# FARM GROWTH AND ESTATE TRANSFER IN AN UNCERTAIN ENVIRONMENT

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Farm firm growth has been an important topic for research and discussion since the 1950s. Incentives for farm growth have been and continue to be substantial. An agricultural economy characterized by technological improvement, decreasing costs, competition, and an inelastic demand for farm products leaves little alternative but growth for a commercial farm. Farm growth is stimulated by the need to achieve size economies that arises partly from new technology and partly from large investments in machinery and equipment. Growth is encouraged by the improving managerial ability of the operator as he matures and gains experience. Increased family living needs and the desire to overcome the adverse effects of inflation on purchasing power spur interest in improving the farm's earning potential. In addition, the operator's goals may include size aspirations to satisfy the desire for a large operation or to support the family of a son or daughter attempting to become established in farming. Because the pressures for growth, both internal and external to the firm, are long-run phenomena in agriculture, continued study and evaluation of the process of entry, firm growth, and exit coordination are essential.

Yield and price variability often contribute to wide fluctuations in net farm income. Although production technology and management practices may reduce yield variability over time, the basic factors causing yield variability—weather and pests—remain largely outside of the control of the farm operator. Producers of most agricultural commodities are price takers. Thus, variations in worldwide weather patterns, economic conditions, trade flows, and exchange rates increase price variability at the farm level. Domestic actions of federal and state agencies affect costs and prices through policies and programs on commodities, energy, the environment, trade, money supply, credit, labor and taxes. However, future institutional changes remain largely unknown and unpredictable.

All of these uncertainties, and others, face the farmer who is contemplating major capital investments leading to growth or estate management decisions designed to modify the organization or ownership of the firm's assets. Additional uncertainties arise from the status of family members' health and longevity. An untimely death may create havoc in the firm growth and estate transfer decision process.

One of the frequently overlooked aspects of the entry-growth-exit process is the relationship between the desire of a father to reduce debt and consolidate his operation and that of his son to expand to a size sufficient to support an additional family. Father-son relationships have assumed greater importance because of the myriad of problems now confronting farmers.

One of the most critical problems in beginning and expanding a farm operation is the tremendous amount of capital required. Values of assets and liabilities in the farm sector for selected years from 1940 to 1979 are shown in Table 1 [47, 48]. Value of farm real estate assets increased by 174 percent to $573.1 billion from 1969 to January 1, 1979. Most of this increase was due to increases in the price per acre of land. In deflated dollars (1967 equals 100 percent), the value of farm real estate increased only $8.1 billion, about 3 percent, from 1967 to 1979. Increases in land values tend to be reflected as increases in the net worth of established farm operators. However, increasing land values also increase the land capital required for successful entry into farming. Family financial interrelationships are often used as a partial solution to this problem.

Table 2 shows the balance sheet data on an average per farm basis. Average value of assets per farm exceeded $264,000 in 1978. The value of farm real estate represents about three-fourths of this figure. The average per farm figures are somewhat misleading because numerous small farms are included in these data. In many parts of the country, more than a half-million dollars in value of farm assets is required for a successful economic unit. A recent Oklahoma study indicated that capital required for a $7,000 return to labor and management ranged from $200,000 to 800,000 in different regions of the state. Average farm real estate value per acre in Oklahoma has increased by about one-third (from $302 to $402 per acre) since the study was completed [50].

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Journal Article No. J-3595 of the Oklahoma Agricultural Experiment Station.

Studying the firm growth process requires more than an economic analysis of the expected profitability of adding resources to a going concern. The questions are complex and interrelated. They involve multiple goals, variability in yields and prices, uncertainty with respect to legal and institutional constraints, financial feasibility, implications of alternative forms of business organization, estate planning and management decisions, and the interactions of the these factors with income, gift, and estate tax management decisions.

