Management, Capital Structure and Farm Firm Growth Revisited*

George F. Patrick**

Three levels of managerial ability, capital availability and interest rates were simulated for periods comparing the 1960's and 1970's. Managerial ability was the major determinant of firm growth, but impacts of capital availability and interest rates were greater under conditions of the 1970's than they were in the 1960's.

Research on farm firm growth has received considerable emphasis in agricultural economics since the 1960's. Developments in theoretical conceptualization, quantitative methodology and empirical application have interacted to improve and extend our knowledge of the growth process.[1/] With the emphasis the area has received, one would expect that the problems of farm firm growth have been resolved, but researchers, extension specialists, and farmers remain perplexed by the practicalities of growth.

Although considerable progress has been made in understanding the process of growth, the economic environment has recently undergone substantial change. The combination of higher land prices, building costs, machinery and equipment prices, together with higher interest rates, have increased the overall capital requirements for farming and annual capital

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* Prepared for presentation to Section XVIII of the American Agricultural Economics Association annual meeting at Pennsylvania State University, August 15-18, 1976. Appreciation is expressed to Lars Brink, John Kadlec, Earl Kehrberg, Kurt Klein and Paul Robbins for helpful comments on an earlier version.

** Assistant Professor, Department of Agricultural Economics, Purdue University.

costs. Emphasis on environmental protection has influenced some of the alternatives farmers may consider and often raised capital requirements. Compared with the 1960's, there has been a large increase in the variability of both product and input prices.[2/] The high product prices and relatively wide profit margins of the past few years have attracted many young people into agriculture and the growth process is particularly important for them.

The objective of this paper is to present some preliminary results with respect to the differences between the 1960's and 1970's in simulated growth paths followed by an Indiana agricultural firm with similar physical resources. Emphasis is given to the effect of managerial ability, capital availability and the interest rate on the firm's pattern of growth and organization. The paper is divided into four sections. First, the model used to simulate the growth process is discussed. Second, the initial position of the firm and simulations are described. Third, the results obtained are presented and discussed. The paper concludes with some implications for the growth process in the 1970's.

The Model

The basic model utilized in this study is based on the simulation model developed by Patrick and Eisgruber, which was updated and modified by Harshbarger and further modified by Brink. The current version of the model incorporates some additional modifications and updating.

The simulation model consists of a series of interrelated annual feedback loops. The firm's current resource position, farm family goals and external factors interact to specify the alternatives which will be considered. A farmer's expectations with respect to prices and yields, which are based on previous experience, are used to budget the alternatives being considered. Expected outcomes are analyzed considering the goals, expectations

and resources of a family and evaluated in relation to the family's goals. The plan offering the greatest level of satisfaction, within the constraints of the model, is selected and implemented. The outcome of the selected alternative in turn affects the firm's resource position, farm family goals and expectations with respect to future prices and yields. Although containing a provision for stochastic variations in prices and yields, the results presented in this paper consider only the deterministic mode.[3/]

The farm family was assumed to have multiple goals which include a desire for income for current consumption, to own land and accumulate net worth, for leisure and family time and a willingness to sacrifice security and accept risk in the farm operation to achieve other goals. The relative importance of these family goals change over time and an individual's "score" for a particular goal is a function of variables such as his age, net worth, size of farm and size of family.[4/] Expectations with respect to future prices and yields are a function of the prices received and yields obtained previously.[5/]

The planning process requires a farmer to specify an alternative, analyze and evaluate the expected results in relation to his goals.[6/] As indicated previously, the alternatives considered are determined by the interaction of family goals, firm resource position and external factors. For example, a farmer could have the financial resources and land might be available for purchase, but if the land ownership goal had a relatively low weight in the goal structure, land purchase would not be considered.

