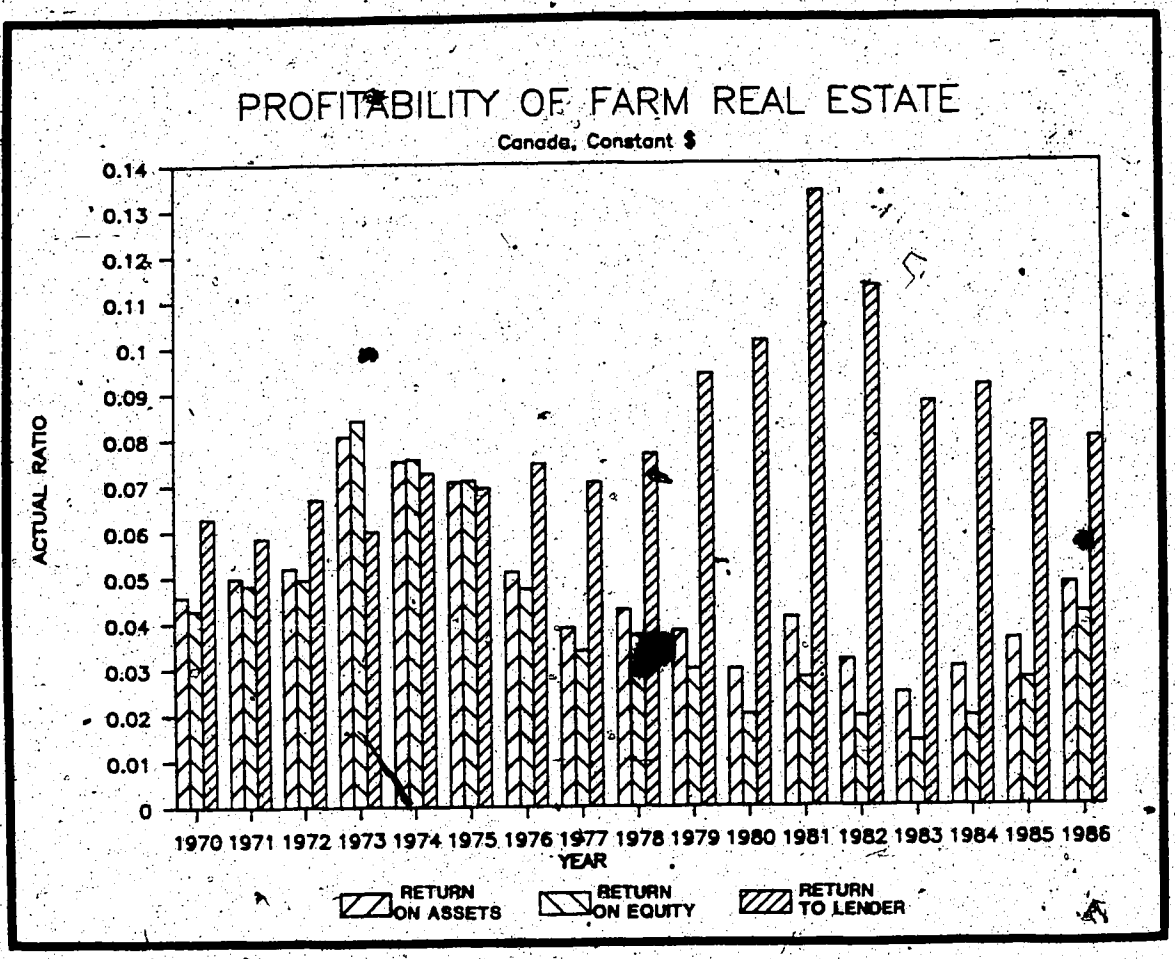


Figure 5.2 Profitability in the Canadian farm real estate market, 1970-1986. A comparison of return on assets (ROA), return on equity (ROE) and returns to the lender (ROL) are shown. While all three returns were similar in the early 1970's, since that time ROA and ROE have declined appreciably, returns to the lender have risen, resulting in a large discrepancy in the rates of return. The rates of return are listed in Table 5.2.

adjusted measures for ROA and ROE.

Return on assets (ROA) measures the net earnings of both owner and lender in relation to the total capital invested in the business. ROA is sensitive to changes in gross income, farm expenses, the amount of interest paid to creditors and to changes in asset values. This concept is identical to the annual returns to farm assets, discussed in section 4.3.2. Annual (adjusted) estimates of ROA, shown in Figure 5.2, increased during the period from 1970 to 1973 and have been declining since that time. The lowest returns to assets were in 1983 when Canadian farm assets returned 2.4% expressed as an aggregate annual rate of real dollar annual return and Alberta farm assets generated a 1.4% annual rate of annual return.

The return on equity (ROE) ratio shown in Figure 5.2 measures the profit accruing to an asset owner or owner/operator relative to the equity held in the asset. Annual return on equity held by an owner/operator, expressed in real terms, peaked in 1973 at a rate of 9.6% in Canada and 8.2% in Alberta.

By 1984 annual return to owner equity in farm assets, expressed in real values, was a mere 0.3% in Alberta; in Canada, by 1984, this return was only 1.9%. Figure 5.3. illustrates real dollar returns to equity in both farm assets and, for comparison, on equity capital held in non-chequing savings deposits. These two measures of returns to equity capital invested in different investments were remarkably similar in 1970 and also in the period from 1981 to 1986. During the period of rapid growth in land values, returns to equity in land were both positive and larger than were corresponding returns on equity capital held in non-chequing savings

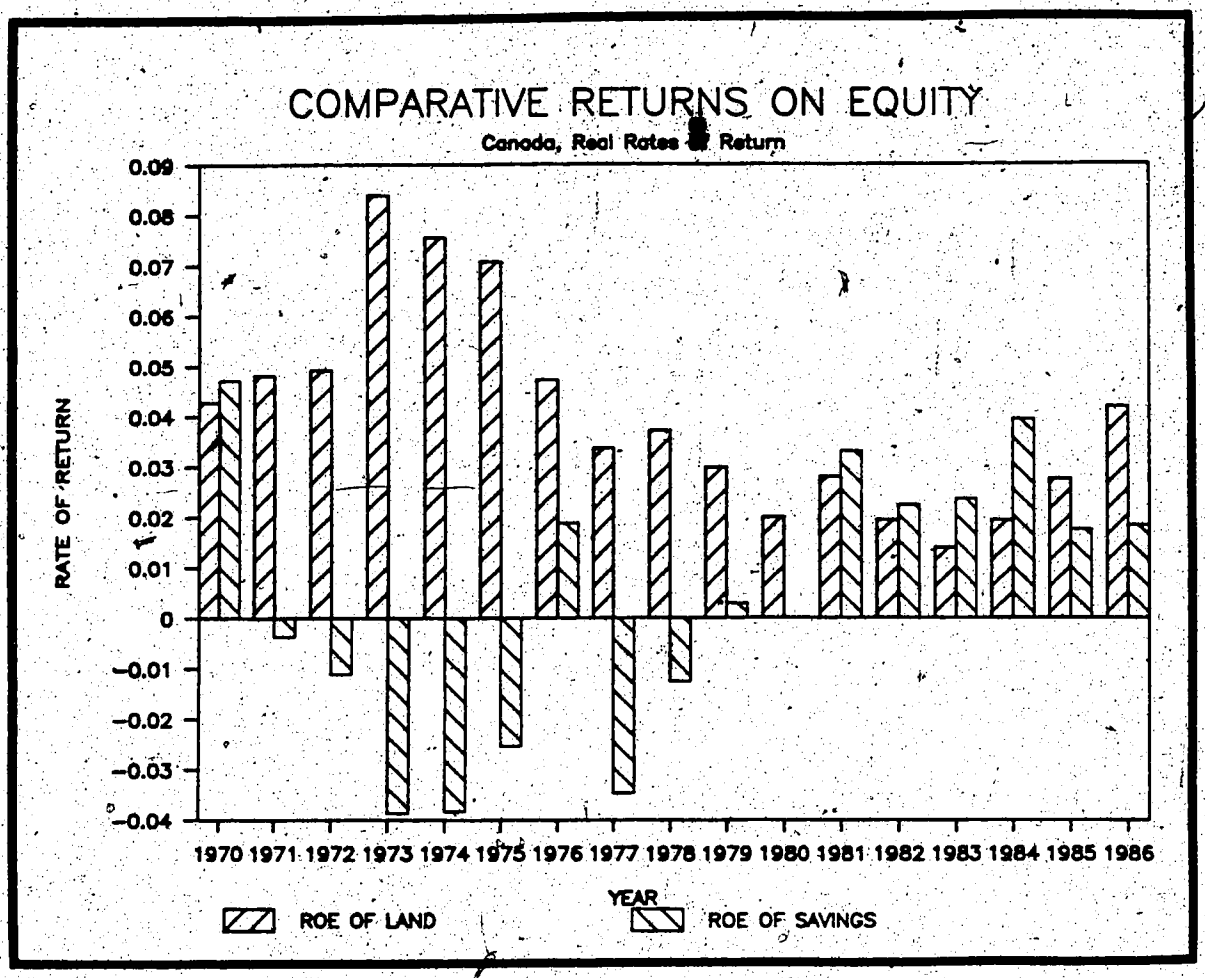


Figure 5.3 Rates of return on equity capital investment, 1970-1986. A comparison is made between equity capital invested in Canadian total farm assets (calculated as net farm income minus returns to labor and management, divided by owner's equity) and typical bank savings deposits. The two investments yielded similar rates of return early in the 1970's and in the early to mid 1980's. However, during the mid 1970's, returns to equity capital in farm assets were much higher than the real dollar yields from savings interest. The individual rates of return are found in Table 5.2 as bank rate: interest on savings and ROE: profit for owner.

deposits in the Canadian chartered banks which were actually negative in real dollar terms.

Return to the lender, expressed as the ratio of interest paid relative to total liabilities, is a measure of the profits made by the creditors of the business for the use of their money. Except for a brief period of time between 1973 and 1975, in both Canada and Alberta creditors earned a higher rate of return than did equity holders of farm assets (see Table 5.2). By 1981, Alberta creditors were earning 11.7% more than were equity holders. In Canada this discrepancy was 10.6%. However, 1981 was an exceptional year in that both interest rates and land values peaked, thus tending to increase lender returns on debt.

In summary, the spreadsheet data presented in both Table 5.2 and Figure 5.2 indicated that for the aggregate farmer:

1) Real annual return to capital invested in farm assets and to equity in farm assets peaked in 1973 and fell steadily after that.

2) Returns on assets and returns on equity are inversely proportional to farm real estate values.

3) Real money market returns to equity exceeded returns to equity in farm assets in Canada for 5 out of 17 years. In nominal dollars the money market returns on equity were larger than for equity held in farm real estate for 12 out of 17 years.

4) Assisted by high interest rates and high land values, nominal returns to lenders rose to a peak of 13.4% in Canada in 1981.

5.2.3.1 Owning a Growth Stock: Business Profitability

The larger the proportion of farm real estate in the farm investment portfolio, the lower the business potential is to earn profits from income generated by portfolio capital (or equity in that capital). As in the case of the efficiency ratios, it is evident that capital invested in farm assets does not efficiently generate either income or profits. However, it is also apparent that agricultural programs or policies should not be based solely on measures of business efficiency and business profitability without taking into account the role of real capital gains. Assessment of business performance needs to be isolated from asset appreciation and depreciation; this could be done by using purchase values for assets rather than current market values when making business performance assessments.

5.3 FINANCIAL RISK

Maintaining high levels of leverage can represent an economically sound attempt to use the opportunity of rising asset values to boost the growth of an investor's farm business. However, it is the responsibility of the investor to assure that liquidity is maintained at a level that allows the cash obligations of the business, portfolio, and family to be simultaneously met. The potential for cash flow deficiencies due to shortfalls in year to year income, changing interest, unexpected business or production loss or family needs exists and, at an extreme, may force the liquidation of assets. To carry high levels of leverage safely requires the maintenance of sound liquidity practices. These may include maintaining credit reserves, generating off farm incomes, using alternate production strategies, and practicing forward marketing or leasing.

There is a balance between maintaining liquidity and foregoing opportunities for growth. Table 5.3 shows aggregate annual price to earnings (P/E) ratios for farm real estate and for farm assets in Canada and Alberta 1970 to 1986. High P/E ratios, between 37 and 51 in Canada, for farm real estate suggest that investors have felt that farm real estate has had good and fairly steady growth opportunities over the period. Investors were willing to bid the price of real estate far above the earnings levels that are recovered.

It appears that these earnings (rent) were perceived to be relatively safe despite being very low (i.e. rent from a property being less than its mortgage payments). This perception is borne out by the data. Aggregate rental income was, on average, 2.3% of the aggregate value of real estate and it averaged 9.0% of gross farm income between 1970 and 1986.

5.3.1 Cash Flow Issues

The liquidity necessary to finance investment in farm real estate is more apparent if farm assets are viewed as a portfolio of farm real estate and other non-real estate farm assets. Non real estate farm assets had P/E's between 5 and 8 at the Canadian aggregate level, or 1/6 to 1/9 the P/E of farm real estate alone (see Table 5.3). Diversification of assets to this relatively limited extent not only helped reduce price risk to the investor (see Section 5.1), it also substantially increased the returns per dollar invested, providing the cash flow necessary to meet the cash obligations of purchasing farm real estate.

	CANADA:		ALBERTA:	
YEAR	TOTAL FARM ASSETS/ $ EARNINGS[a]	VALUE OF REAL ESTATE/ $ RENT[b]	TOTAL FARM ASSETS/ $ EARNINGS[a]	VALUE OF REAL ESTATE/ $ RENT[b]
1969	6.03	37.0	7.4	42.1
1970	6.51	41.9	7.9	44.6
1971	6.05	38.1	7.6	40.4
1972	6.00	39.5	7.2	43.1
1973	5.02	44.8	6.1	32.8
1974	5.12	38.7	6.3	44.2
1975	5.44	41.4	6.7	47.8
1976	6.27	44.4	7.7	51.1
1977	6.91	47.3	9.2	58.2
1978	6.72	46.9	8.5	54.7
1979	7.44	47.9	9.9	63.1
1980	8.20	48.3	10.7	65.6
1981	7.38	51.1	9.7	67.6
1982	7.87	49.8	10.7	64.9
1983	8.09	47.3	11.2	58.6
1984	7.40	46.6	10.2	54.8
1985	6.87	45.1	9.6	55.4
1986	6.30	46.1	8.2	54.9

Table 5.3 Price to earnings (P/E) ratios for aggregate Canadian and Alberta values from 1970 to 1986. Dollar terms, nominal or real, have no differentiating impact on price earnings ratios.

a) The P/E for farm assets is calculated by dividing the value of farm assets by the value of gross farm income.

b) The P/E for farm real estate is calculated by dividing the value of farm real estate by the value of imputed rental earnings.

