



Sensitivity to changes in leverage, long term interest rates and land values : a grain farm simulation  
by Darrell Martin Johnson

A thesis submitted in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE  
in Applied Economics

Montana State University

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Abstract:

This study evaluates the sensitivity of a grain farm's financial condition to financial variables. A cash flow simulation model is used. Long-term interest rates, land values, and leverage positions are the variables analyzed.

The model simulates financial changes over a ten-year period.

A total of 18 variable combinations are examined. Major year-to-year considerations include gross income, consumption, taxes, debt payments, and equipment replacement costs. Gross incomes are generated from historic yield trends and estimated future prices.

Findings indicate that changes in interest rates do not have a significant impact on the financial condition of the case farm.

A similar result occurred with land value changes at the lower of two leverage levels. At the higher leverage level changes in land values did substantially alter ending net worth.

A one percent increase in the interest rate caused short-term funds demanded to increase up to 8.89 percent. For all variable combinations, rates of return on total capital and net worth were low and showed little variation. Solvency problems occurred when higher values for the variables were used.

The minor effect of interest rate changes reveals the ability of the farm family to make adjustments in other areas to compensate for larger debt payments. This tendency is also shown with land value changes. The low returns and the large short-term fund demand shows the producer's inability to accumulate cash assets.

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AND LAND VALUES: A GRAIN FARM SIMULATION

by

DARRELL MARTIN JOHNSON

A thesis submitted in partial fulfillment  
of the requirements for the degree

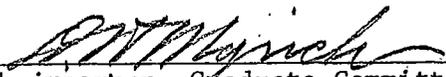
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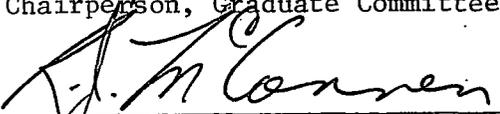
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## ABSTRACT

This study evaluates the sensitivity of a grain farm's financial condition to financial variables. A cash flow simulation model is used. Long-term interest rates, land values, and leverage positions are the variables analyzed.

The model simulates financial changes over a ten-year period. A total of 18 variable combinations are examined. Major year-to-year considerations include gross income, consumption, taxes, debt payments, and equipment replacement costs. Gross incomes are generated from historic yield trends and estimated future prices.

Findings indicate that changes in interest rates do not have a significant impact on the financial condition of the case farm. A similar result occurred with land value changes at the lower of two leverage levels. At the higher leverage level changes in land values did substantially alter ending net worth.

A one percent increase in the interest rate caused short-term funds demanded to increase up to 8.89 percent. For all variable combinations, rates of return on total capital and net worth were low and showed little variation. Solvency problems occurred when higher values for the variables were used.

The minor effect of interest rate changes reveals the ability of the farm family to make adjustments in other areas to compensate for larger debt payments. This tendency is also shown with land value changes. The low returns and the large short-term fund demand shows the producer's inability to accumulate cash assets.

## Chapter 1

### INTRODUCTION

#### THE PROBLEM

Investment decisions in agriculture, because of their long-run effects on production possibilities and capital improvements, are some of the most difficult and important decisions to be made. To evaluate alternative investments under these conditions requires accurate information on the financial history of a firm and its management as well as reasonable estimates of the prospective cash flows from each venture. It is important that proper criteria be used to analyze and evaluate the alternatives.

Traditionally, the farmer's financial position has been evaluated in terms of balance sheets and annual income statements, or some facsimile thereof, when available. Although these tools have gained wide acceptance, there are limitations to using them in evaluating firm growth alternatives. The income statement, for example, merely records revenues and expenditures over a relatively short period and then arbitrarily imputes the net returns to the fixed factors of production. This procedure may or may not reveal the actual productivity of the firm's capital, labor, and management resources. With the balance sheet, a major problem involves the realistic valuation of the firm assets.

An additional financial tool is the cash flow statement. It identifies the various sources and uses the cash in the business --

including credit transactions and family consumption -- and offers more precise information for ascertaining future cash flows from prospective operations.

In the fall of 1975 a survey of agricultural bankers was conducted in Montana in an effort to establish some background on financial statement use in the farming/ranching sector.<sup>1</sup> The results of this survey indicated that, in Montana, financial tools are not extensively used. Inconsistencies were evident in the format used for statements and in the types of information supplied. This makes early detection of cash flow problems more difficult. The survey indicated that producers, as financial managers, have a difficult time estimating changes in their year to year financial position.<sup>2</sup>

#### PURPOSE OF THIS STUDY

The ability of a particular farm firm to survive is dependent on numerous variables. These include large variances in incomes due to price and yield variations, interest rates, the farm firm's financial

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<sup>1</sup>Luft, LeRoy D. and Darrell M. Johnson, "Results of Survey of Agricultural Lenders on Financial Statements and Related Matters", Staff Paper 76-27, Agricultural Economics and Economics Department, Montana State University, 1976.

<sup>2</sup>Throughout this study producer, manager, operator and farmer are used synonymously. They all refer to the decision-maker, whether he is a paid manager, owner-operator or leasee.

position, land values, the individual producer' managerial ability and the farm's production capabilities. In Montana, dryland grain farming is highly sensitive to these variables. Consequently, their impact on the firm's success should be valuable information in the decision-making process.

There has been growing interest in recent years on the part of the non-agricultural financial community to develop a form of sensitivity analysis with which to test the impact of key variables on the ability of a business to survive. An analysis is made over an appropriately long period of time to determine the effect of operational fluctuations which are normal for that type of company and industry with respect to these variables. The analysis of past conditions is then projected into the future. The more sizable the fluctuations the less willing the lenders may be to provide financial support.