The first step in the planning process is the evaluation of the outcome of last year's plan. If it was at least minimally satisfactory in relation to the family's goals, the same farm organization is budgeted and its expected results in the coming year evaluated. The farmer then considers the

acquisition of additional land either by buying or on a crop share rental basis. The importance attached to the land ownership and the amount of capital and labor available will influence the decision made. If labor availability constrains expansion of crop acreage, a farmer may consider reducing or eliminating his livestock. Although not considered explicitly, the availability of machinery and equipment may influence the land acquisition decision.[7/]

Alternative crop rotations are specified in the model and the farmer selects the most satisfactory one. When considering livestock, existing facilities will be utilized before investments in new facilities are made. If the previously considered plans are highly satisfactory, the farmer will not consider an expansion of livestock facilities, but these will be replaced as required.[8/] Labor is also a factor influencing livestock decision and if a farmer is already hiring some seasonal labor to help with the crops, he may consider hiring a man on a full-time basis to expand livestock.

Expected prices and yields are used in budgeting an alternative which is evaluated in relation to a norm which a family seeks to attain for each of its goals. For the living standard goal, a desired level of family consumption which is a function of previous income and other variables is specified as the norm. The norm for the land ownership goal is defined in terms of an increase in net worth. The number of days of operator labor used is the norm for the leisure-family goal. The magnitude of loss under unfavorable price and yields relative to net worth is the norm for the risk-taking goal.

A level of satisfaction is determined for each alternative considered which reflects the degree to which the plan is expected to attain the

desired norms.[9] The typical farmer is assumed to weight the achievement of various goals as follows: living standard, 0.40; land ownership, 0.25; leisure-family, 0.10; and risk-taking credit-using behaviour, 0.25. The weighting of these goals will be altered as the conditions of the farm family change. For example, if a farmer's "score" on the living standard goal is above average, but below for the farm ownership goal, then the weight given attainment of the living standard will increase and that of farm ownership will decrease.[10]

The plan providing the highest level of overall satisfaction--that is the one which best attains the multiple goals of the family--is selected for implementation. In the implementation phase of the model, the resource requirements are computed, purchases and loans made as necessary, financial results printed out, and the variables updated for another year's decision-making.

Initial Situation and Simulations

A hypothetical Indiana farm operated by a 28-year-old high school graduate who was married and had three children was assumed for the initial situation. As a part-owner of his operation, he owned 80 acres and had rented an additional 120 acres on a fifty-fifty crop-share lease the previous year. He had produced 130 acres of corn, 30 acres of wheat, 30 acres of soybeans and 10 acres of hay/pasture. There was sufficient machinery in the form of two tractors, planting and harvesting equipment for a somewhat larger operation. He also had sufficient buildings and equipment for the 10 sows and 20 beef cows he owned. Although the physical resources were the same, the total investment was about $70,180 in the 1960's and $171,160 in the 1970's. In both periods, the operator has about 42 percent equity in the farm business, but the initial net worth was only $29,680 in the 1960's as

compared with $70,660 in the 1970's.

Farm operations were simulated for periods of 20 years with three levels of managerial ability, capital rationing and interest rates. Managerial ability, as defined in this study, considered only the technical transformation rates. Yields of crops and livestock for the average manager were approximately the state average. Yields of the "high" and "low" level managers were fifteen percent above and below the average for crops and ten percent for livestock. Crop yields and fertilizer applications were higher in the 1970's than in the 1960's. The three levels of capital availability considered were 40, 60 and 80 percent of the value of total assets. In other words, with the 80 percent limit, a farmer could consider borrowing up to 80 percent of the value of an asset and the limit could be considered as internally or externally imposed. Interest rates of 6, 9 and 12 percent annually were considered.

Prices and costs used in the simulations of the 1960's and 1970's were approximately those of the level of the middle of each period, but no specific year or sequence of years was simulated.[11/] With the exception of fertilizer application, a similar production technology was assumed for both periods. Although there was a difference in the price level between the 1960's and 1970's, inflation was not considered in the simulations of particular cases. It was assumed that 80 acres of land would be available for purchase every other year, but additional land could be rented on a fifty-fifty crop share every year. If land were purchased, the amount of rented land would be reduced by that amount.