The overall purpose of this article is to develop and present analyses from firm growth and estate planning models which address the complex firm growth and estate planning issues currently facing farm operators. Specific objectives are (1) to evaluate the likelihood of success for specified firm growth and estate transfer plans for father and son under conditions of risk and uncertainty and selected future economic patterns and (2) to determine the differences in transfer costs, net value of property transferred, and liquidity positions of a father and son under alternative growth and transfer scenarios. The emphasis in the analysis is on the financial viability of father and son farm businesses. Future increases in land values and capital requirements are expected to increase the importance of father and son coordination

TABLE 1. BALANCE SHEET OF THE FARMING SECTOR, JANUARY 1, SELECTED YEARS, 1940-79

| Item | 1940 | 1950 | 1960 | 1970 | 1975 | 1979[a] |
|---|---|---|---|---|---|---|
| | | | -Million dollars- | | | |
| ASSETS | | | | | | |
| Physical assets: | | | | | | |
| Real estate | 33,636 | 77,600 | 137,161 | 215,783 | 368,455 | 573,100 |
| Nonreal estate | 15,072 | 41,092 | 54,947 | 76,281 | 119,147 | 163,400 |
| Financial assets | 4,317 | 15,852 | 18,073 | 22,832 | 31,443 | 37,800 |
| Total | 53,025 | 134,544 | 210,181 | 314,896 | 519,045 | 774,300 |
| Claims | | | | | | |
| Liabilities: | | | | | | |
| Real estate debt | 6,586 | 5,579 | 12,082 | 29,183 | 46,288 | 72,200 |
| Nonreal estate debt | 3,449 | 6,875 | 12,693 | 23,844 | 35,545 | 58,200 |
| Total liabilities | 10,035 | 112,454 | 24,775 | 53,027 | 81,833 | 135,900 |
| Proprietors' equity | 42,990 | 122,090 | 185,406 | 261,869 | 435,673 | 638,400 |
| Total | 53,025 | 134,544 | 210,181 | 314,896 | 519,045 | 774,300 |
| Debt to asset ratio | 18.9 | 9.3 | 11.8 | 16.8 | 15.8 | 17.6 |

[a]Preliminary estimate

Source: [45]

TABLE 2. BALANCE SHEET OF THE FARMING SECTOR: AVERAGE PER FARM, JANUARY 1, SELECTED YEARS, 1940-78

| Item | 1940 | 1950 | 1960 | 1970 | 1978 |
|---|---|---|---|---|---|
| ASSETS | | | | | |
| Physical assets | | | | | |
| Real estate | 5,297 | 13,324 | 34,610 | 73,172 | 196,202 |
| Nonreal estate | 2,373 | 7,305 | 13,865 | 25,866 | 54,580 |
| Financial assets | 680 | 2,807 | 4,561 | 7,742 | 13,509 |
| Total | 8,350 | 23,436 | 53,036 | 106,780 | 264,291 |
| Claims | | | | | |
| Liabilities | | | | | |
| Real estate debt | 1,037 | 988 | 3,049 | 9,896 | 23,620 |
| Nonreal estate debt | 543 | 1,217 | 3,203 | 8,085 | 20,696 |
| Total liabilities | 1,580 | 2,205 | 6,252 | 17,981 | 44,316 |
| Proprietors' equity | 6,770 | 21,231 | 46,784 | 88,799 | 219,975 |
| Total | 8,350 | 23,436 | 53,036 | 106,780 | 264,291 |
| Debt to asset ratio | 18.9 | 9.3 | 11.8 | 16.8 | 16.8 |

Source: [46]

as a means by which the son can acquire a viable economic unit and the father can achieve a satisfactory estate management plan.

## PREVIOUS RESEARCH

Research and writings on the growth process are so numerous that no attempt is made here to treat them exhaustively. Several excellent firm growth review articles and publications with extensive reference lists are available [4, 12, 22, 28].