It is the purpose of this study to isolate some of the financial risks in the form of variables and to analyze their influence on the financial condition of a farm firm. In addition to the information provided by the analysis, this study will also show the effectiveness of simulation models for use in agricultural finance.

#### OBJECTIVES OF THIS STUDY

The primary objective of this study is to examine the impact of three influential variables on the financial condition of a farm firm over time. A technique of computerized sensitivity analysis is

employed as the examination tool. Used as a cash flow generator, this tool indicates the sensitivity of a farm firm to financial variables. The specific objectives are:

- 1) to develop a cash flow simulation model based on a representative farm firm patterned after existing farms in the triangle area of Montana;
- 2) to quantify the effect of price/yield fluctuations on the financial condition of this firm at various levels of land values, long-term interest rates, and leverages, using the above model; and,
- 3) to analyze the quantified results by use of a financial analysis computer program.

## Chapter 2

### HISTORICAL PERSPECTIVE

#### HISTORY OF FARM FINANCIAL MANAGEMENT

Bostwick describes financial management as the managerial process applied to financial resources.<sup>3</sup> It therefore partially overlaps the area generally conceded to farm production management. In general, production management concerns problems of resource organization for agricultural production, while financial management concerns itself with the financial means by which the acquired resources may be controlled.

These two kinds of management are separated for functional resource purposes, even though they often are not separated in practical farming situations. Research in farm financial management assumes the existence of physical resource requirements.

The financial requirements in agriculture have risen due to various economic and political forces. The resource mix, for example, has changed because of the exodus of farm labor and the introduction of capital inputs. The result has been a sharp increase in the financial needs in agriculture for both equity and borrowed funds.

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<sup>3</sup>Bostwick, Don, "Farm Financial Management Research: A Theoretical Analysis," ERS-389, Economic Research Service, USDA, November 1968, p. 1.

While the amount of farm labor in recent years has declined to less than half the 1950 level, the quantities of other inputs, notably fertilizer, have risen significantly (Figure 1). Agricultural output per man-hour has more than tripled as a result of the substitution of capital for labor during this period. Overall resource productivity has also increased. In 1973, for example, total farm output per unit of input was over 50 percent above 1950 (Figure 2).

In the ten-year period ending in 1974, the total debt outstanding in the U.S. farming sector rose from \$35 billion to \$82 billion, an overall advance of 131 percent or an average yearly increase of 8.7 percent. In recent years farm debt has grown at an even more rapid pace, rising at an annual rate of 12.8 percent in the three-year period 1972-74. At the end of 1974, real estate debt totaled \$46 billion while nonreal estate debt amounted to \$35 billion.<sup>4</sup> This increase reveals, to some extent, agriculture's past ability to acquire more capital funds. Of primary importance is agriculture's future ability to attract the necessary funds and use them effectively and efficiently.

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<sup>4</sup>Hamblin, Mary, "Bank Lending to Agriculture: An Overview," Monthly Review, November 1975, p. 17.

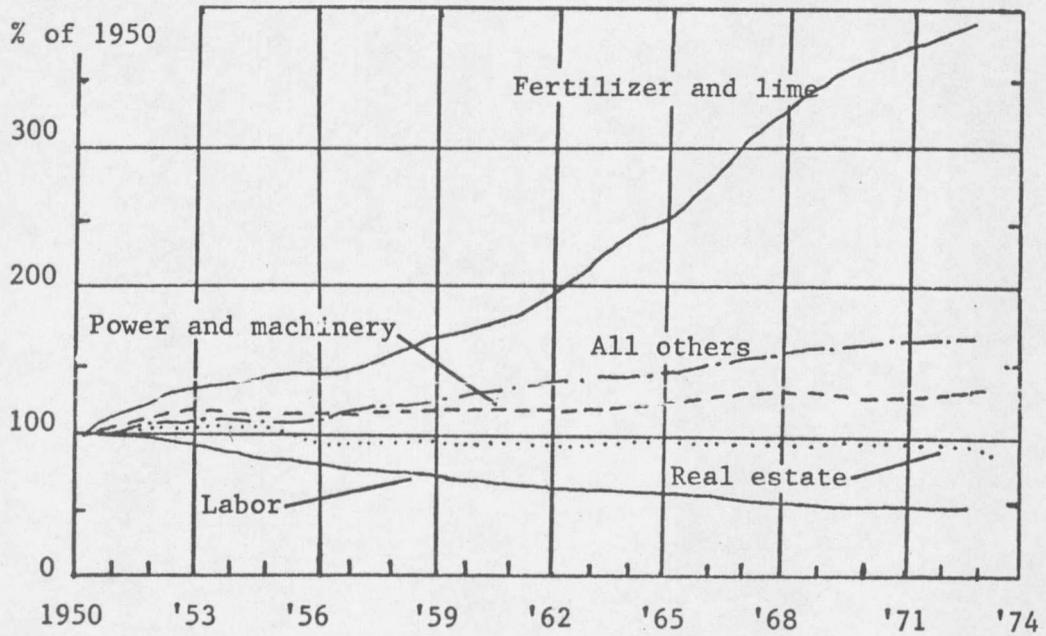


FIGURE 1: Quantities of Selected Farm Inputs, 1950-1974

Source: 1974 Handbook of Agricultural Charts, Agriculture Handbook No. 477, USDA, October 1974, p. 12.





































































































































