Results

The terminal net worth, size of the farm in acres and quantity of livestock on the farms simulated are presented in Table 1. Although the absolute

TABLE 1. Terminal Net Worth[1/] of the Simulated Farms, Farm Size[2/] and Livestock[3/]

Loan Limit %	Interest Rate %	1960's Mangerial Ability Level I	1960's Mangerial Ability Level II	1960's Mangerial Ability Level III	1970's Managerial Ability Level Low	1970's Managerial Ability Level Average	1970's Managerial Ability Level High
80	12	Sold Year 6	Sold Year 7	111 i,e	Sold Year 4	Sold Year 5	258 h,a
	9	Sold Year 6	Sold Year 8	120 e,e	Sold Year 4	214 h,c	306 d,b
	6	Sold Year 6	83 j,f	183 a,k	Sold Year 4	296 d,a	336 d,a
60	12	Sold Year 5	Sold Year 6	111 i,e	Sold Year 4	Sold Year 4	247 h,a
	9	Sold Year 10	Sold Year 7	120 e,e	Sold Year 4	203 h,d	294 d,a
	6	Sold Year 6	83 j,f	146 b,f	Sold Year 7	289 d,g	329 d,a
40	12	Sold Year 19	117 c,a	164 c,a	Sold Year 4	Sold Year 4	245 h,i
	9	81 f,a	127 c,a	170 c,a	Sold Year 4	196 h,h	266 d,g
	6	93 f,a	146 c,a	171 f,a	Sold Year 5	208 h,j	273 d,b

1/ Expressed in thousands of dollars. A statement such as "Sold Year 5" means that the desired levels of consumption, debt payments, etc. could not be met and the farm was sold.

2/ The first letter following the net worth indicates farm size and is coded: a = 480 acres owned b = 320 acres owned; c = 240 acreas owned, 200 rented; d = 240 acres owned, 120 rented; e = 240 acres owned, 80 rented; f = 160 acres owned, 280 rented; g = 160 acres owned,240 rented; h = 160 acres owned, 200 rented; i = 160 acres owned, 160 rented; j = 80 acres owned, 240 rented.

3/ Livestock are indicated by the second letter following net worth and are coded: a = 10 sows, 20 beef cows; b = 11 sows, 20 beef cows; c = 11 sows, 22 beef cows; d = 13 sows, 22 beef cows; e = 10 sows, 4 feeder calves, 20 beef cows; f = 10 sows, 11 feeder calves, 20 beef cows; g = 10 sows, 150 feeder pigs, 20 beef cows; h = 13 sows, 150 feeder pigs, 22 beef cows; i = 13 sows, 300 feeder pigs, 23 beef cows; j = 15 sows, 300 feeder pigs, 38 beef cows; k = 2 sows, 49 feeder calves.

size of the net worth accumulated increased substantially from the 1960's to the 1970's, many of the general conclusions are the same in both periods.

Managerial ability of the farm operator was the major factor, among those considered in this study, determining the rate of growth of the farm firm. The below average manager was able to maintain a satisfactory level of family consumption expenditures and make the debt payments required to acquire land in only two of the circumstances simulated for the 1960's and none for the 1970's. In contrast, the operator with a high level of managerial ability experienced fairly substantial growth in all circumstances. In general, high interest rates, especially with the high debt limits, caused the average manager to experience financial difficulties.

Increases in the interest rate tended to reduce the amount of net worth accumulated in both periods considered. During the 1960's, the largest effect came from a change from 6 to 9 percent interest while in the 1970's, the change from 9 to 12 percent had a larger impact. In simulations of both periods higher interest rates tended to result in a smaller number of acres being owned by farmers although total crop acres and livestock operations were not greatly affected. Payment of higher interest rates reduced the amount of income available for reinvestment and slowed expansion of land resources. In addition to restricting the rate of net worth accumulation, higher interest rates also reduced the level of family consumption expenditures. Both of these effects would make the farm unit more vulnerable to unfavorable prices or yields.

Changes in the loan limit or self-imposed limit of capital availability did not have a consistent effect on the net worth accumulation. During the 1960's, some of the high level managers with low loan limits actually had as much land and greater accumulations of net worth than those with higher

loan limits. By being forced to delay acquisition of land until having a larger down payment, the farmers with low loan limits saved on interest payments. If the simulation model had considered inflation of land values such as has occurred since the 1960's, the pattern of net worth accumulation would have been quite different. The net worth of all farmers would have increased substantially, but the net worth of the farmers acquiring land during the first years of the simulations would have increased relatively more. Higher loan limits also generally led to farmers selling out sooner.