Despite favorable long-term nominal and real rates of return on farmland investment, severe cash-flow difficulties are caused by shifting earnings from cash (income) returns to capital gains. In aggregate, the Canadian and Alberta farm sector has responded by maintaining high levels of solvency. Although it may have been financially possible to use more debt for business advantage, this was not done.

This dilemma permeates the agricultural sector. In early years of investment, a young family aspiring to be full time owner operators are limited by cash flow to the debt which can be serviced. The time needed to turn over assets is of especial concern for entry-level farmers. While low gross incomes, high asset values or a combination of the two will extend turnover time, a farmer's only control of how efficiently capital is used lies in the ability to influence the magnitude and stability of his gross income. An entry level farmer faced with a long period of time before farm capital can be regenerated from farm gross income may perceive this as a future barrier to growth and may choose to invest capital and energies in assets which will generate more income. Ownership of farm real estate or purchase of a business unit may become an unattractive barrier to entry-level farmers disadvantaged by cash flow problems.

Established farmers are generally in a much stronger liquidity position. They are expanding or consolidating farmers who have been able to survive cash flow deficiencies and high fixed costs associated with entry by building a business which generates sufficient cash flow, through careful family consumption, efficient production and marketing of their products and outside incomes. However, since they can service high levels of debt with their cash flow and solvency positions, they may be motivated to do so to

take advantage of scale economies. Should land values drop, the consolidating farmer faces risks associated with both low liquidity reserves and a declining solvency position. The comparative advantage in farm real estate investment rests with the farmer, later in years, whose investments finally generate large cash surplus over family living costs. These farmers may, however, again be faced with liquidity problems in their retirement if they decide to refinance the family farm for the next generation. They also face an erosion of wealth if asset values fall or if they do not carefully plan the dissolving of estate with regard to capital gains tax and transfer costs. Lee et al. (1980) quote liquidation costs of 10% to 40% of the original value of assefs owned prior to liquidation.

Attempts by governmental agencies to facilitate the entry of young people into agriculture by extending assistance in forms such as inexpensive loans are often criticized because "such terms benefit only earliest buyers. Cash flow and equity advantages are soon bid into the price of land. With each relaxation of credit terms, land prices can be expected to rise more rapidly, then assume a normal pattern" (Reinsel and Reinsel, 1979, p. 1096).

Other attempts to treat the cash flow deficiencies of leveraged farmers in periods of declining annual returns and asset values may lead to government-prescribed systems of output payments or price supports. This strategy is also criticized because it would not only "fail to raise rates of return after land prices adjust but would actually intensify the cash flow problem for entry level farmers. The real problem, one of liquidity, would be worsened because cash outflow to service land land interest and principal payments would increase relative to cash outflow for new owner operators" (Tweeten, 1981, p. 23).

However at the current time, individuals within the Canadian and Alberta agricultural sectors are making adjustments to carry out viable forms of agriculture undaunted by the many barriers and aided by government programs. Investors interested in agriculture but not willing to risk a cash flow "crunch" are finding other ways to enter and stay in farming. Assistance from family plays an important role enabling many individuals to farm. To decrease the impact of cash flow restrictions, individuals are using different strategies. They may farm part time and work off the farm for wages or they may form corporations with access to both debt and equity capital. Some forms of corporations may be able to stop the losses of capital from agriculture which occurs in generation financing and life cycle management and financing of the family farm.

In the end it may be those who adapt and those who find ways of coping with or alleviating their financial problems who will continue in agriculture. It may be the pessimists who sell out their farm businesses to the optimists (Brown and Brown, 1984).

6. CONCLUSIONS

Between 1970 and 1986, Canadian and Alberta farm real estate has been exhibiting the characteristics of a growth stock. The value of farm real estate has changed at a rate different than the rate of general inflation. Land values rose quickly in the 1970's, stabilized in 1980 and 1981, and have been falling since that time. This historical pattern can be described by a cubic polynomial. Overall, the real dollar growth rate has averaged 4.7%, representing an increase of real estate values of nearly 150% between 1970 and 1986. Thus, the rate of growth in farm real estate values has not been constant over the seventeen years examined in this study.

Returns to farm estate have provided economic motives for investors to participate in the land market. Ownership of land has been profitable over the period from 1970 to 1986, earning real returns to equity that averaged 4.0%. This is in contrast to real dollar returns on equity in chartered bank's non-chequing savings accounts of 0.7%. The returns on investment in farm real estate have consisted of both current income (rent), as well as contributions to wealth in the form of capital gains.

As is typical of growth stocks, the annual returns to land have been very low. Rent, the annual return to farm real estate, averaged only 0.7% of farm real estate values, varying in a pattern similar to that of farm real estate values.

On the other hand, real capital gains returns to land have been highly volatile. These ranged from a high of 19.5% in 1974 to a low of -11.3% in

1983 in Canada and were positive for only 9 out of the 17 years. The large gains posted throughout the 1970's are being rapidly eroded by falling land prices in the 1980's.

The repercussions of volatile land prices and returns have been realized in several different types of risk. The unpredictability of prices has posed a risk to holding both a single, farm real estate asset and a representative farm asset portfolio. However, farm land investors may diversify the single asset into a more balanced investment portfolio and dilute some of the effects of extreme variations in the price of land. Uncertainty in the magnitude of income returns to farm land ownership has an impact on the financial position of the farm business. Capital efficiency and income profitability move inversely in proportion to real estate prices, while solvency is proportional. High land values restrict the liquidity of the farm business if debt capital has been used to finance current farm land purchase.

The influences of farm land prices are also likely to be seen in the structure of the agricultural sector. Barriers to entry are posed by high land prices because of increased turnover periods and cash restrictions. High values appear to favor the consolidation of land by established farmers who have the potential cash flow necessary to service debt accumulation, as well as strong solvency positions to support it. Farmers are accumulating wealth by investing in land. This represents a transformation of income into wealth. Despite the real cash flow difficulties that are experienced by farmers, if governments continue to assist farmers in the purchase of land, they should recognize that they are assisting farmers in the accumulation of wealth.

The banner cry raised by Melichar (1979) that agriculture is doomed to low rates of annual return need not be the epitaph of the farm industry. If farmers recognize that although use of their capital to purchase farm real estate guarantees a low annual return, they can control of the proportions of their investment portfolios that are committed to this asset. By varying the composition of this portfolio they can regulate the general levels of income expected. Farmers do not have to face Melichar's sentence helplessly.

This conclusion can be made notwithstanding the problems of either aggregation or data specification encountered in this study. Aggregation of national data into an agricultural balance sheet required some heroic assumptions. Data specification would have been improved if Statistics Canada series were available for the value of improvements in agriculture, the accounting adjustment used by Melichar; the value of current assets on farms in Canada; and if the data available had been more detailed for the value of agricultural rental income. In addition, returns and expenses may have been attributed to the wrong year since there is no one date during the year when a farm financial snapshot of values for all assets and liabilities is reported by Statistics Canada. Unaccountable observational error may have been introduced at any time by after the fact revisions to the data series made by Statistics Canada, by the series being initially collected for divergent purposes, or by demographic changes in the sample population over time.

To further the work presented in this thesis, a comparison of the results reported on American land values by Melichar (1979) and this Canadian study may be of interest. The two studies are designed identically and would thus provide an useful base for the comparison of forces shaping

farmland values in Canada and the U.S. as well as making possible an overview of the dynamics of the price behavior of farmland values in North America.

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APPENDIX 1

WORKSHEET TABLES AND WORKING VARIABLES

1.1 Canadian Aggregate Data.

1.2 Alberta Aggregate Data.

1.3 Working Variables: Definitions and Assumptions

APPENDIX 1.1

CANADIAN AGGREGATE DATA

TABLE A1.1 Canadian aggregate farm data and data analysis. Dollars ('000) reported in (A) nominal and (B) real dollar terms.

A) CURRENT $

YEAR[1,19]	LAND[2]	LAND & BLDG.[3]	MACHINERY & VEHICLES[4]	LIVESTOCK[5]	OTHER ASSETS[6]	TOTAL ASSETS[7]	LIABILITIES FARM DEBT[8]	OWNER EQUITY (NET WORTH)[9]	ANNUAL CHANGE IN NET WORTH[10]	NEW INVESTMENT[11]	DEPR'N[12]
1969	10218848	18626354	3926388	2955886	4546678	28854147	4393500	23860647	---	1864264	648378
1970	10242655	18738362	3922978	3139658	5047835	28848835	4310088	24538835	877388	1575558	668618
1971	10278481	18911982	3904961	3065088	5459898	29341588	4564298	24777211	238176	887948	648369
1972	11338178	18349678	4124921	3761178	6994853	32328338	4838787	27489821	2712388	1388814	687848
1973	13897191	22232843	4517817	4907388	7313888	38971938	5567026	33414913	5926342	1698111	888672
1974	18218182	29828888	5785888	5892815	8849858	48688817	8329713	40139384	6724391	2187284	842478
1975	23238883	36648889	7515892	4128888	9148782	57431874	7628888	49883184	9483888	2888618	1188888
1976	27827848	43488481	9828878	4448882	8888225	65857388	9067948	56789448	7198258	2181228	1348387
1977	32223188	48932148	10074855	4458888	8721478	73184883	10308717	62877848	6078488	288448	1881472
1978	38828882	58222721	11483843	8114973	8788841	83687178	12813387	71873811	8898988	4611874	1718827
1979	48337947	73878888	13388888	8838528	13291882	188857238	14158478	94488788	22828848	8132472	2812883
1988	61717748	81943328	15888881	9518521	13782814	138288444	15878878	114428888	28818888	4438788	2384238
1981	69784228	183221183	17431882	8888884	15418881	145739488	18117958	127621482	13288823	3888871	2828888
1982	78782888	183882888	18371381	8884388	18288125	148743782	19888848	128837858	2318387	2878282	2718848
1983	88178838	98318328	18811848	8817828	21888188	148188888	21248481	126888871	-2881381	2388878	2738414
1984	85438144	94887432	18848843	8117848	22122488	145888518	21584488	123472818	-3474488	2311188	2787318
1985	88783588	88382871	18478888	8388881	28388881	141538888	22118118	118428883	-4843488	2418884	2822488
1986	88887888	81882744	18888588	8714488	28477888	138948713	22788888	113248713	-8182848	1828888	2818884

B) CONSTANT $

YEAR[1,19]	LAND[2]	LAND & BLDG.[3]	MACHINERY & VEHICLES[4]	LIVESTOCK[5]	OTHER ASSETS[6]	TOTAL ASSETS[7]	LIABILITIES FARM DEBT[8]	OWNER EQUITY (NET WORTH)[9]	ANNUAL CHANGE IN NET WORTH[10]	NEW INVESTMENT[11]	DEPR'N[12]
1969	25231232	41852726	9692119	7298268	11226388	69269495	10848148	58421361	---	4884488	1134888
1970	24921382	48726944	9544961	7639871	12278898	70188868	10488618	59783248	1281887	[illegible]	[illegible]
1971	24882137	38238837	9888234	7111527	12882844	68877743	10588814	57487728	-2218518	[illegible]	1278278
1972	25828884	48888787	9188888	8288748	13483881	71347328	18883848	58883388	3188882	[illegible]	1388888
1973	27883821	44814834	9128883	9913818	14778832	78731188	11228313	67584878	8821488	[illegible]	1888448
1974	32788878	52188838	10281788	8158818	12318828	83837882	11744888	72182884	4888118	[illegible]	1818248
1975	38144584	58188188	12341838	8778388	15822831	84388212	12884882	81488221	9287238	[illegible]	1828282
1976	43142787	67438428	13888147	8887387	13778842	182184477	14843338	88881147	6818828	[illegible]	2828138
1977	45841881	78728411	14288288	8312874	12383888	183888854	14888748	88882184	1888888	[illegible]	2128731
1978	58484852	77418322	14871852	7883428	8883883	188284288	15783748	93588538	4488433	8787188	2128818
1979	57544481	88888882	15883888	18812833	15822821	128234884	16852848	112381887	18823318	8118888	2388818
1988	88878858	98448384	16138883	18182287	14738284	138583888	16887728	122588882	18124188	4782448	2528887
1981	88881883	98887548	16848182	8234541	14728941	138187182	17384848	121882842	-813428	3811838	2588114
1982	81883821	98818278	18888882	8381888	15888818	138884845	17312882	113582844	-8318488	2283718	2377487
1983	88888112	83848488	15728883	7838888	17888478	123888873	17787133	188142848	-7438884	1888388	2287872
1984	82728581	78818887	15188278	7347257	17834388	118888783	17382827	88483888	-8848874	1882342	2181888
1985	48844881	88187314	14287884	6478288	28381854	188288288	17873448	82222821	-7271148	1888878	2828872
1986	42228488	88788737	13838883	8488887	18827788	188778178	18827278	83847887	-8274824	1428842	1841187

TABLE A1.1 (con.)