Many studies have examined production, financial and investment strategies required to achieve various rates of change in size or net worth of the agricultural firm [1, 2, 3, 5, 6, 11, 15, 16, 17, 26, 27, 32, 36, 38, 49]. More recently the emphasis has broadened somewhat to include problems of growth under risk and uncertainty and inflation [7, 8, 13, 14, 19, 21, 25, 29, 33, 35, 41, 42]. Boehlje describes the firm growth process as consisting of entry, growth, and exit phases [9]. Despite the continuity of the process, little research has concentrated on more than one phase. The problem of entry into agriculture has received little attention. The few studies concerned with entry have explored capital requirements for specified levels of return to labor and management [34, 50]. Research on the exit phase has focused on retirement income and disinvestment strategies [20, 30, 37, 44, 45] or estate planning and transfer strategies [25, 31, 39]. The study by Boehlje and Eisgruber is one of the few to link strategies for both firm growth and successful transfer of the farm estate to the next generation. Strategies were judged successful if they resulted in large present value of net worth transferred to the heir. Plans leading to rapid increases in net worth also resulted in successful transfers to the heir [10]. The Boehlje-Eisgruber research was completed prior to the Tax Reform Act of 1976 which substantially modified federal estate and gift tax regulations for the first time since the 1940s. In addition, it failed to consider the effects of price and yield variability on the probability of success of a given growth and transfer plan.

Roush has evaluated the implications for estate planning of the Tax Reform Act of 1976 [39, 40]. Dobbins performed a multiple goal analysis of the intergeneration transfer of the farm firm and incorporated the effects of the Tax Reform Act of 1976 [18]. Their research did not investigate the effects of price and yield variability or alternative rates of increase in land values or prices paid and received by farm operators on the success of farms under alternative estate management strategies.

## THE MODELS

The models used in this study were developed, in part, because of a need for on-line tools to assist individual farmers in evaluating investments, planning firm growth, and evaluating estate planning and transfer strategies. The models were also intended for use in research on the impacts of key economic variables, the effects of alternative growth strategies, and the effects of alternative gift and estate planning strategies on the economic growth of the firm. The two simulation models were developed separately [22, 38]. Figure 1 shows the components of each model and illustrates how they are coordinated for use in the analysis presented here.

The growth-investment model simulates operation of the firm through a specified planning horizon under trended and stochastic prices and yields. Triangular distributions of prices and yields are used in the study. The model is designed to answer questions such as: (1) Would the investment be desirable? That is, is the gain in net present value positive? (2) Is the growth-investment plan financially feasible, given the farmer's consumption needs, initial financial position, and potential income distributions over the planning horizon? As indicated in Figure 1, two types of results are generated: (1) cash flow data used in present value and feasibility analyses and (2) balance sheet information needed to determine whether equity is sufficient to maintain the financial feasibility of the investment and growth plan throughout the planning horizon.

The growth-investment strategy to be simulated is specified as input data for the model. Similarly, alternative future economic trends are specified, e. g., for inflation, land appreciation, product prices, and input prices. Experiments can be conducted with alternative beginning financial positions, levels of credit availability, and gift strategies. No attempt is made to incorporate control theory approaches or optimize procedures to allow adaptation of growth strategies or to find the optimum strategy for a given situation and set of objectives [43, 51]. Optimizing procedures are planned in further development of the model to permit an internal choice of the timing of land purchases and other investments similar to that achieved in multiperiod and multiobjective programming models.

The estate planning model also simulates a farm operation over a specified planning horizon. The model is capable of considering business organization alternatives (proprietorship, partnership, and corporation), variations in financial positions, property ownership alternatives, will decisions, transfers by gift and sale, and timing of death events. Different scenarios

are easily evaluated with the model, but there is no decision process internal to the model. The model maintains a record of each asset owned in accordance with resource contributions, and maintains annual income and balance sheet information. At the death of a parent, estate tax liabilities are estimated under the provisions of the Tax Reform Act of 1976. The net worth of the parents and farm and nonfarm heirs is reported before and after the transfer of the farm estate. Estate transfer costs, the new value of the estate transferred to the heirs, and measures of liquidity also are reported as output of the estate planning model.