For above average managers in the 1970's, higher loan limits did lead to greater net worth accumulations at given interest rates. The effect of increasing the loan limit from 40 to 60 percent was greater than from 60 to 80 percent. Effects of higher loan limits on number of owned acres and net worth were greatly reduced by higher interest rates. Farmers acquired less land because a larger part of the farm receipts went to interest payments, but family consumption tended to be higher and more stable with the higher interest rates. This was because with the higher interest rates the "surplus" for reinvestment was reduced and farmers did not extend themselves as far with respect to debts and loan repayments as when interest rates were lower. The effects of changes in both the loan limits and interest rates were accentuated for the average manager in the 1970's.

In general, the livestock operation of the farms simulated did not change greatly as loan limits and interest rates changed. During the 1970's, there was a tendency for the farmers with low loan limits to expand livestock slightly. The failure of the livestock operation to exhibit greater changes is due largely to the secondary role it was given in the model.[12/]

Implications

The results obtained from the simulations indicate that managerial ability continues to be the major determinant of farm firm growth in the 1970's as it was in the 1960's. In fact, the relative difference in the net worth accumulated in similar conditions by farmers of differing managerial ability has increased from the 1960's to the 1970's. The relative effects of loan limits and interest rates on net worth accumulation also seem to have increased.

The effects of these variables are not limited to the direct effects on net worth accumulation. Family consumption levels and overall satisfaction are affected by them. Although simulated nominal levels of consumption were commonly about 50 percent higher in the 1970's than in the 1960's, the overall levels of satisfaction were nearly equal for farmers in similar situations.

The managerial ability of a farmer is presumed constant in the model. In the real world, possibilities do exist for a farmer to improve his managerial ability. The simulation results suggest that the return to an improvement in managerial ability would be very high.

Substantial differences can and did exist in terms of the type and quantity of resources controlled by the farm situations with similar net worth accumulations. In an inflationary situation, the performance and security of various resource bundles can differ greatly. Recognition of these possible differences may lead farmers to modify their decision rules and behaviour. Effects of factors such as inflation, risk and uncertainty need to be analyzed in greater depth.

Footnotes

1/ For an extensive review and bibliography see Renborg and Western Regional Research Project W-104.

2/ Indiana's corn price ranged from $.80 to $3.42 per bushel since 1970. Anhydrous ammonia ranged from $75 to $140 per ton from 1958 to 1970 and from $75 to $265 since then.

3/ Even in the deterministic mode, prices of beef cattle and hogs cycle.

4/ For a further discussion of these functions see Patrick and Eisgruber.

5/ The previous year was weighted as 0.7; two years ago, 0.2; and three years ago, 0.1 in formulation of short-run expectation. The best and worst years are also considered when evaluating a plan.

6/ For a schematic diagram of the planning process see Irwin.

7/ As currently formulated, the farmer has very limited possibilities of increasing the size of equipment being used if labor is a barrier to further expansion.

8/ As presently formulated, the model does not consider investment in the highly capital intensive, confinement livestock facilities.

9/ These procedures are described in Patrick and Eisgruber.

10/ For example, if a family has a consumption goal of $10,000 and an alternative is expected to provide $14,000 for consumption is satisfactory and rated as three. A plan providing $9000 to $10,000 is less than satisfactory and rated as a two. If an alternative provides less than $9000 for consumption, it is not satisfactory and rated as one. Similar procedures are followed for the other goals. The overall level of satisfaction of an alternative is found by multiplying its rating for each goal by the weight of that goal. The sum of these values is the overall level of satisfaction.

11/ For example, corn changed from $1.08 per bushel in the 1960's to $2.25 in the 1970's. Soybeans increased from $2.24 to $5.50 per bushel, pork from $16.00 per hundred weight to $36.00 and beef from $22.35 to $43.00 per hundred weight. The price of class one land increased from $600 to $1400 per acre and nitrogen fertilizer went from $.09 to $.14 per pound. The acquisition cost of a tractor went from $5,325 to $14,000.

12/ It should also be noted that the scale of several of the livestock operations is small by standards of the 1970's. As indicated previously, new livestock technology was not incorporated in the model and livestock in general was given a secondary role. In the real world, farmers would have probably dropped or substantially expanded their livestock operations.

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