A) CURRENT $

YEAR	Δ INVENTORY (LVSTK,CROPS)[13,14]	Δ IN LIABILITIES[15]	Δ OTHER ASSETS[16]	NET INVESTMENT[16]	NOMINAL CAPITAL GAINS[17]
1969	285616	---	---	---	---
1970	62997	83500	626703	1806231	-822643
1971	172252	-264296	461319	888856	-589886
1972	-264871	-266471	812178	795463	1516957
1973	871368	-728258	872615	1458284	4467078
1974	-78361	-972688	-939632	-717866	7442256
1975	261770	-1298872	2272778	2612827	6851253
1976	287774	-1229268	-494188	-884832	7781087
1977	218669	-1240789	-282488	-2536534	8888940
1978	289631	-1708659	-2491272	-1291848	9987818
1979	28575	-2143189	5769489	5765895	18868284
1980	-238658	-1719488	538881	872551	10346258
1981	811661	-2242082	920889	863985	12336039
1982	6331	-1697687	2736820	912670	1403698
1983	-815898	-1443646	3897569	881714	-3883895
1984	-868748	-2356087	2154385	468483	-3928669
1985	419622	-525618	2763288	2484549	-8498998
1986	974844	-589884	261881	-42847	-6139193

YEAR	CPI/FAMILY LIVING INDEX (Dec. 31) 1981=100[18]	ANNUAL % Δ IN LIVING INDEX[18]	ANNUAL Δ IN PURCHASING POWER OF NET WORTH[20]	REAL CAPITAL GAINS ON FARM ASSETS[21]	NOMINAL CAPITAL GAINS ON R. ESTATE[22]	REAL CAPITAL GAINS ON R.ESTATE[23]
1969	40.8	---	---	---	---	---
1970	41.1	0.018	-383626	-1286369	112009	-136867
1971	43.1	0.048	-1285704	-1775363	173819	-849348
1972	45.3	0.051	-1403189	613777	1437597	609969
1973	49.6	0.093	-3098871	1369086	3863284	1821941
1974	55.6	0.123	-4946469	2496796	6788043	3211732
1975	60.9	0.095	-4728361	1922892	7619714	4126995
1976	64.5	0.059	-3367863	4423485	6456891	4284879
1977	70.8	0.095	-5846587	2862353	6435640	1713388
1978	78.6	0.084	-5861381	4088536	9290581	4341273
1979	84.8	0.098	-6264978	5966277	13863887	6889514
1980	93.4	0.112	-12884286	6642851	10886728	8877024
1981	104.7	0.121	-18440288	-3103348	11277038	-1218378
1982	114.4	0.093	-12038178	-10634481	331748	-9261982
1983	118.6	0.045	-6778284	-9463389	-4238883	-8788961
1984	124.1	0.038	-4648686	-8574858	-4356883	-7531788
1985	129.5	0.044	-6198738	-11884738	-8864881	-10487187
1986	134.9	0.042	-4722216	-10881488	-8348827	-8787161

B) CONSTANT $

YEAR				
1969	786718	---	---	---
1970	153277	381538	1800338	4600138
1971	398857	-183398	886484	1982884
1972	-602938	-728831	886881	1616381
1973	1184278	-882368	2184481	2984471
1974	-126631	-817775	-2985888	-1276383
1975	428838	-1178884	3147877	[illegible]
1976	322138	-1188338	-1188387	[illegible]
1977	386897	-858418	-1237381	-2238648
1978	274027	-1184888	-3886378	-1182718
1979	24484	-1149288	8437885	8828484
1980	-248888	-1447788	-838828	1388884
1981	776148	-388814	-217888	1884884
1982	4888	-8182	1818873	1487881
1983	-514958	-464331	2148484	887813
1984	-288617	374388	1278483	688824
1985	324833	318378	1883449	2848383
1986	722648	248188	-484328	-7378

YEAR				
1969	40.8	---	---	---
1970	41.1	-3227232		-328782
1971	43.1	-4118183		-1487887
1972	45.3	1388271		1287888
1973	49.6	3917824		4488837
1974	55.6	6883882		7281884
1975	60.8	4281131		7888381
1976	64.5	7323827		7271231
1977	70.8	4237888		3288881
1978	78.6	6881144		6888811
1979	84.8	8784888		8588848
1980	93.4	8814811		11444432
1981	104.7	-2187884		147184
1982	114.4	-8788288		-8868272
1983	118.8	-8327117		-7477871
1984	124.1	-7188487		-8528838
1985	129.5	-8311888		-8328884
1986	134.8	-8287848		-7438877

TABLE A1.1 (con.)

A) CURRENT $

YEAR	NET FARM INCOME[24]	INTEREST ON DEBT[25]	GROSS FARM INCOME[26]	IMPUTED RETURN TO MANAGEMENT[27]	IMPUTED RETURN TO OPER. LABOR[28]	RETURN TO OWNER'S EQUITY[29]	RETURN TO PRODUCTION ASSETS[30]	IMPUTED FARM RENT[31]
1969	1586873	297639	4666666	232799	3128	1278863	1587782	449128
1970	1276636	270629	4439134	221667	3372	1058606	1321235	388832
1971	1438645	266663	4852622	242631	3466	1192456	1488121	444898
1972	1627557	323814	5364283	268213	3696	1364646	1677662	484364
1973	2197664	332666	7756446	387822	4128	2006614	2138288	498682
1974	3492451	472867	9110349	455517	4636	3032096	3504985	768818
1975	4043623	542198	10666466	526273	5692	3508856	4051706	885385
1976	3216532	574679	10581632	525682	6384	2664066	3368745	878927
1977	2666692	725914	10564666	528244	7428	2118936	2846844	1048316
1978	3284147	920284	12436271	621764	7888	2854683	3674787	1262866
1979	3561336	1330848	14588866	729443	8282	2813681	4164490	1624811
1980	3088836	1606841	15888786	794336	8746	2377747	3664388	1986696
1981	4561369	2422291	19741916	987096	9372	3564812	5067283	2016336
1982	3476277	2240832	19028699	951436	10082	2613756	4763787	2077211
1983	2691366	1863706	16324636	916227	10762	1764376	3628861	2099136
1984	3371632	1871917	19691191	979668	11282	2388716	4362633	2037146
1985	4320813	1636204	20866672	1038278	11668	3278182	5114306	1968903
1986	6838268	1614949	21673164	1078658	12432	4761818	6666669	1777979

B) CONSTANTS

YEAR								
1969	3718462	734911	11496616	574781	7704	3136857	3878669	1108866
1970	3103738	668466	10786214	539311	8204	2568228	3214684	972828
1971	3337691	618788	11268884	562948	8018	2766724	3388431	1030372
1972	3692841	713866	11886788	594288	8188	2998383	3783448	1828886
1973	6458728	672863	15669566	783478	8338	5887986	6338959	1883418
1974	6281387	858516	16386628	819278	8886	5463413	6363628	1348863
1975	6628611	888161	17348884	867443	9182	5782886	6663146	1453834
1976	4986321	1046814	16281688	814088	9888	4161243	5207367	1517717
1977	3782882	1028287	14982768	749638	10521	3822732	4838948	1484671
1978	4283883	1282881	16266266	812783	10186	3728844	4672826	1668823
1979	4227781	1664344	17387866	868384	9871	3349826	4933868	1816262
1980	3298533	1728172	17088321	854466	9366	2438781	4186873	2048388
1981	4856619	2313664	18866898	942786	8861	3484682	5716437	1927727
1982	3837838	1956878	16633391	831678	8822	2187338	4166488	1816744
1983	2268287	1568282	15321618	766878	8998	1476231	3833613	1766128
1984	2717828	1508974	15788816	789331	9089	1918888	3507872	1641636
1985	3336636	1417918	16911639	795582	8924	2532838	3948946	1519436
1986	4321818	1346483	16881887	788598	9216	3613184	4966668	1317888

TABLE A1.1 (con.)

A) CURRENT $

	RETURN TO FARM ASSETS:[32]					RETURN TO FARM REAL ESTATE:[33]				
YEAR	NOMINAL CAPITAL GAIN[a]	REAL CAPITAL GAIN[b]	CURRENT RETURN[c]	EXPECTED NOMINAL RETURN[d]	EXPECTED REAL RETURN[f]	NOMINAL CAPITAL GAIN[a]	REAL CAPITAL GAIN[b]	ANNUAL RETURN: IMPUTED RENT[c]	IMPUTED NOMINAL ECONOMIC RETURN[e]	IMPUTED REAL ECONOMIC RETURN[f]
1970	-0.033	-0.046	0.047	0.014	0.001	0.007	-0.008	0.024	0.031	0.016
1971	-0.020	-0.062	0.051	0.031	-0.011	0.010	-0.039	0.027	0.037	-0.012
1972	0.066	0.018	0.057	0.123	0.076	0.086	0.030	0.027	0.112	0.057
1973	0.138	0.042	0.097	0.235	0.139	0.212	0.099	0.027	0.239	0.126
1974	0.101	0.004	0.098	0.201	0.104	0.306	0.144	0.034	0.339	0.178
1975	0.143	0.021	0.087	0.229	0.128	0.263	0.142	0.031	0.293	0.173
1976	0.135	0.077	0.058	0.194	0.135	0.187	0.117	0.027	0.214	0.144
1977	0.151	0.040	0.043	0.174	0.084	0.148	0.030	0.024	0.172	0.083
1978	0.138	0.055	0.049	0.186	0.104	0.186	0.087	0.025	0.221	0.112
1979	0.192	0.081	0.050	0.242	0.131	0.234	0.113	0.028	0.260	0.139
1980	0.178	0.060	0.036	0.214	0.096	0.258	0.117	0.026	0.284	0.143
1981	0.085	-0.024	0.048	0.141	0.022	0.123	-0.013	0.022	0.145	0.009
1982	0.010	-0.073	0.033	0.042	-0.040	0.003	-0.098	0.020	0.023	-0.078
1983	-0.025	-0.083	0.024	-0.000	-0.038	-0.041	-0.085	0.020	-0.021	-0.064
1984	-0.027	-0.083	0.020	0.003	-0.020	-0.044	-0.080	0.021	-0.023	-0.059
1985	-0.045	-0.081	0.036	-0.010	-0.046	-0.078	-0.111	0.021	-0.049	-0.090
1986	-0.043	-0.077	0.046	0.003	-0.036	-0.072	-0.111	0.020	-0.052	-0.090

B) CONSTANT $

1970	-0.047	0.048[d]	-0.000	-0.008	0.024[d]		-0.001
1971	-0.068	0.048	-0.010	-0.037	0.027		-0.020
1972	0.020	0.054	0.075	0.032	0.027		0.040
1973	0.065	0.080	0.144	0.100	0.027		0.119
1974	0.076	0.088	0.168	0.102	0.034		0.171
1975	0.050	0.078	0.128	0.103	0.031		0.161
1976	0.078	0.055	0.133	0.121	0.027		0.128
1977	0.042	0.038	0.081	0.048	0.024		0.055
1978	0.068	0.048	0.100	0.095	0.025		0.102
1979	0.088	0.048	0.136	0.124	0.028		0.131
1980	0.068	0.032	0.100	0.132	0.026		0.139
1981	-0.010	0.041	0.025	0.081	0.022		0.008
1982	-0.070	0.030	-0.041	-0.082	0.020		-0.078
1983	-0.064	0.023	-0.040	-0.083	0.020		-0.078
1984	-0.058	0.020	-0.038	-0.078	0.021		-0.072
1985	-0.080	0.034	-0.046	-0.100	0.021		-0.102
1986	-0.078	0.044	-0.034	-0.100	0.020		-0.102

TABLE A1.1 (con.)

A) CURRENT $ GROWTH RATES[34]

YEAR	GROWTH IN REAL ESTATE (NOMINAL)[a] (endA/begA)-1	GROWTH IN EQUITY (NOMINAL)[b] (endE/begE)-1	GROWTH IN FARM ASSETS (NOMINAL)[c]
1970	0.087	0.037	-0.039
1971	0.010	0.010	-0.023
1972	0.085	0.109	0.077
1973	0.212	0.218	0.163
1974	0.305	0.201	0.223
1975	0.203	0.236	0.168
1976	0.157	0.146	0.157
1977	0.148	0.107	0.152
1978	0.188	0.138	0.169
1979	0.234	0.318	0.224
1980	0.258	0.212	0.286
1981	0.123	0.115	0.108
1982	0.003	0.018	0.011
1983	-0.041	-0.023	-0.028
1984	-0.044	-0.027	-0.031
1985	-0.070	-0.033	-0.053
1986	-0.072	-0.052	-0.051

B) CONSTANT $

			cmf[d]	Melichar[e]
1970	-0.006	0.022	-0.055	-0.054
1971	-0.037	-0.037	-0.069	-0.072
1972	0.032	0.056	0.024	0.021
1973	0.109	0.112	0.066	0.060
1974	0.102	0.089	0.088	0.075
1975	0.163	0.128	0.068	0.048
1976	0.121	0.081	0.080	0.068
1977	0.048	0.011	0.048	0.042
1978	0.095	0.051	0.064	0.064
1979	0.124	0.201	0.105	0.095
1980	0.122	0.038	0.078	0.068
1981	0.001	-0.005	-0.010	-0.027
1982	-0.062	-0.058	-0.060	-0.063
1983	-0.063	-0.065	-0.073	-0.073
1984	-0.079	-0.063	-0.068	-0.068
1985	-0.103	-0.073	-0.084	-0.086
1986	-0.108	-0.080	-0.090	-0.091

SOLVENCY RATIOS[35]

	1.CAPITAL RATIO[a] A/L	2.EQUITY RATIO[b] E/A
	0.39	0.643
	0.69	0.861
	0.43	0.844
	0.69	0.861
	7.01	0.867
	7.15	0.860
	7.34	0.864
	7.27	0.862
	7.18	0.859
	0.86	0.856
	7.67	0.870
	0.21	0.876
	0.04	0.876
	7.58	0.868
	0.67	0.867
	0.72	0.861
	0.48	0.844
	0.69	0.833
	0.69	0.861
	0.43	0.844
	0.69	0.861
	7.01	0.867
	7.15	0.860
	7.34	0.864
	7.27	0.862
	7.18	0.859
	0.86	0.856
	7.67	0.870
	0.21	0.876
	0.04	0.876
	7.58	0.868
	0.67	0.867
	0.72	0.861
	0.48	0.844
	0.69	0.833

EFFICIENCY RATIOS[36]

3.LEVERAGE RATIO[c] L/E	1.TURNOVER[a] A/GI	2.SCALE[b] GI/A
0.166	0.03	0.166
0.176	0.01	0.164
0.164	0.05	0.466
0.176	0.09	0.167
0.166	0.02	0.199
0.163	0.12	0.195
0.158	0.44	0.184
0.159	0.27	0.159
0.164	0.01	0.146
0.166	0.72	0.149
0.150	7.44	0.134
0.139	0.20	0.122
0.142	7.38	0.138
0.152	7.07	0.127
0.167	0.09	0.134
0.176	7.40	0.136
0.166	0.07	0.146
0.200	0.30	0.159
0.176	0.01	0.164
0.164	0.05	0.166
0.176	0.09	0.167
0.166	0.02	0.199
0.163	0.12	0.195
0.158	0.44	0.184
0.159	0.27	0.159
0.164	0.01	0.146
0.166	0.72	0.149
0.150	7.44	0.134
0.139	0.20	0.222
0.142	7.38	0.138
0.152	7.07	0.127
0.167	0.09	0.124
0.176	7.40	0.136
0.166	0.07	0.146
0.200	0.30	0.159

TABLE A1.1 (con.)