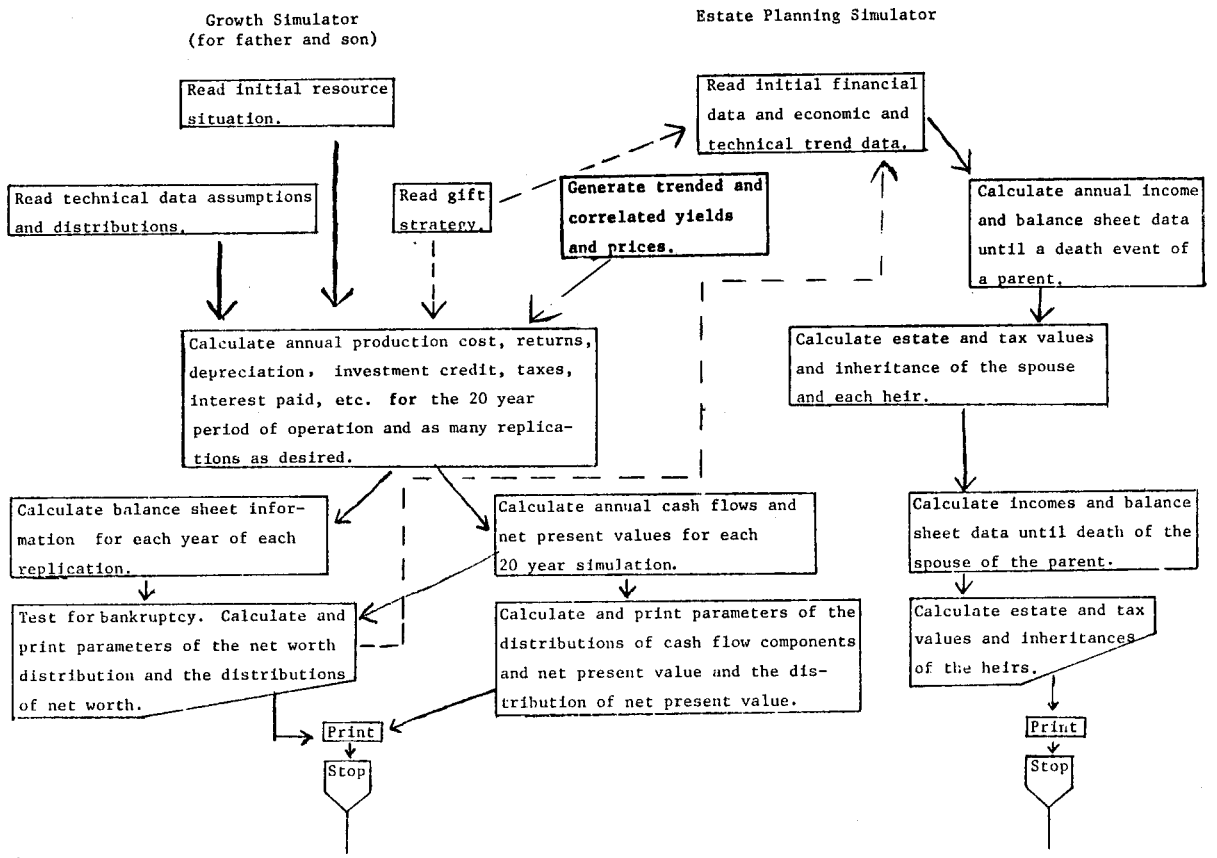
The firm growth and estate planning models are used jointly to study the effects of price and yield variability, beginning equity, firm growth strategies, and estate transfer plans on a son's success in establishing a viable economic unit in conjunction with the father's operation of a northcentral Oklahoma wheat and cattle farm. Key factors likely to affect success include the annual rate of increase in land values, annual rates of increase in prices paid and prices received by the farm operator, beginning equity situations for the father and son, and the amount and timing of gifts from the father to the son. Effects of alternative combinations of these factors are evaluated.