A) CURRENT $

CANADA: PROFITABILITY RATIOS:[37]

YEAR	1.PROFIT FOR BUSINESS[a] (ROA) (NFI+INT-RO1-ROM)/A	2.PROFIT FOR OWNER/OPERATOR[b] (ROE)(1) NFI/E	3.PROFIT FOR OWNER[c] (ROE)(2) (NFI-RO1-ROM)/E	4.BANK RATE:[d] INTEREST ON SAVINGS	5.PROFIT FOR LENDER[e] (ROL) INT/L
1969	0.056	0.064	0.064	0.068	0.068
1970	0.048	0.052	0.043	0.062	0.063
1971	0.050	0.056	0.048	0.048	0.058
1972	0.052	0.059	0.048	0.048	0.057
1973	0.061	0.066	0.064	0.064	0.065
1974	0.076	0.067	0.076	0.086	0.072
1975	0.071	0.062	0.071	0.070	0.069
1976	0.061	0.057	0.047	0.076	0.074
1977	0.039	0.042	0.034	0.068	0.070
1978	0.043	0.046	0.037	0.071	0.077
1979	0.038	0.038	0.038	0.101	0.094
1980	0.038	0.027	0.020	0.112	0.101
1981	0.041	0.038	0.028	0.134	0.134
1982	0.032	0.027	0.018	0.116	0.113
1983	0.024	0.021	0.014	0.088	0.088
1984	0.030	0.027	0.019	0.077	0.081
1985	0.038	0.035	0.027	0.081	0.083
1986	0.048	0.051	0.042	0.068	0.068

EARNINGS RATIOS: P/E[38]

1.FARM PROPN ASSETS/ $ EARNINGS[a]	2.VALUE OF REAL ESTATE/ $ IMPUTED RENT[b]
6.03	37.82
6.51	41.86
6.05	38.08
6.00	39.82
5.02	44.76
6.12	38.67
5.44	41.36
6.27	44.43
6.91	47.63
6.72	48.09
7.44	47.93
8.26	48.26
7.38	51.14
7.87	49.85
8.09	47.31
7.48	48.81
8.07	46.96
6.38	48.09

CANADA: WEIGHTING RATIOS:[39]

1.LAND/ TOTAL ASSETS[c]	2.REAL ESTATE/ TOTAL ASSETS[a]	3.LAND/ REAL ESTATE[b]
0.384	0.593	0.615
0.385	0.580	0.612
0.384	0.575	0.614
0.381	0.580	0.618
0.385	0.570	0.622
0.398	0.622	0.628
0.404	0.638	0.634
0.423	0.680	0.640
0.440	0.682	0.645
0.462	0.700	0.652
0.445	0.673	0.661
0.474	0.700	0.671
0.479	0.708	0.676
0.472	0.692	0.683
0.460	0.670	0.686
0.451	0.656	0.689
0.430	0.624	0.688
0.419	0.603	0.695

B) CONSTANT $

YEAR	1.PROFIT FOR BUSINESS[a] (ROA) (NFI+INT-RO1-ROM)/A	2.PROFIT FOR OWNER/OPERATOR[b] (ROE)(1) NFI/E	3.PROFIT FOR OWNER[c] (ROE)(2) (NFI-RO1-ROM)/E	4.BANK RATE:[d] INTEREST ON SAVINGS	5.PROFIT FOR LENDER[e] (ROL) INT/L
1969	0.056	0.064	0.064	0.068	0.068
1970	0.048	0.052	0.043	0.047	0.063
1971	0.050	0.056	0.048	-0.004	0.058
1972	0.052	0.059	0.048	-0.011	0.057
1973	0.061	0.066	0.064	-0.038	0.065
1974	0.076	0.067	0.076	-0.036	0.072
1975	0.071	0.062	0.071	-0.035	0.069
1976	0.061	0.057	0.047	0.018	0.074
1977	0.039	0.042	0.034	-0.035	0.070
1978	0.043	0.046	0.037	-0.013	0.077
1979	0.038	0.038	0.038	0.003	0.094
1980	0.038	0.027	0.020	0.000	0.101
1981	0.041	0.038	0.028	0.033	0.134
1982	0.032	0.027	0.018	0.022	0.113
1983	0.024	0.021	0.014	0.024	0.088
1984	0.030	0.027	0.019	0.038	0.081
1985	0.038	0.035	0.027	0.017	0.083
1986	0.048	0.051	0.042	0.018	0.068

1.FARM PROPN ASSETS/ $ EARNINGS[a]	2.VALUE OF REAL ESTATE/ $ IMPUTED RENT[b]
6.03	37.82
6.51	41.86
6.05	38.08
6.00	39.82
5.02	44.76
6.12	38.67
5.44	41.36
6.27	44.43
6.91	47.63
6.72	48.09
7.44	47.93
8.26	48.26
7.38	51.14
7.87	49.85
8.09	47.31
7.48	48.81
8.07	46.96
6.38	48.09

1.LAND/ TOTAL ASSETS[c]	2.REAL ESTATE/ TOTAL ASSETS[a]	3.LAND/ REAL ESTATE[b]
0.384	0.593	0.615
0.385	0.580	0.612
0.384	0.575	0.614
0.381	0.580	0.618
0.385	0.570	0.622
0.398	0.622	0.628
0.404	0.638	0.634
0.423	0.680	0.640
0.440	0.682	0.645
0.462	0.700	0.652
0.445	0.673	0.661
0.474	0.700	0.671
0.479	0.708	0.676
0.472	0.692	0.683
0.460	0.670	0.686
0.451	0.656	0.689
0.430	0.624	0.688
0.419	0.603	0.695

TABLE A1.1 (con.)

A) CURRENT $

YEAR	POTATOES	WHEAT	OATS	BARLEY	RYE	FLAX	RAPE	TOTAL VALUE CROP INVENTORY[14,15]
1969	59087	1117687	166075	236292	14012	39215	43480	1674868
1970	63985	865937	178106	258155	14978	69833	95617	1546611
1971	48864	789868	167324	291376	15799	67329	137093	1507653
1972	80232	750204	196071	340497	18870	60078	124686	1530634
1973	124807	997804	277222	492102	29177	93418	182724	2177254
1974	111997	1269618	321712	672797	34033	71481	171116	2652654
1975	145116	1311810	292617	617904	30807	86790	213860	2679004
1976	117697	1662947	266200	586964	25569	64587	183662	2819626
1977	102698	1647703	243237	586788	28027	76049	253688	2918288
1978	127316	1778460	228686	629610	40163	113079	564910	3484023
1979	126292	2338627	263656	679724	75833	179978	853686	4209874
1980	229752	2856532	207936	940013	54502	119644	646048	4143328
1981	215716	2674446	270587	1162271	74879	90756	389306	4867963
1982	192068	2798197	262268	1192091	60136	126088	347333	4978208
1983	285811	2653096	264901	856209	85600	77910	462136	4865663
1984	166214	1883483	247778	836072	55840	81184	523125	3593677
1985	---	---	---	---	---	---	---	5066581
1986	---	---	---	---	---	---	---	4913878

B) CONSTANT $

1969	59087	1117687	166075	236292	14012	39215	43480	4218788
1970	63985	865937	178106	258155	14978	69833	95617	3771978
1971	48864	789868	167324	291376	15799	67329	137093	3672637
1972	80232	750204	196071	340497	18870	60078	124686	3462873
1973	124807	997804	277222	492102	29177	93418	182724	4574083
1974	111997	1269618	321712	672797	34033	71481	171116	5023966
1975	145116	1311810	292617	617904	30807	86790	213860	4579494
1976	117697	1662947	266200	586964	25569	64587	183662	4482712
1977	102698	1647703	243237	586788	28027	76049	253688	4297928
1978	127316	1778460	228686	629610	40163	113079	564910	4714610
1979	126292	2338627	263656	679724	75833	179978	853686	5216449
1980	229752	2856532	207936	940013	54502	119644	646048	4860659
1981	215716	2674446	270587	1162271	74879	90756	389306	4867963
1982	192068	2798197	262268	1192091	60136	126088	347333	4492988
1983	285811	2653096	264901	856209	85600	77910	462136	3980941
1984	166214	1883483	247778	836072	55840	81184	523125	2938411
1985	---	---	---	---	---	---	---	3812418
1986	---	---	---	---	---	---	---	3642882

APPENDIX 1.2

ALBERTA AGGREGATE DATA

TABLE A1.2 Alberta Aggregate Farm Data and Data Analysis. Dollars (000) reported in nominal and real dollar terms.

A) CURRENT $

YEAR[1,19]	LAND[2]	LAND & BLDG[3]	MACHINERY & VEHICLES[4]	LIVESTOCK[5]	OTHER ASSETS[6]	TOTAL ASSETS[7]	LIABILITIES/ FARM DEBT[8]	OWNER EQUITY (NET WORTH)[9]	ANNUAL CHANGE IN NET WORTH[10]	NEW INVESTMENT[11]	DEPR'N[12]
1968	2648892	3638868	883031	885184	---	---	788871		---	---	18848
1969	2484361	3663368	873484	730882	818538	8984234	834285	8168828	282384	18878
1978	2488238	3632628	874233	783818	811668	8111444	888288	8382184	182188	231881	19237
1971	2484118	3638282	887448	883866	1858864	8281217	932898	8328818	28438	131881	28878
1972	2888614	4143681	888881	1818172	1888828	7183843	1838883	8128888	788471	188343	21782
1973	3832884	8181281	888888	1388481	1384288	8932892	1288881	7843811	1818421	214448	24488
1974	4883888	8878778	1278881	1388388	1481952	11818881	1837218	9482883	1838183	328818	31978
1975	8388348	8857888	1728888	1824338	1787358	13488374	1784482	11781972	2218388	437888	41488
1978	7883838	18827828	2118883	1128484	1711828	18874884	2828718	13844348	1842374	382588	48382
1977	8878872	12823881	2438818	1888884	1488888	17842272	2233488	15388884	1784488	58847	84178
1978	18838388	14842872	2781888	1718884	1848258	28482814	2883873	17888841	2881837	788887	83744
1978	15138338	21172488	3287248	2478357	2148188	28888278	3888788	28827487	8137848	1882488	78588
1988	18484788	27137888	3842787	2881751	2882788	38814822	3428788	32188142	8188888	1181888	888884
1981	21881888	28981188	4382218	2831888	1884237	38788478	4883427	34888848	2888887	1227811	888838
1982	21888788	28288771	4555885	2824214	3224888	48588588	4884488	38811122	1318873	831822	898184
1983	28878888	28448128	4882848	2487341	3874888	38528272	4838828	34881847	-1428478	772887	888472
1984	19311388	28453888	4488847	2488338	3888888	37288847	5882884	32193843	-2388884	877888	888882
1985	18182711	24888728	4484283	2178428	4778488	38288888	8248932	31844884	-1148888	818711	848718
1988	18837788	22877388	4888813	2278881	8738888	38388833	8388888	38848833	-888321	238884	843111

B) CONSTANT $

1968	8188881	8788418	2188778	1884873	2818124	14778887	2888788	12718122	---	822873	44838
1978	8887871	8884881	2127888	1828484	2218178	14888883	1888882	12888881	184888	883488	48888
1971	8717288	8188848	2812838	1888883	2488317	14527188	2183888	12383388	-837388	318888	47978
1972	8482881	8147888	1888871	2243288	2423888	18813781	2282811	13821178	1187758	384888	48884
1973	7337883	18487184	1883111	2788871	2788488	18848841	2884284	15441437	1828287	433238	48383
1974	8828883	12548348	2284888	2487388	2821488	18818838	2784781	17888148	1813713	888483	57514
1975	18388281	14788183	2838481	1881887	2888841	22112272	2887212	18218888	2188811	717888	87888
1978	11832812	18478788	3271488	1744888	2882758	24148838	3148858	28888888	1783828	848888	74887
1977	12878388	17738888	3442882	1887324	2188588	24847411	3182882	21883888	884873	84488	78737
1978	13887782	18838287	3848481	2238884	1378281	28788123	3482718	23388413	1781888	1828182	83328
1979	18821821	28288348	3928288	2888428	2847843	34828888	3843788	38888183	7888888	1282872	88888
1988	28881888	28888234	4114344	2732887	2228883	38131888	3871821	34488837	3478434	1288188	838848
1981	28832278	28818188	4188384	2418288	1818788	37818887	3881818	33138838	-1322888	1171838	838888
1982	18181847	28481723	3882347	2288481	2818881	38488432	3981178	31478283	-1888284	728842	883238
1983	17288848	23783848	3848838	2888878	3323844	33843788	4128288	28814421	-2883833	848882	873137
1984	15881188	21318883	3822888	2811884	3888378	38828183	4878872	25841211	-2873218	848238	832824
1985	14817837	18282187	3447388	1882178	3888488	28818888	4847882	23872838	-1888274	481321	888834
1988	12481888	18858777	3342118	1887814	4281842	28248847	3988881	22274747	-1888181	174888	478732

TABLE A1.2 (con.)

A) CURRENTS

YEAR	Δ INVENTORY (LVSTK,CROPS)[13,14]	Δ IN LIABILITIES[15]	Δ OTHER ASSETS[15]	NET INVESTMENT[16]	NOMINAL CAPITAL GAINS[17]	C.P.I./FAMILY LIVING INDEX (Dec. 31)[18]	ANNUAL % Δ LIVING INDEX[18]	ANNUAL Δ PURCHASING POWER OF NET WORTH[20]	REAL CAPITAL GAINS ON ASSETS[21]	NOMINAL CAPITAL GAIN R.ESTATE[22]	REAL CAPITAL GAIN R. ESTATE[23]
						(1981=100)					
1968	61872	---	---	---	---	40.6				-72722	-72722
1969	44745	-66634	824771	1038112	4111918	41.1	0.015	-78661	-2056604	-38833	-83107
1970	32147	24046	98682	368107	-216963	43.1	0.049	-259388	-488834	-2273	-174861
1971	16749	-123338	217878	227669	-281234	45.3	0.051	-312659	436246	813338	481633
1972	28313	-185855	-12342	44576	781895	48.5	0.093	-706678	576858	1837878	867288
1973	204188	-250526	86477	230093	1286328	55.6	0.123	-1188571	778821	1784689	834869
1974	-11788	-248137	-135833	-186240	1944391	60.9	0.095	-1116478	581668	1982118	1126211
1975	98484	-227184	334412	602277	1617031	64.6	0.059	-688661	1002868	1698848	1041428
1976	61528	-266318	-88813	38666	1882718	70.6	0.095	-1447888	781902	1685663	711209
1977	-73882	-283788	-193372	-466263	2228712	78.5	0.884	-1456843	1234784	2418881	1171188
1978	69836	-388686	-881643	-1468788	2728827	84.8	0.098	-2681714	4186885	8228518	4183784
1979	74184	-467718	786888	1388368	8748288	93.4	0.112	-3881783	2638868	8866888	2828274
1980	152174	-367881	-343133	28817	6132858	104.7	0.121	-4187782	-1437781	2823578	-881281
1981	88288	-634647	-241782	-288814	2788821	114.4	0.093	-3338274	-2998868	288812	-2883817
1982	-84888	-481841	1488288	874888	348288	118.8	0.045	-1671883	-3247184	-1818848	-3186888
1983	-211648	-384187	884387	348828	-1778381	124.1	0.038	-1211277	-3288248	-1881188	-2888581
1984	-388883	-123378	128888	-333833	-2884871	128.8	0.044	-1388888	-3887878	-1587238	-2888271
1985	-88888	-178828	887783	888821	-1737818	134.8	0.042	-1282883	-3878834	-1888338	-2843288
1986	823884	-188888	818888	828328	-1822848						

B) CONSTANTS

1968	118481					40.6					
1969	78217	88783	227843	-813426		41.1		-728888		-283483	
1970	38881	-184788	448183	882283		43.1		-1888888		-484111	
1971	88884	-128811	-124483	131782		45.3		1838883		888188	
1972	412323	-311883	82378	827834		48.5		1383234		1238184	
1973	-21888	-188877	-428832	-78318		55.6		1883831		[illegible]8788	
1974	182228	-132431	448748	[illegible]87283		60.9		1832788		2182814	
1975	128387	-248838	-218888	[illegible]32897		64.6		1881328		1787828	
1976	-184282	-18783	-388481	-888887		70.6		1183888		1281382	
1977	138242	-238187	-488487	-28838		78.5		1738881		1788287	
1978	88814	-841887	834472	[illegible]848328		84.8		8888812		8872848	
1979	182827	-27274	-478242	288714		93.4		3188721		3848888	
1980	88282	-288848	-288282	82878		104.7		-1414878		-438827	
1981	-74212	-188188	1288884	[illegible]188817		114.4		-2818381		-2184478	
1982	-178888	-148187	848817	288388		118.8		-2888217		-2888174	
1983	-282788	88313	21123	-187888		124.1		-2778884		-2488887	
1984	-78187	31828	871884	833784		128.8		-2582837		-2114848	
1985	388338	81181	482772	888218		134.8		-2388488		-2243338	
1986											

TABLE A1.2 (con.)