## THE FARM RESOURCE SITUATION

Northcentral Oklahoma is a productive part of the hard red winter wheat area of the Great Plains. It features highly mechanized, level farms and a relatively stable wheat yield averaging about 30 bushels per acre. Wheat and cattle on winter wheat pasture are the major products. The area is characterized by fairly large commercial farms that appear to be successful over time.

The initial resource situation assumed for the father in this analysis includes 640 acres of owned land and 640 acres of rented land. The father has sufficient machinery to operate the farm during the first 10 years of the planning horizon. In year 11, the father retires and rents the owned land to the son. In addition, a nonfarm heir is accorded full consideration in gift and estate planning. Initially the son is assumed to own 160 acres of land and to rent an additional 320 acres. In year 1, the son purchases an additional 160 acres of land. After the father's retirement in year 10, the son assumes operation of the 640 acres owned by his father. The son continues to operate the 320 acres he owns and rents a total of 960 acres. The son is assumed to purchase his father's machinery complement and to phase out his own machinery set. Assumptions about the

FIGURE 1. MODELS' FLOW AND INTERACTIONS CHART



initial asset, liability, and net worth positions of the father and son used in the analysis are stated in Table 3.

TABLE 3. INITIAL FINANCIAL POSITIONS USED IN THE BASE ANALYSIS

| | Father | Son |
|---|---|---|
| Assets | -dollars- | |
| Intermediate | 81,165.00 | 40,810.00 |
| Long Term | 572,000.00 | 148,000.00 |
| Total Assets | 653,165.00 | 188,810.00 |
| Liabilities | | |
| Intermediate | 20,291.25 | 20,405.00 |
| Long Term | 143,000.00 | 74,000.00 |
| Total Liabilities | 163,291.25 | 94,405.00 |
| Net Worth | 489,873.75 | 94,405.00 |

Production activities include only wheat and stocker cattle on wheat pasture. Wheat prices are generated from a triangular distribution using minimum, mode, and maximum wheat prices of $1.90, $2.35, and $3.00 respectively in year 1. Stocker cattle prices are in the $50 range. Oklahoma State University Enterprise Budgets for 1977 were used for initial production costs. All loans are amortized and machinery and buildings are depreciated over a 10- to 20-year period. The initial machinery complement is assumed to have a distribution of ages, and replacement costs of machinery are inflated over time at a constant rate. Twenty percent additional first year depreciation and investment tax credit are used on all qualified assets. The 1977 income tax schedule is used in the simulation analyses.

Labor availability and hired labor requirements are calculated separately for the father and son. The living expenses for each family are assumed to be $12,000 the first year of each simulation run and to increase at a 4 percent annual rate. The son is assumed to earn $6,000 per year in off-farm income with increases averaging 3 percent annually. Beginning in year 11, when the son assumes full control of the farm operation, the part-time job is dropped and family living requirements are derived entirely from the farm.

Throughout the stochastic simulation analysis, annual cash flow and balance sheet information is maintained separately for the father and son. If net cash income remaining after production costs, family living, taxes, machinery replacements, and interest and principal payments is positive, it is accumulated. If it is negative, a loan is initiated as long as an equity ratio limit specified by the user is not violated. If the equity ratio limit is reached, the iteration fails the "survival test" and a farm failure is recorded. A limit of equity/long-term assets of $\geq .2$ is used in the analysis reported. Even if a farm failure is recorded in an iteration, the iteration is completed and used in the statistical analysis of simulation results.

## GROWTH AND TRANSFER STRATEGIES

The economic situations and gift strategies used in the simulation runs are summarized in Table 4. Annual rates of increase in land values of 4 and 10 percent are simulated over a 20-year planning horizon. Rates of increase in prices received of 2 and 3 percent are evaluated. The rate of increase in prices paid is held constant at 3 percent for all runs. Beginning equity for the son is assumed to be 50 percent for all runs. The father's beginning equity is either 50 percent or 75 percent for the various simulation runs. In addition, three gift strategies are evaluated: (1) no gifts, (2) $3,000 annual cash gifts to each child, and (3) $3,000 annual cash gift to each child plus 160 acres divided equally between children in year 11.