A) CURRENTS

YEAR	NET FARM INCOME[24]	INTEREST ON DEBT[25]	GROSS FARM INCOME[26]	IMPUTED RETURN TO MANAGEMENT[27]	IMPUTED RETURN TO OPER. LABOR[28]	RETURN TO OWNER'S EQUITY[29]	RETURN TO PRODUCTION ASSETS[30]	IMPUTED RENT[31]
1958	335154	53636	884469	44223	3848	287883	341519	89178
1959	259788	61525	883258	40163	3240	207377	268902	84732
1970	210857	58496	768938	38447	3576	177035	236538	79271
1971	222848	67614	827857	41393	3624	177831	235345	87368
1972	317717	78865	999301	49966	3972	263785	333850	96958
1973	629666	75349	1488361	73428	4368	551478	627227	158167
1974	686326	117267	1763464	87873	5088	578564	693821	167787
1975	743566	129221	2018183	100918	5088	636656	765877	187618
1976	548468	159442	2016448	100822	6936	432590	592032	208094
1977	322668	164689	1912732	95636	6544	218478	383087	215344
1978	617887	208174	2416074	120804	8978	488187	696281	273158
1979	719732	307325	2936727	146836	9936	563186	870486	336364
1980	756082	382733	3336819	166761	10208	579111	941844	413973
1981	794268	545170	3988766	199386	10532	583648	1128818	443381
1982	644768	509637	3777467	188873	11844	344333	853978	486282
1983	346118	392366	3537184	176858	12264	156996	649362	485328
1984	298281	442317	3646986	182348	12232	86211	637626	483009
1985	460311	418762	3782842	189082	13236	247473	668226	448898
1986	1243992	408489	4320294	216015	13478	1014501	1422978	416908

B) CONSTANTS

1969	619218	161914	1963378	98168	8008	512041	683956	289215
1970	532985	142324	1870878	93544	8761	430741	573084	192874
1971	517049	133443	1920782	96039	8408	412601	546044	202682
1972	781362	154869	2296742	114837	8758	582307	736976	212039
1973	1272853	152228	2966446	148322	8824	1114906	1267126	319518
1974	1203822	218884	3153712	157686	9151	1035985	1247879	283886
1975	1220962	212186	3313946	166697	9852	1045413	1267698	307886
1976	837842	247197	3126284	156313	10747	670682	917878	322827
1977	467623	233157	2709238	135462	12182	309458	542816	306020
1978	887695	272123	3158267	157913	11733	638049	910172	357871
1979	856824	365663	3496486	174824	11471	670428	1036291	399231
1980	809468	398366	3570884	178534	10921	620033	1006398	443226
1981	786613	540697	3820216	191011	10155	557446	1078145	423481
1982	476188	446467	3361882	168094	10691	300898	748477	407628
1983	289396	328665	2967496	147875	10254	131267	489393	405784
1984	233917	356428	2938731	146937	10259	78721	433141	389288
1985	347731	323361	2928218	146411	10221	191099	514459	346715
1986	922156	302784	3202696	160130	9998	782040	1054833	309058

TABLE A1.2 (con.)

A) CURRENTS

YEAR	RETURNS TO TOTAL ASSETS[32]					RETURNS TO FARM REAL ESTATE[33]				
	NOMINAL CAPITAL GAIN[a]	REAL CAPITAL GAIN[b]	CURRENT RETURN	EXPECTED RATE OF NOMINAL RETURN[c]	EXPECTED RATE OF REAL RETURN[d]	NOMINAL CAPITAL GAIN[a]	REAL CAPITAL GAIN[b]	ANNUAL RETURN TO OWNER: IMPUTED RENT[c]	IMPUTED RATE OF NOMINAL RETURN[d]	IMPUTED RATE OF REAL RETURN[e]
1970	-0.038	-0.049	0.038	0.003	-0.010	-0.009	-0.023	0.022	0.014	-0.001
1971	-0.033	-0.075	0.039	0.008	-0.037	-0.001	-0.048	0.026	0.024	-0.025
1972	0.120	0.070	0.053	0.173	0.123	0.174	0.114	0.027	0.201	0.141
1973	0.106	0.061	0.068	0.267	0.188	0.260	0.134	0.036	0.288	0.179
1974	0.216	0.087	0.078	0.295	0.165	0.345	0.188	0.030	0.377	0.211
1975	0.147	-0.048	0.069	0.216	0.118	0.284	0.182	0.029	0.311	0.168
1976	0.134	0.074	0.044	0.178	0.110	0.188	0.116	0.023	0.210	0.139
1977	0.143	0.058	0.026	0.168	0.078	0.178	0.087	0.020	0.198	0.087
1978	0.156	0.078	0.040	0.196	0.110	0.193	0.094	0.022	0.216	0.116
1979	0.329	0.286	0.042	0.372	0.247	0.417	0.278	0.022	0.438	0.308
1980	0.211	0.087	0.032	0.243	0.119	0.202	0.128	0.020	0.201	0.168
1981	0.077	-0.048	0.032	0.109	-0.009	0.106	-0.009	0.016	0.120	-0.013
1982	0.009	-0.077	0.022	0.031	-0.055	0.010	-0.004	0.018	0.026	-0.008
1983	-0.044	-0.083	0.014	-0.030	-0.069	-0.060	-0.103	0.016	-0.044	-0.087
1984	-0.052	-0.083	0.014	-0.038	-0.069	-0.070	-0.105	0.017	-0.053	-0.088
1985	-0.047	-0.083	0.018	-0.028	-0.065	-0.060	-0.101	0.017	-0.043	-0.084
1986	-0.060	-0.086	0.025	-0.011	-0.046	-0.086	-0.118	0.012	-0.083	-0.102

B) CONSTANTS

1970	-0.048	0.038[d]	-0.011	-0.023	0.022[d]		-0.001
1971	-0.074	0.037	-0.037	-0.047	0.024		-0.023
1972	0.071	0.051	0.122	0.117	0.026		0.143
1973	0.066	0.068	0.166	0.144	0.035		0.179
1974	0.094	0.089	0.183	0.198	0.027		0.226
1975	0.052	0.083	0.116	0.172	0.026		0.197
1976	0.076	0.042	0.118	0.120	0.022		0.142
1977	0.048	0.022	0.072	0.077	0.018		0.095
1978	0.078	0.037	0.106	0.101	0.020		0.121
1979	0.211	0.039	0.250	0.298	0.020		0.311
1980	0.092	0.029	0.121	0.153	0.018		0.170
1981	-0.037	0.028	-0.009	-0.015	0.016		-0.001
1982	-0.076	0.020	-0.055	-0.076	0.014		-0.061
1983	-0.083	0.013	-0.071	-0.101	0.015		-0.086
1984	-0.084	0.013	-0.071	-0.104	0.016		-0.087
1985	-0.083	0.017	-0.066	-0.099	0.016		-0.083
1986	-0.084	0.038	-0.047	-0.117	0.016		-0.101

TABLE A1.2 (con.)

A) CURRENTS

YEAR	GROWTH RATES:[34] GROWTH IN REAL ESTATE (NOMINAL) (endA/begA)-1[a]	GROWTH IN EQUITY (NOMINAL) (endE/begE)-1[b]	GROWTH IN FARM ASSETS (NOMINAL)[c]	SOLVENCY RATIOS:[35] 1. CAPITAL RATIO[a] A/L	2. EQUITY RATIO[b] E/A	3. LEVERAGE RATIO[c] L/E	EFFICIENCY RATIOS:[36] 1. TURNOVER[a] A/GI	2. SCALE[b] GI/A
1970	-0.009	0.030	-0.042	7.86	0.888	0.183	7.86	0.126
1971	-0.001	0.006	-0.030	8.71	0.881	0.175	7.66	0.132
1972	0.174	0.149	0.141	8.98	0.866	0.170	7.17	0.139
1973	0.268	0.246	0.210	8.83	0.866	0.169	8.06	0.166
1974	0.348	0.241	0.284	7.17	0.861	0.162	6.26	0.159
1975	0.204	0.234	0.171	7.83	0.869	0.151	6.67	0.150
1976	0.166	0.157	0.164	7.67	0.870	0.150	7.72	0.129
1977	0.178	0.130	0.166	7.66	0.873	0.146	9.17	0.109
1978	0.183	0.169	0.178	7.67	0.873	0.146	8.46	0.118
1979	0.417	0.466	0.377	8.60	0.895	0.118	8.90	0.101
1980	0.262	0.237	0.236	10.38	0.904	0.107	10.66	0.094
1981	0.104	0.078	0.088	8.64	0.885	0.117	8.69	0.103
1982	0.010	0.038	0.010	8.91	0.888	0.126	10.74	0.093
1983	-0.008	-0.040	-0.045	8.00	0.875	0.143	11.17	0.090
1984	-0.070	-0.069	-0.059	7.36	0.884	0.157	10.22	0.098
1985	-0.060	-0.036	-0.054	8.82	0.888	0.169	9.67	0.106
1986	-0.080	-0.092	-0.069	6.62	0.848	0.178	8.18	0.122

B) CONSTANTS

	(endA/begA)-1	(endE/begE)-1	emf	Melichar				
					7.17	0.861	0.162	7.46	0.134
1970	-0.023	0.015	-0.017	-0.007	7.86	0.886	0.183	7.96	0.126
1971	-0.047	-0.042	-0.065	-0.007	8.71	0.881	0.175	7.66	0.132
1972	0.117	0.094	0.084	0.082	8.98	0.866	0.170	7.17	0.139
1973	0.144	0.142	0.103	0.096	8.83	0.866	0.169	8.06	0.164
1974	0.199	0.165	0.116	0.162	7.17	0.861	0.162	6.26	0.159
1975	0.172	0.127	0.081	0.063	7.83	0.869	0.151	6.67	0.150
1976	0.120	0.093	0.066	0.066	7.67	0.870	0.150	7.72	0.129
1977	0.077	0.033	0.057	0.058	7.66	0.873	0.146	9.17	0.109
1978	0.101	0.076	0.060	0.061	7.67	0.873	0.146	8.46	0.118
1979	0.298	0.325	0.242	0.235	8.60	0.895	0.118	8.90	0.101
1980	0.153	0.112	0.103	0.097	10.38	0.904	0.107	10.66	0.094
1981	-0.016	-0.038	-0.041	-0.045	8.64	0.885	0.117	8.69	0.103
1982	-0.070	-0.068	-0.066	-0.068	8.91	0.888	0.126	10.74	0.093
1983	-0.101	-0.081	-0.084	-0.093	8.00	0.875	0.143	11.17	0.090
1984	-0.104	-0.103	-0.098	-0.094	7.36	0.884	0.157	10.22	0.098
1985	-0.099	-0.078	-0.098	-0.096	8.82	0.888	0.169	9.67	0.106
1986	-0.117	-0.071	-0.098	-0.099	6.62	0.848	0.178	8.18	0.122

TABLE A1.2 (con.)

A) CURRENTS

YEAR	PROFITIBILITY RATIOS:[37] 1.PROFIT FOR BUSINESS (ROA)[a] (NFI+INT-RO1-ROM)/A	2.PROFIT FOR OWNER/OPERATOR (ROE)[b] NFI/E	3.PROFIT FOR OWNER (RO1)[c] (NFI-RO1-ROM)/E	4.RETURN ON BANK SAVINGS[d]	5.PROFIT FOR LENDER (ROL)[e] INT/L	EARNING RATIOS: P/E[38] 1.FARM PROD ASSETS/ $EARNINGS[a]	2.VALUE OF REAL ESTATE/ $RENT[b]	WEIGHTING RATIOS:[39] 1.LAND/ TOTAL ASSETS[a]	2.REAL ESTATE/ TOTAL ASSETS[b]	3.LAND/ REAL ESTATE[c]
1969	0.045	0.049	0.040	0.050	0.074	7.4	42.1	0.417	0.595	0.700
1970	0.038	0.041	0.033	0.062	0.072	7.9	44.6	0.404	0.578	0.699
1971	0.038	0.042	0.033	0.045	0.062	7.8	48.4	0.394	0.564	0.698
1972	0.047	0.052	0.043	0.040	0.067	7.2	43.1	0.406	0.578	0.700
1973	0.078	0.082	0.072	0.054	0.058	6.1	32.8	0.407	0.580	0.701
1974	0.063	0.071	0.061	0.068	0.078	6.3	44.2	0.445	0.633	0.703
1975	0.057	0.064	0.054	0.070	0.073	6.7	47.8	0.466	0.665	0.704
1976	0.038	0.040	0.032	0.078	0.078	7.7	51.1	0.482	0.682	0.706
1977	0.022	0.021	0.014	0.088	0.074	9.2	58.2	0.506	0.714	0.708
1978	0.034	0.036	0.027	0.071	0.080	8.5	54.7	0.519	0.729	0.712
1979	0.030	0.028	0.022	0.101	0.100	9.9	63.1	0.520	0.728	0.715
1980	0.026	0.023	0.016	0.112	0.106	10.7	66.6	0.547	0.762	0.718
1981	0.029	0.023	0.017	0.104	0.134	9.7	67.6	0.557	0.773	0.721
1982	0.021	0.015	0.010	0.116	0.112	10.7	64.9	0.540	0.746	0.724
1983	0.014	0.010	0.005	0.089	0.078	11.2	58.6	0.523	0.720	0.727
1984	0.014	0.009	0.003	0.077	0.087	10.2	54.8	0.518	0.710	0.730
1985	0.018	0.015	0.008	0.061	0.088	9.6	55.4	0.500	0.685	0.730
1986	0.040	0.041	0.034	0.060	0.078	8.2	54.9	0.476	0.648	0.736

B) CONSTANTS

1969	0.045	0.049	0.040	0.050	0.074	7.4	42.1	0.417	0.595	0.700
1970	0.038	0.041	0.033	0.047	0.072	7.9	44.6	0.404	0.578	0.699
1971	0.038	0.042	0.033	-0.004	0.062	7.8	48.4	0.394	0.564	0.698
1972	0.047	0.052	0.043	-0.011	0.067	7.2	43.1	0.406	0.578	0.700
1973	0.078	0.082	0.072	-0.019	0.058	6.1	32.8	0.407	0.580	0.701
1974	0.063	0.071	0.061	-0.028	0.078	6.3	44.2	0.445	0.633	0.703
1975	0.057	0.064	0.054	-0.026	0.073	6.7	47.8	0.466	0.665	0.704
1976	0.038	0.040	0.032	0.010	0.078	7.7	51.1	0.482	0.682	0.706
1977	0.022	0.021	0.014	-0.035	0.074	9.2	58.2	0.506	0.714	0.709
1978	0.034	0.036	0.027	-0.013	0.080	8.5	54.7	0.519	0.729	0.712
1979	0.030	0.028	0.022	0.003	0.100	9.9	63.1	0.520	0.728	0.715
1980	0.026	0.023	0.016	0.000	0.106	10.7	66.6	0.547	0.762	0.718
1981	0.029	0.023	0.017	0.033	0.134	9.7	67.6	0.557	0.773	0.721
1982	0.021	0.015	0.010	0.022	0.112	10.7	64.9	0.540	0.746	0.724
1983	0.014	0.010	0.005	0.024	0.078	11.2	58.6	0.523	0.720	0.727
1984	0.014	0.009	0.003	0.039	0.087	10.2	54.8	0.518	0.710	0.730
1985	0.018	0.015	0.008	0.017	0.088	9.6	55.4	0.500	0.685	0.730
1986	0.040	0.041	0.034	0.018	0.078	8.2	54.9	0.476	0.648	0.736

TABLE A1.2 (con.)

CROPS

A) CURRENTS

YEAR	WHEAT	OATS	BARLEY	POTATOES	RYE	FLAX	RAPE	TOTAL CROP INVENTORY
1968	221586	43781	124283	3817	2484	8338	11318	416517
1969	226131	40306	114692	5660	3009	18010	14446	408276
1970	161776	48447	133520	7472	4083	17443	31562	403722
1971	126944	41123	104488	3631	4781	8826	45367	333842
1972	128886	50198	167656	6424	8541	7177	36457	391549
1973	264246	85919	288578	9566	11604	13351	66027	591293
1974	264417	97934	288745	12648	12824	11869	60091	747928
1975	272701	92968	292843	9575	11474	13659	76500	768920
1976	341166	83872	277634	8499	8316	7873	75244	803406
1977	264882	76902	311647	9585	8246	8138	97538	774419
1978	321983	69108	289234	9402	15048	8262	221586	936643
1979	581713	87909	311201	11198	27236	21355	270988	1231584
1980	816441	113824	505631	14015	22854	16466	230282	1617313
1981	699036	96274	591859	14944	25457	13829	140959	1580558
1982	656632	88530	554413	17240	16356	14546	146116	1491831
1983	686909	88816	385408	17747	17844	8827	176250	1387592
1984	483286	82113	371618	16298	12714	7126	206099	1088186
1985	377368	75472	376780	20727	11618	6131	209316	1077801
1986	519922	86123	351868	28020	12631	6169	217762	1218286

B) CONSTANTS

1969	543633	99526	283198	14026	7430	24716	35869	1008089
1970	392153	117878	324888	18188	9934	42448	76842	982282
1971	282213	95413	242227	8426	11023	20814	185268	774676
1972	282773	110812	348028	11974	14439	15843	80479	864347
1973	412622	173674	485208	19326	23442	26972	133388	1154631
1974	476578	176140	519328	22668	22705	20808	168077	1346194
1975	447785	152857	479545	15722	18841	22428	125818	1262594
1976	526...8	138034	438448	14727	12888	11898	116867	1246591
1977	374984	107519	441718	13698	13098	8695	138158	1096911
1978	420893	98337	378084	12298	19871	12187	289681	1223063
1979	597277	104654	378477	13321	32424	25423	322596	1468171
1980	658938	121667	541361	15805	24255	16569	246556	1624632
1981	667656	90997	565298	14273	24314	12444	134631	1609508
1982	573978	77386	484627	15070	13423	12714	126849	1304048
1983	673503	74260	330582	14839	14928	8541	146530	1160184
1984	324803	66167	299444	12328	10246	6744	166076	884903
1985	281396	58280	282494	16006	8508	3982	161633	822279
1986	385413	63101	260606	18547	9363	4573	161440	903043

APPENDIX 1.3

WORKING VARIABLES: DEFINITIONS AND ASSUMPTIONS

APPENDIX 1.3

WORKING VARIABLES: DEFINITIONS AND ASSUMPTIONS

1. Years of study. The time span 1970 through 1986 was chosen was because 1969 was the first year that series F (other assets) and series K (new investment) were reported. In addition, to minimize the influence of technical change on growth, a recent time span was chosen.

2. Land. Land only values reported in Statistics Canada data represent 61.2% of the land and buildings total in 1970. This figure rises to 68.9% by 1984. These values are imputed by Statistics Canada because the original data series is collected as an aggregate value of land and buildings. Since values for Newfoundland were not included in the Canadian figures prior to 1976, they have been subtracted from the 1976-1986 series in order to maintain consistency throughout the series. The land to buildings ratio is developed by Statistics Canada using a value per acre survey to determine the land values and census intercensal extrapolation for total land and building values.

3. Land and Buildings. Value data for this variable are found in both Statistics Canada Cat. No. 21-603E which superseded 21-202 in 1986, and the "Farm Net Income Reference Handbook" in the "Value of Farm Capital" tables. Since values from Newfoundland were not included in the Canadian series prior to 1976, they were subtracted from the 1976-1986 series in order to maintain consistency within the series. Canadian farm real estate is defined as land and buildings located on at least one acre and generating at least

$250 agricultural gross sales. The values are a December estimate of present market value based on a per acre index established for each census year.

It was decided to analyze farm real estate values in the study rather than to simply examine farm land values. This was because of specification problems for two variables which would render land a poor choice for study. Rent is expressed in the Statistics Canada data as a return to buildings and land, rather than land. In addition, the value of land is an estimate made on the basis of land and buildings. Therefore, the difficulty of distinguishing between land and buildings (farm real estate) and land alone were considered to make farm real estate a more reliable variable in the study.

4. Machinery and Vehicles. Data are found in Statistics Canada Cat. No. 21-603E and "Farm Net Income Handbook". This category includes implements, machinery, motor trucks and automobiles. This is a June 3 estimate of value. Newfoundland values are subtracted from the series for 1976-1986 in order to maintain consistency. The machinery and equipment inventories are estimates based on census data; their value is based on the current year's market value. The market value reflects what a machine of comparable age and condition would bring at an auction sale. It is, therefore, a replacement value and not an original or assessed value.

5. Livestock. December inventory values are found in Statistics Canada Cat. No.21-603E; "Value of Farm Capital" and also in the "Farm Net Income Reference Handbook". Livestock includes livestock, poultry and fur-bearing animals. Data for Newfoundland have been subtracted for the period from 1976

to 1986 in order to make the series consistent. The estimate of inventories is based on census data and intracensal surveys, while the value is calculated by Statistics Canada from the current year's average value for livestock.

6. Other Assets. These were found in the Farm Credit Corporation (FCC) Statistics series "Average Assets, Liabilities and Net Worth After Loan per Farm Unit". Other assets are comprised of farmers' current and monetary assets. This includes stocks, bonds, crop stocks, marketing board quota, supply inventories and a small percentage of intermediate and long term non-farm assets. Although FCC began lending in 1959, the published data are available for only 1970 to 1986. The data are published in the form of per farm averages. To derive an aggregate estimate for Canada, the FCC average for other assets was multiplied by the number of farms in Canada (excluding farms in Newfoundland). The number of farms is published every five years with census year. In intervening years, a linear extrapolation was used to estimate farm numbers. The number of farms in Alberta is also estimated using a linear extrapolation between census years.

7. Total Assets. The sum of land and building values, machinery values, livestock and values for other current and monetary assets for each year in current dollars.

8. Liabilities. These are comprised of Farm Debt found in Statistics Canada Cat. No. 21-603E, 21-202 and 21-202P in a table entitled "Farm Debt Outstanding as of December 31, Classified by Lender and by Province". This series is compiled by Statistics Canada from publications of the Bank of Canada, the Farm Credit Corporation, Provincial government lending agencies,

the annual reports of financial institutions operating in Canada and from Statistics Canada farm surveys. Liabilities are based on fourth quarter or fiscal year end figures (March 31 for governments) which are assumed to be representative of December 31 of the previous calendar year. The 1986 value will not be published until mid December, 1987. The value for 1986 was provisionally estimated for Canada as being $22,700,000 and for Alberta as $5,350,000 based on phone information with the Farm Income Branch of Statistics Canada in Ottawa which suggested that 1986 figures were not considerably different than 1985 figures. The provisional estimates may be found to over estimate total liabilities.

9. Owner's Equity or Net Worth. Calculated strictly on the basis of the accounting principle $A \equiv L + E$ where A is assets, L is liabilities and E is owner's equity. Owner's equity on an aggregate level is thus found by subtracting farm debt from total farm assets.

10. Annual change in Net Worth. Calculated as the difference between the equity, E, at time t minus $E_{(t-1)}$. This is the change in net worth between the beginning and ending balance sheet for the year.

11. New Investment. This is estimated from a series published by the Farm Credit Corporation (FCC) in FCC Statistics. The series "Improvements" in the table "FCA loans approved, by purpose of loan" includes the value of new buildings, breaking and leveling land, irrigation and drainage systems. To convert the aggregate FCC value into a per unit value, the value of "Improvements" was divided by the "Number of farm units" for each year of 1979 to 1986 data and by the "Number of borrowers" for data from 1970 to

1978 from the table "FCA loans approved, by type of farm enterprise". The average value of improvements thus derived was then multiplied by the number of farms in Canada (excluding Newfoundland) to arrive at a Canadian estimate. None of the National Accounts Statistics Canada series were used for investment because a comparable series for Alberta was not published. Thus calculation was therefore of: [($FCC improvements/number FCC units) * number farms Statistics Canada].

12. Depreciation. This series can be found in Statistics Canada Farm Net Income Handbook tables of "Farm Operating Expenses and Depreciation Charges". The Newfoundland figures for the years from 1976 to 1986 were excluded in order to maintain consistency in the data. The depreciation cost is designed to reflect the declining value of farm buildings and machinery used in a year. For farm buildings, the depreciation estimate is based on building values calculated as a residual from land to building ratios (described earlier under land values).

13. Change in Livestock and Crop Inventories. Found in a series entitled "Net Farm Income" published in Statistics Canada Cat. No. 21-603E and in the "Farm Net Income Handbook". The inventories include wheat, oats, barley, rye, flaxseed, rapeseed, soybeans, corn potatoes, tobacco, cattle, calves, hogs, sheep and lambs (adjusted to reflect end of year inventory levels). The physical change in inventories are priced by Statistics Canada at a weighted or annual average price.

14. Year End Crop Stocks. These are unpublished Statistics Canada values for year end crop stocks from 1970 to 1986. In Alberta, the crops include

wheat, oats, barley, rye, flax, canola, and potatoes. At the Canadian level, additional crops included are tobacco, corn and soybeans. This series was used as part of an adjustment to the "Change in Other Assets and Liabilities " series which was performed in order to avoid double counting crop inventories in the estimation of Net Investment. Crop stocks were included in two series, the FCC "Other Assets" series and the Statistics Canada series "Change in Livestock and Crop Inventories", both of which were used in the calculation of Net Investment. The adjustment is described below (A1.15).

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15. Annual Change in Other Assets and Liabilities. This series primarily represents the annual change in the values of current ("other") assets and liabilities. However, because of the double counting of crop inventories outlined above (A1.14), the annual change in value of year end crop inventories was subtracted from this series. This adjustment assumes that crop inventories can be consistently identified as a discreet series. In practice this is not the case due to the large and rapidly fluctuating nature of crop inventories during the year.

16. Net Investment. Conceptually, the net investment adjustment to net worth attempts to isolate pure price changes (capital gains) from other causes of variation in farm asset values. This adjustment must be made since, in addition to price changes, the value of farm assets may also respond to changes in inflation, annual capital improvements, depreciation, changes in capital or current inventories, and/or changes in total debt. The process of isolating pure price induced variations in farm asset values involves subtracting (or adding) the value of annual changes in each

variable listed above back out of changes calculated in annual net worth. Net investment is composed of the current year's new investment plus depreciation minus inventory changes minus changes in the outstanding current asset and liability position. This process effectively cancels each extraneous variable's contribution to variations in farm asset values, leaving capital gains the only variable influencing values. (Only Table A2.1 and Figure 4.1 are deflated by the "average" CPI).

17. Nominal Capital Gains. The calculation of nominal capital gains is described above (A1.16). In essence, they are annual changes in net worth minus annual changes in net investment expressed in current dollar terms.

18. Inflation Index. Indexing was based on the CPI, found in Statistics Canada Cat. No. 62-001. The percentage annual change is calculated from $(I_{(t+1)} - I_{(t)})/I_{(t)}$ where I is the index in the t'th year. In the calculation of real values, unless it is explicitly stated otherwise, all values were deflated by the December CPI so that all numbers are as consistent as possible with a December balance sheet date.