Each simulation run of the firm growth model is replicated 100 times to provide distributions of the key economic variables in the analysis. The estate planning model is deterministic. Neither time nor resources permitted simulation of the 100 growth model replications in the estate planning model. Rather, the replication closest to the expected value was chosen for Run 1 and that replication was used for all other runs to fix stochastic variables at the same level. The high outcome is the replication with the 16th highest net worth in run 1 and the low is the replication with the net worth 16th from the lowest. Thus, a range of about one standard deviation is shown in the estate transfer results for Run 1. Again, the same replications were used for all estate transfer runs.

The estate planning model is used to calculate changes in net worth, the value of the estate transferred to the heirs, gift and estate taxes, other transfer costs, and the liquidity needs of the estate. It is assumed that the father dies at the end of year 20 in the planning horizon and his wife dies soon thereafter. The model will easily accommodate alternative assumptions about longevity of each parent and the order of death events. The father's will provides for his wife to receive one-half of the net estate (gross estate minus debt, funeral expenses, and administrative costs). Each child is to receive one-half of the remaining estate after estate taxes are paid. The husband owns $100,000 of life insurance with the estate as beneficiary. At the wife's death each child receives one-half of the remaining estate.

## RESULTS OF THE ANALYSIS

Evaluation of the results of firm growth under different economic conditions is based on several factors, including the level and distribution of ending net worth, the probability of successful growth and transfer to the son, and the liquidity positions of the father and son. These output measures are generated for each combination of economic conditions and gift strategies in Table 4.

The results of the growth plan and gift strategies in terms of successful transfer of the operation are evaluated on the basis of the net value of assets transferred to the heirs, levels of gift and estate taxes and other transfer costs, and the liquidity and income positions for the father and son. Interactions among gift strategies and growth scenarios for the father and son are analyzed by using data from both models.

## EFFECTS OF ECONOMIC CONDITIONS ON GROWTH SUCCESS

The net worth for farming units of the father and son at the end of a 20-year simulated planning horizon is summarized for alternative future economic conditions and estate transfer strategies in Table 5.

Under the base assumptions, the son faces a decline in net worth except in the best yield and price series (Table 5, Run 1). Unless the father provides security for the son's losses, the son's farm business will fail in 98 of 100 years. Only three of the 100 replications give positive ending net worth. Table 6 shows that cash flow problems and resulting financial failure occur early in the 20-year planning horizon, or after the son takes over the father's machinery in year 10. Thus, the financial and profitability situation for the son does not appear favorable.

The father increases his expected net worth by $751,015 during the 20-year period and has no failures. The value of total assets increases by $513,283. Therefore, he could provide assets to secure the son's loans in a majority of the iterations.

The results generated by the estate planning model for alternative gift strategies are summarized in Table 7. Individual replications from the 100 simulated by the growth model were chosen for analysis and high, medium, and low replications are presented in Table 7. The high reflects the 16th best outcome, the low reflects the 16th from the lowest outcome, and the medium is as close to the mean of the

TABLE 4. ECONOMIC SITUATIONS AND GIFT STRATEGIES USED IN SIMULATION RUNS FOR FATHER AND SON

| | | Base Analysis | Effects of Lower Prices Received and Beginning Equity | | Effects of High Land Appreciation Rate | | Effects of Gift Strategies | |
|---|---|---|---|---|---|---|---|---|
| Simulation Run No. | Son | 1 | 3 | 3 | 5 | 11 | 7 | 9 |
| | Father | 2 | 4 | 6 | 8 | | 10 | 12 |
| Conditions and Assumptions | | | | | | | | |
| Annual Percentage Rate of Increase in Land Value | | 4 | 4 | 4 | 10 | 7 | 4 | 4 |
| Annual Percentage Rate of Increase in Prices Received | | 3 | 2 | 2 | 2 | 3 | 3 | 3 |
| Annual Percentage Rate of Increase in Prices Paid | | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Beginning Percent Equity | Son | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| | Father | 75 | 75 | 50 | 75 | 75 | 75 | 75 |
| Gift Strategy | | | | | | | | |
| (1) No Gifts | | X | X | X | X | | | |
| (2) $3,000 Annual Gift to Each Child | | | | | | X | X | |
| (3) $3,000 Annual Gift to Each Child and 160 Acres Divided Equally Between Children in Year 11 | | | | | | | | X |