19. Year Values and the CPI. All values are deflated by the December Consumer Price Index (CPI) in order to be consistent with a December balance sheet date. One specification difference between the Canadian and U.S. balance sheet models is the use of a December 31 balance sheet in Canada rather than a January 1 balance sheet. A December 31 balance sheet date better coincided with Canadian farm data: a December estimate for the value of Canadian farm real estate, inventory of livestock and estimates of liabilities.

20. Annual Change in the Purchasing Power of Net Worth. Calculated by multiplying the percentage change in the CPI by the value of the Net Worth.

21. Real Capital Gain of Farm Assets. Calculated by adjusting nominal capital gains into real dollar terms. In the CMF method this is done by subtracting the real dollar value of net investment from the real dollar value of net worth. The Melichar method calculates nominal capital gains, (the nominal values of net worth minus net investment), and adds it to the annual change in the purchasing power or net worth (A1.20)

22. Nominal Capital Gains on Farm Real Estate. Calculated by subtracting the nominal value of farm real estate at the beginning of the year from its value at the end of the year.

23. Real Capital Gains on Farm Real Estate. Calculated by subtracting the constant dollar value of farm real estate at the beginning of the year from its value at the end of the year.

24. Net Farm Income. Found in the Statistics Canada series "Agricultural Economic Statistics" Cat. No. 21-603E , Net Farm Income tables for 1970-1986. This was adjusted to exclude Newfoundland data for the period from 1976 to 1986. These series are comprised of December estimates of cash receipts plus income in kind plus supplementary payments plus the value of inventory payments minus operating and depreciation charges. There are two important limitations to these series. First, net farm income is associated with the sale of agricultural products. It is not indicative of cash flow to

the sector or to the farmer since income from the sale of farm capital is considered investment income and has therefore not been included in net farm income. Other incomes such as nonfarm wages and salaries, rental or pension incomes are also not included in net farm income. Secondly, the Canadian net farm income series was initially derived as part of an interprovincial business statement. This means that intraprovincial sales and purchase transactions are not included by Statistics Canada since they essentially canceled each other out within the provincial ledger. However, by not including these intrafarm transactions, the volume of sales and purchases is not fully represented.

25. Interest on Debt. Found in the Statistics Canada series "Farm Operating Expenses and Depreciation Charges" from Cat. No. 21-603E. This is an estimation, compiled by Statistics Canada, from chartered banks, federal and provincial lending agencies, the FCC, credit unions, insurance, loan and trust companies. The Canadian values have been adjusted to exclude Newfoundland values.

26. Gross Farm Income. Found in the Statistics Canada series "Agriculture Economic Statistics" Cat. No 21-603E. Gross income is composed of cash receipts plus income in kind plus supplementary payments plus the value of inventory changes. The Canadian values have been adjusted to exclude Newfoundland.

27. Imputed Return to Management. Calculated by multiplying gross income by 5% (0.05). This multiplier for estimating renumeration for management followed a precedent for its use set by Brinkman and Clark (1985).

28. Imputed Return to Operator's Labor. Based on a monthly "Hired Labor Wage" Statistics Canada series where 1940-1976 data is found in Cat. No. 21-003b and 1977-1986 data is found in Cat. No. 21-002. The wage used is the January (pre-1976) or February (post 1977), no board, monthly wage which is then multiplied by 12 to reflect the wage earned from a full year of hired service. This is a very conservative estimation of hired farm labor renumeration; it means that the 1986 Canadian daily wage for operator's labor is $46.04.

29. Actual Return to Owner's Equity (ROE). Calculated by subtracting imputed returns to management (ROM) and imputed returns to operator's labor (ROI) from net farm income.

30. Actual Return to Production Assets (ROA). Calculated by adding interest on debt to net farm income and subtracting the value of imputed returns to management and imputed returns to operator's labor.

31. Imputed Farm Rent. Calculated by extrapolating an average gross farm rent per acre leased to a rental value for every acre farmed. Imputed farm rent represents the annual return which accrues to the owner of farm land for the use of the productive services of the land. Imputed rent estimates the returns to the landlord for use of his land whether or not it is paid by a tenant or, in essence, by the owner/operator himself.

The calculation of imputed rent is based on the series gross farm rent which is listed in "Agricultural Economic Statistics", Cat. No. 21-603E, in

the table entitled "Farm Operating Expenses and Depreciation Charges". Although the gross rent is reported as an expense, rent can be expressed as an item of income for the owner. Gross rent includes income from rental of land and buildings whether it was paid on a cash or a share basis. The calculation of imputed rent begins by converting gross farm rent into an average gross farm rent by dividing annual gross farm rent by the number of acres rented. Imputed farm rent is the product of this average gross farm rent and the total area farmed (in Canada or Alberta).

Both series, number of acres rented and number of acres farmed are found for census years in "Census Canada 1986: Agriculture", Cat. No. 96-102, in table 31 entitled "Other Selected Farm Data 1971, 1976, 1981, 1986.". Annual data for these two series was calculated using a linear extrapolation between census years. It was suggested in a phone conversation with Statistics Canada in Ottawa that the series reported in the Alberta, 1981 census for number of acres rented and total acres farmed were each underestimated by 2,000,000 acres. Since this error has not been corrected in a Statistics Canada published series, it was not considered. If there is a bias in the data, it would affect both annual and economic estimates of returns to farm real estate and the price/ earnings ratios for Alberta from 1977 to 1985.

32. Return to Farm Assets. The returns shown are the nominal dollar and real dollar rates of capital gain in aggregate values of farm assets, annual returns from owning farm assets (gross farm income) and expected rates of return when both aggregate capital gains and annual incomes are considered as an annualized income stream.

a) Rate of nominal capital gain on farm assets is calculated by dividing nominal capital gains on farm assets (the difference between net worth and net investment) by the beginning of the year value of total farm assets.

b) Rate of real capital gain on farm assets is calculated by dividing real capital gains on farm assets (the real dollar difference between net worth and net investment) by the beginning of the year value of total farm assets.

c) Rate of nominal annual return to farm assets for the owner is calculated by adding interest on debt to gross farm income and then subtracting returns for labor and management. The resulting term is then divided by the beginning of the year value of total farm assets.

d) Rate of real annual return to farm assets is calculated by adjusting nominal annual returns to farm assets by the CPI.

e) Rate of expected nominal return to farm assets is the sum of the rate of nominal capital gain in farm asset values and the rate of nominal annual return.

f) Rate of expected real return to farm assets is the sum of the rate of real capital gain in farm asset values and the rate of real annual return.

33. Return to Farm Real Estate. The returns shown are the nominal dollar and real dollar rates of capital gain in aggregate values of farm real estate, annual returns from owning farm real estate (imputed rental income) and

imputed economic rates of return when both aggregate capital gains and annual incomes are considered as an annualized income stream.

a) Rate of nominal capital gain on farm real estate is calculated by dividing nominal capital gains from farm real estate (the nominal dollar value at the end of the year minus the value at the beginning of the year) by the beginning of the year nominal value of farm real estate.

b) Rate of real capital gain on farm real estate is calculated by dividing the real capital gains from farm real estate (the real dollar value at the end of the year minus the value at the beginning of the year) by the beginning of the real dollar value of farm real estate.

c) Rate of nominal annual return to farm real estate is the nominal value rental income divided by the value of farm real estate. Both variables are found in Statistics Canada Cat. No. 21-603E.

d) Rate of real annual return to farm real estate is the value of rental income divided by the value of farm real estate expressed in real dollar terms.

e) Rate of imputed nominal return to farm real estate is the sum of the rate of nominal capital gain in farm real estate values and the rate of nominal annual return to farm real estate ownership.

f) Rate of imputed real return to farm real estate is the sum of the rate of real of capital gain in farm real estate values and the rate of real annual return.

34. Growth Rates. The three measures used to estimate growth in the farm sector were: growth in farm real estate values, growth in the value of equity in farm assets and growth in the value of farm assets. The growth rates are all calculated from aggregate, nominal and real dollar values of Canadian and Alberta data.

a) Growth in real estate values is the annual change in real estate value calculated by: [(end of year value/beginning of year value) - 1].

b) Growth in equity values is calculated by subtracting annual aggregate values of total farm liabilities from annual aggregate values of total farm assets. Growth in equity is the annual change calculated by : [(end of year value/ beginning of year value) - 1].

c) Growth in farm asset values, a measure of capital gain in farm asset values, is calculated by subtracting net investment from annual changes in owner's equity (i.e. net worth) of farm assets.

d) CMF and Melichar methods of calculating real capital gain in farm asset values differ in a minor technicality of discounting dollar values by the CPI. These two methods are discussed in Chapter 3.

35. Solvency. The ability of a business to meet its long-term financial obligations is measured using the following financial ratios:

a) Capital ratio = assets/ debt. This measures the amount of assets available to cover total debts.

b) Leverage ratio = debt/ equity. This measures the proportion of ownership controlled by the owner and lender.

c) Equity ratio = equity/ assets. The equity ratio measures the proportion of assets owned by the owner.

36. Capital efficiency. The efficiency with which capital generates annual income is measured in the following financial ratios:

a) Turnover = assets/ Gross Farm Income (GFI). This is the number of years needed to turnover the price of assets one time with income produced on the farm.

b) Scale = GFI/ assets. The amount of money earned per dollar of assets.

37. Profitability. Measures the profitability of annual income relative to investment. The following ratios measure different aspects of profitability.

a) Return on assets (ROA) = Net Farm Income (NFI)/ assets. ROA measures the net earnings of both owner and lender in relation to the total capital invested in the business.

b) Return on equity (ROE) = NFI + interest / assets. This is an earnings measurement of the return to owner/ operator.

c) An alternate form of ROE is expressed as ROA = NFI + interest - Ro_l - Ro_m / assets. The latter form measures the return to owner.

d) Bank rate: The interest on savings is the typical interest rate on non-chequing savings deposits posted in the 5 largest Canadian chartered banks. The data series are found in FCC Statistics, table of "Canadian bond yields and other interest rates". FCC compiles the

contents of this series from the Bank of Canada Review. This interest rate is complied from the "typical" rates listed by the five largest Canadian chartered banks for non-chequing savings deposits. It was used in this study as an example of a reasonable return which could have been expected from investment of equity capital in the money market. The real interest rate on savings is calculated by subtracting the rate of change in the CPI from the Chartered Bank rate.

e) Return to lender (ROL) = Interest paid on debt/ liabilities. This measures the profits made by the lenders on business loans.

38. Price to earnings (P/E) ratios for aggregate Canadian and Alberta values from 1970 to 1986. Dollar terms, nominal or real, have no differentiating impact on price earnings ratios.

a) The P/E for farm assets is calculated by dividing the value of farm assets by the value of gross farm income.

b) The P/E for farm real estate is calculated by dividing the value of farm real estate by the value of imputed rental income.

39. Weighting Ratios. The ratios reflect the percentage of total farm assets that which is composed of either farm land or farm real estate. This percentage is not influenced differentially by real or nominal dollars. The ratios are: a) calculated by dividing the value of land by the value of total farm assets; b) calculated by dividing the value of farm real estate in land and buildings by the value of total assets; and c) calculated by dividing the value of farmland by the value of farm real estate.

APPENDIX 2

CANADIAN FARM REAL ESTATE VALUES, 1926-1986

TABLE A2.1 CANADIAN FARM REAL ESTATE VALUES 1926-1988
(Thousands of Constant and Current $)

YEAR	CURRENT LAND & BLDG. VALUE	C.P.I. FAMILY LIVING INDEX (Averaged) (1981=100)	CONSTANT LAND & BLDG. VALUES
1926	4696745	18.6	25262070
1927	4696745	18.3	25676202
1928	4696745	18.3	25676202
1929	4696745	18.6	25262070
1930	4440478	18.4	24133022
1931	4053282	16.6	24417281
1932	3489400	15.1	23108609
1933	3425200	14.4	23788111
1934	3467808	14.8	23752110
1935	3449256	14.7	23464320
1936	3292258	15.0	21948387
1937	3253348	15.4	21125822
1938	3083058	15.6	19763179
1939	3106885	15.5	20044419
1940	2983228	16.1	18405130
1941	3029848	17.0	17822824
1942	3238024	17.9	18089520
1943	3454480	18.2	19005990
1944	3649477	18.3	19942497
1945	3711473	18.4	20171049
1946	3697005	18.0	20510553
1947	4214119	20.8	20260188
1948	4665128	23.7	19684078
1949	4716823	24.5	19252899
1950	5022842	25.2	19931119
1951	5512519	27.9	19758133
1952	5668467	28.5	19889358
1953	6295977	28.3	22247269
1954	6183050	28.5	21694912
1955	6567066	28.5	23042337
1956	6852657	28.9	23711616
1957	6958491	29.8	23350641
1958	7466775	30.8	24335866
1959	7842180	31.0	25297997
1960	7409195	31.4	23598908
1961	7993535	31.8	25346630
1962	8658699	32.0	27058984
1963	9571797	32.8	29361340
1964	10539983	33.2	31737940
1965	11616736	34.0	34755108
1966	13146821	35.2	37357446
1967	14826184	36.5	40625107
1968	16338228	38.0	42995337
1969	16826354	39.7	41879985
1970	16736383	41.0	40825278
1971	16911982	42.2	40075787
1972	18346579	44.2	41514885
1973	22232843	47.6	46707653
1974	29020898	52.8	54953799
1975	36640800	58.5	62633504
1976	43555388	62.9	69245415
1977	48990119	67.9	72823150
1978	56287804	73.9	80226798
1979	73150858	80.7	90645548
1980	92028372	88.9	103518879
1981	103275080	100.0	103275080
1982	109840282	110.8	99138143
1983	99408879	117.2	84815428
1984	95041908	122.8	77712104
1985	8636702	127.2	69466666
1986	82035528	132.4	61980967

a) Source: Statistics Canada, 21-603E.
b) Source: Statistics Canada, 62-001.
c) Calculated by [(current value for land and buildings)/CPI] x 100.

APPENDIX 3

CANADIAN INDEX VALUES FOR FARM ASSETS AND INCOMES, 1970-1986

TABLE A3.1 Indexed Values of Canadian Farm Sector Variables. All variables reported as fraction of 1981 value.