## TABLE 5. NET WORTH AFTER 20 YEARS FOR FARM UNITS OF FATHER AND SON UNDER ALTERNATIVE FUTURES FOR AGRICULTURE AND GIFT STRATEGIES BY THE PARENTS

| Economic Conditions and/or Gift Strategy | Financial Condition of the Son Ending Net Worth ($1,000) Run | Maximum | Mean | Minimum | Number of Farm Failures[b] | Financial Condition of the Father Ending Net Worth ($1,000) Run | Maximum | Mean | Minimum | Number of Farm Failures |
|---|---|---|---|---|---|---|---|---|---|---|
| Base Assumptions[a] | 1 | 75.3 | -424.7 | -1,053.8 | 98 | 2 | 1,825.4 | 1,240.9 | 475.8 | 0 |
| 2% Annual Increase in Ag. Prices | 3 | -210.2 | -777.5 | -1,449.2 | 100 | 4 | 1,743.5 | 1,169.4 | 360.3 | 0 |
| 50% Equity for the Father | | | | | | 6 | 1,364.4 | 641.2 | -274.7 | 8 |
| 10% Annual Land Appreciation | 5 | 951.2 | 383.8 | -287.9 | 34 | 8 | 4,066.1 | 3,492.0 | 2,682.9 | 0 |
| Base Assumptions With: | | | | | | | | | | |
| $3,000 Annual Gift to Son | 7 | 160.8 | -325.8 | -934.5 | 91 | 10 | 1,650.7 | 1,077.4 | 237.3 | 0 |
| $3,000 Annual Gift Plus a Gift of Land in Year 11 | 9 | 328.5 | -152.8 | -748.7 | 78 | 12 | 1,262.4 | 617.6 | -280.7 | 3 |
| 7% Land Appreciation and a $3,000 Annual Gift | 11 | 590.5 | 103.9 | -504.8 | 47 | | | | | |

[a]See Table 4 for a description of assumptions.

[b]Assumes that the father does not allow his assets to be used as security for additional loans to the son.

distribution as possible. The choice of replications used in the estate planning model was based on Run 1.[1]

In the medium case, the son ends the 20-year period with a negative net worth of $421,568. However, the combined balance sheets of the father and son would support the liabilities of the separate businesses or the combined business if it is a partnership. Under the terms of the will, the son would receive an increment of $205,241 to his equity position at the father's death. Total cash needs are for debt, funeral expenses, administrative expenses, and taxes. The son must supply some cash at that time because the will provides that he receive one-fourth of the land and the estate must take care of the liability at the time of the father's death. The wife's estate would, if the mother were willing, still support the liabilities of the son's operation. At the second death, the son's equity receives another $198,747 increment, but his net equity is a negative $17,580.

It appears that under the economic conditions assumed and after the death of the parents and the dispersement of a portion of the estate to the other heir, the son's business could not continue. Additionally, if the business were a partnership, the other heir would not be able to receive his or her inheritance because of the level of indebtedness involved. Possibly the family could share the net worth so that the operation would not become bankrupt.

## TABLE 6. DISTRIBUTION OF FARM FAILURES BY YEARS FOR 100 SIMULATION REPLICATIONS —SEPARATE FATHER AND SON OPERATIONS, NORTH CENTRAL OKLAHOMA[a]