CANADA: 1981 INDEX = 1.00

	LAND	R.ESTATE	MACHINERY	LIVESTOCK	OTHER ASSETS	TOTAL ASSETS	LIABILITIES	NET FARM INCOME	GROSS FARM INCOME	IMPUTED RENT	YEAR END CROP STOCK
1969	0.378	0.418	0.582	0.798	0.762	0.498	0.627	0.864	0.818	0.578	0.868
1970	0.374	0.413	0.573	0.827	0.834	0.504	0.606	0.712	0.672	0.585	0.773
1971	0.381	0.398	0.544	0.770	0.868	0.489	0.612	0.788	0.697	0.535	0.719
1972	0.378	0.411	0.547	0.897	0.814	0.513	0.618	0.826	0.630	0.532	0.884
1973	0.419	0.486	0.548	1.074	1.083	0.586	0.648	1.483	0.831	0.521	0.994
1974	0.492	0.528	0.616	0.992	0.837	0.603	0.679	1.442	0.889	0.708	0.989
1975	0.572	0.610	0.741	0.734	1.028	0.677	0.743	1.624	0.928	0.764	0.984
1976	0.647	0.684	0.841	0.747	0.936	0.734	0.812	1.144	0.863	0.787	0.998
1977	0.686	0.717	0.857	0.884	0.939	0.745	0.844	0.884	0.796	0.770	0.948
1978	0.758	0.785	0.899	0.886	0.803	0.785	0.897	0.985	0.862	0.858	0.938
1979	0.883	0.882	0.955	1.138	1.074	0.926	0.974	0.970	0.921	0.942	1.028
1980	0.991	0.998	0.968	1.104	1.001	1.002	0.982	0.767	0.982	1.058	0.911
1981	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.966
1982	0.927	0.918	0.985	0.994	1.084	0.948	1.000	0.697	0.982	0.942	0.884
1983	0.885	0.842	0.945	0.818	1.188	0.888	1.027	0.617	0.813	0.916	0.801
1984	0.791	0.778	0.912	0.798	1.211	0.840	1.008	0.824	0.837	0.852	0.888
1985	0.784	0.692	0.867	0.702	1.383	0.785	0.987	0.788	0.844	0.786	0.884
1986	0.634	0.618	0.837	0.788	1.533	0.724	0.972	0.882	0.848	0.884	0.748

APPENDIX 4

POLYNOMIAL REGRESSIONS DETAILED

4.1 Polynomial Regressions

4.2 Calculation of Functional Form

4.3 Historical Farm Real Estate Values Described by a Cubic Model

POLYNOMIAL REGRESSIONS

1. LINEAR POLYNOMIAL REGRESSION.

a. Mathematical form: $y = 2777283\ x^2 + 42916148$

where: y = farm real estate values.
x = time, in years, for the period from 1970 to 1986.

b. Lotus 123 Statistical Analysis:

Constant	42916148
Std Err of Y Est	14358563
R Squared	0.53
No. of Observations	18
Degrees of Freedom	16
X Coefficient	2777283
Std Err of Coef.	652325

2. QUADRATIC POLYNOMIAL REGRESSION.

a. Mathematical form: $y = -402027\ x^2 + 9611743\ x + 24690920$

where: y = value of farm real estate.
x = time, in years, for the period from 1970 to 1986.

b. Lotus 123 Statistical Analysis:

Constant	24690920
Std Err of Y Est	10418347
R Squared	0.77
No. of Observations	18
Degrees of Freedom	15
X Coefficient	9611743
Std Err of Coef.	1805248
X^2 Coefficient	-402027
Std Err of Coef.	102476

3. CUBIC POLYNOMIAL REGRESSION.

a. Mathematical form: $y = -81790\ x^3 + 1683626\ x^2 - 4169927\ x + 41376146$

where: y = value of farm real estate.
x = time, in years, for the period from 1970 to 1986.

b. Lotus 123 Statistical Analysis:

Constant	41376146
Std Err of Y Est	4035179
R Squared	0.97
No. of Observations	18
Degrees of Freedom	14
X Coefficient	-4169927
Std Err of Coef.	1642448
X^2 Coefficient	1683626
Std Err of Coef.	228388
X^3 Coefficient	-81790
Std Err of Coef.	8820

CALCULATION OF FUNCTIONAL FORMS

ble A4.1 A working table showing the calculation of linear, quadratic and cubic lynomial regressions for farm aggregate Canadian real estate values versus time. All lues are reported in constant dollar terms and in ('000) of dollars.

Land & bld[a]	Year	Year code=x^b	$x(x)^b$	$x(x)x^b$	Cubic[c]	Quadratic[d]	Linear[e]
40725944	1970	1	1	1	38808056	33900636	45693430
39238937	1971	2	4	8	39116475	42306298	48470713
40506797	1972	3	9	27	41810664	49907906	51247996
44914834	1973	4	16	64	46399878	56705459	54025279
52195838	1974	5	25	125	52393378	62698959	56802561
60165189	1975	6	36	216	59300420	67888404	59579844
67436420	1976	7	49	343	66830283	72273795	62357127
70725411	1977	8	64	512	73892184	75855132	65134410
77415322	1978	9	81	729	80595382	78632415	67911693
86995962	1979	10	100	1000	86249176	80605643	70688975
98440394	1980	11	121	1331	90382802	81774818	73466258
98587548	1981	12	144	1728	92445519	82139938	76243541
90518276	1982	13	169	2197	92006585	81701004	79020824
83040406	1983	14	196	2744	88555258	80458016	81798106
78516867	1984	15	225	3375	81600797	78410974	84575389
68187314	1985	16	256	4096	70652458	75558878	87352672
60750737	1986	17	289	4913	55219501	71904727	90129955

a) Land and buildings. The value of farm real estate is found in Statistics Canada 21-603E. It has been converted to real dollar values in this series.

b) Year code. The independent variable in the regression analysis is time, in years. In order to simplify the coding for the regression, years with a code of 1,2,3...etc. were used to represent the year by year annual data instead of their calander year numbers. For the higher degree polynomials, time is squared and cubed (as represented in the second and third columns of year codes).

c) Cubic. By plugging the x, x^2, and x^3 (in coded form) into the functional form derived by regression analysis (reported on the previous page), the values for the cubic function can be calculated.

d) Quadratic. Calculated in exactly the same way as the cubic values (c).

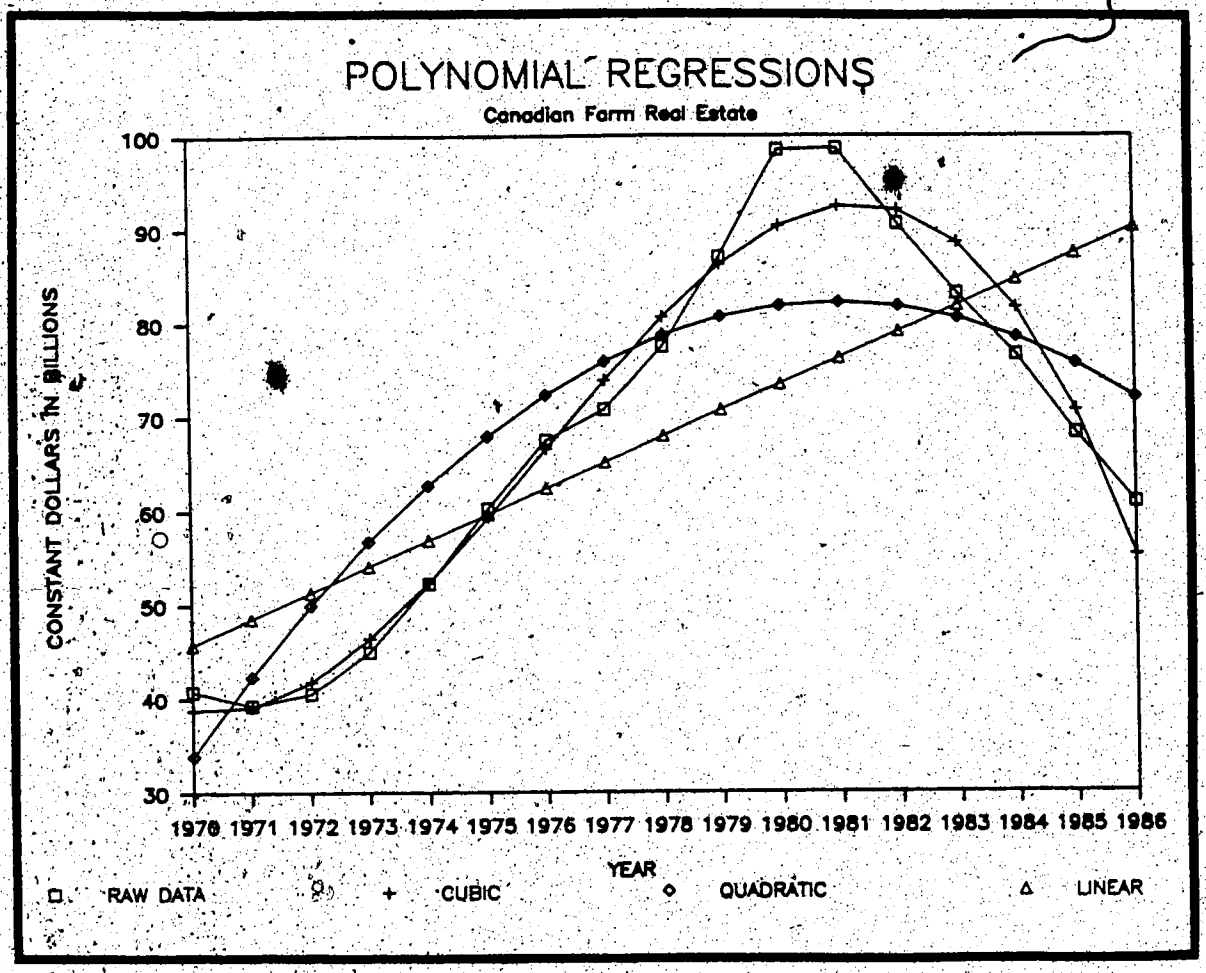
e) Linear. Calculated in exactly the same way as the cubic values (c).

4.3 HISTORICAL FARM REAL ESTATE VALUES DESCRIBED BY A CUBIC MODEL

It appears from both a statistical and visual analysis that a cubic model best describes the trend in farm real estate values between 1970 and 1986. Use of the cubic form implicitly assumes that growth in farm real estate values is quadratic in form and that the rate of growth in farm real estate values is linear and thus not constant over time. The cubic form may best describe the pattern of growth in a dynamic environment.

The time period over which growth in values of farm real estate are observed is critical to the investor's perception of value. With each additional polynomial order, the degrees of freedom in the calculation of growth decrease. When there are less than 20 observations in the regression, the conclusion is sensitive to each year's value. End values and beginning values are also likely to influence the calculated growth rates. It would therefore be unlikely that an investor would feel confident enough about the significance of the cubic form to incorporate it into his future plans. However, from the fit of each functional form shown in Figure A4.1, it is also obvious that neither a linear nor quadratic model could have so adequately describes land values in the mid and late 1980's based on the growth in farm real estate between 1969 and 1986.

The first derivative of Equation 4.1 gives the historic growth rate as estimated by the model; this can be compared to the actual growth rate. The actual growth rate shown in Figure 4.3 was calculated by taking the



Appendix Figure A4.1 Polynomial regressions of Canadian farm real estate values. Regressions performed on the real dollar farm estate values (raw data) versus time included linear, quadratic and cubic functional forms, the results of which are shown on the graph. Clearly the best fit is provided by the cubic form. Farm real estate values are expressed in constant (1981) dollar terms. The source of the real estate values is Statistics Canada Cat. No. 21-603E. These values are also listed in Table A1.1.

difference between the land value at the end of one year minus that at the end of the previous year. This calculation is conceptually identical to the first derivative of the functional form except that it gives a series of snapshots on a segment by segment basis rather than a estimate for the period.

Such comparison yields five similarities and only one appreciable difference. These include:

1)The minimum real value for farm real estate was in 1970 (the functions' slope = 0). This concluded several years of negative growth in the late 1960's.

2)The maximum real value for farm real estate was in 1981 (the functions' slope = 0). This heralded the decline in land values seen in the early 1980's.

3)Capital gains (i.e. positive growth; with the function having a slope greater than 0) were experienced during 9 years out of the period from 1972 to 1981.

4)Capital losses (i.e. negative growth; with the function having a slope less than 0) were experienced during 7 years of the study in 1970 and from 1981 to 1986.

5)Rates of growth in Canadian farm real estate values were constant and negative for 4 years during the 17 year period. This was from 1982 to 1984 and in 1986.

6)Growth was zero in 1981.

For the first nine years of the study period, the fitted growth rate Equation 4.1 is very similar to actual growth rates. However, in the last eight years (1978-1986), the growth rates described in Figure 4.3 by the actual rate and the first derivative of the cubic functional form diverge sharply. The actual growth rate series indicates that the largest rate of growth took place in 1980. It also appears that during 1980 to 1982, the greatest capital loss occurred. In contrast, the cubic functional form

suggests a rate of growth that peaked in 1976 - four years ahead of the actual situation. From 1978 to 1986 the cubic functional form "smoothes out" the highest rates of capital gains and losses actually experienced by farmers and investors.

APPENDIX 5

THE CALCULATION OF STATISTICAL MEASURES OF [redacted]

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THE CALCULATION OF STATISTICAL MEASURES OF RISK

1. Average.

a. Single asset. $x = SUM(A_1 + A_2 ... + A_n)/ n$

where: n = the number of samples.

A_n = the value of an observation.

b. Portfolio. $x_{12} = w_1 x_1 + w_2 x_2$

where: w_j = a weighting function, used as the average value of the asset in the farm portfolio. In the case of a two-asset portfolio $w_1 = 1 - w_2$

x_j = the mean of a sample population.

2. Variance.

a. Single asset. $v = SUM[(x_1 - A_1)^2 + (x_2 - A_2)^2 ... (x_n - A_n)^2] / n$

where: v = the variance of a group of observations.

Note that predicted values from a functional form may substituted into the calculation of variance in place of the mean. For risk analysis, one may wish to assume a growth model and calculate variance as:

$$v = SUM[(p_1 - A_1)^2 + (p_2 - A_2)^2 ... (p_n - A_n)^2] / n$$

where p_n = is the value predicted from the model at observation n.

b. Portfolio variance. $v_{12} = w_1^2 v_1 + w_2^2 v_2 + 2 w_1 w_2 r_{12} SD_1 SD_2$

where: r_{12} = the correlation coefficient between the two sample groups.

SD_j = the standard deviation of the sample group j; the square

root of v_j.

3. Standard deviation. The square root of the variance.

4. Coefficient of variation. For both portfolios and a single asset:

$$COV = SD / \overline{x}$$

This version of the coefficient of variation expresses the variation as net of the beginning value. In order to express the variation in terms of its gross variation, the beginning value (x_1) was included in the estimation of the coefficient of variation using the form:

$$COV = SD / (x_1 + \overline{x})$$