| Year | Simulation Run 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | |
| 2 | 23 | | 29 | | 8 | | 19 | | 19 | | | |
| 3 | 8 | | 9 | | | | 4 | | 4 | | | |
| 4 | 11 | | 12 | | 1 | | 8 | | 8 | | | |
| 5 | 6 | | 7 | | 1 | 1 | 6 | | 6 | | | |
| 6 | 3 | | 4 | | | 1 | | | | | | |
| 7 | 4 | | 5 | | 2 | 4 | | | | | | |
| 8 | | | 2 | | | 1 | 1 | | 1 | | | |
| 9 | 1 | | | | | | 6 | | 6 | | | |
| 10 | 10 | | 12 | | 2 | | 8 | | 1 | | | 1 |
| 11 | 9 | | 15 | | 6 | | 11 | | 5 | | | |
| 12 | 11 | | 5 | | 2 | 1 | 13 | | 10 | | | |
| 13 | 9 | | 1 | | 7 | | 8 | | 5 | | | |
| 14 | 2 | | | | 2 | | 4 | | 3 | | | |
| 15 | | | | | | | 2 | | 3 | | | 1 |
| 16 | | | | | | | | | 1 | | | |
| 17 | | | | | 2 | | 1 | | 1 | | | 1 |
| 18 | | | | | 1 | | | | 5 | | | |
| 19 | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | |
| Total failures | 98 | 0 | 100 | 0 | 34 | 8 | 91 | 0 | 78 | 0 | 47 | 3 |

[a]Assumptions for each run are described in Table 4. Odd numbered runs are for the son and even numbers are for the father.

[1]It is necessary to choose one replication with its unique set of yields and prices to compare all runs. The medium run as defined here for the son in Run 1 will not necessarily be the medium run for another run for the son or father. In fact, the medium run chosen for the son tended toward the unfavorable end of the net worth distributions for the father. Thus, results for father and son are not perfectly associated, partly because the father is free of price and yield effects during years 11 through 20.

The "high" situation for Run 1 in Table 7 represents a favorable set of yields and prices. The son would be in a very good position after receipt of his inheritance. At least 16 of the outcomes are at least this favorable. In the event of a low set of yields and prices during the 20-year period, a very unfavorable situation results.

Runs 3 and 5 for the son evaluate the impact of alternative economic futures for agriculture (Table 6). Run 3 differs from Run 1 in that a 2 percent rate of increase in agricultural prices is assumed along with a 4 percent land appreciation rate. The impact on the results is dramatic—disaster. Run 5 assumes a 2 percent rate of inflation in agricultural prices but a 10 percent land appreciation rate. These rates may not be compatible assumptions over a long run, but they have occurred in the past. Clearly the 10 percent land inflation rate would favorably affect the son. In contrast to the base run in which there are 98 failures, there are only 34 with the 10 percent inflation rate in land. All iterations result in failure for Run 3. Continued increases in land values clearly have a very important impact on the ability of the farm to continue. Of course, that impact would be lessened if the economic situation assumed in this farming situation were improved.

Run 4 for the father reflects the effect of a 2 percent rather than 3 percent agricultural price increase. The results for Run 4 should be compared with those for Run 2. The economic outlook for the father is slightly less favorable. However, in Run 8, with a land inflation of 10 percent, the farmer's ending net worth which includes the 640 acres he owns increases nearly threefold.

Run 6 is included to allow an evaluation of the effect of a lower beginning equity for the father on his ending net worth and his ability to assist the son. A gain in net worth would still be expected for the father. However, eight bankrupt iterations occur as a result of

TABLE 7. ESTATE TRANSFERS, TRANSFER COSTS, AND ENDING NET WORTHS FOR ALTERNATIVE GIFT STRATEGIES

| | No Gifts | | | 10% Increase in Land Value-No Gifts | | | $3000 Annual Gifts | | | Land Gift and $3000 Annual Gift | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Father | High | Medium | Low | High | Medium | Low | High | Medium | Low | High | Medium | Low |
| Land | 1,121,855 | 1,121,855 | 1,121,855 | 3,444,480 | 3,444,480 | 3,444,480 | 1,121,855 | 1.121,855 | 1,121,855 | 831,966 | 831,966 | 831,966 |
| Cash | 439,725 | 44,593 | 22,345 | 350,000 | 19,331 | 715 | 267,689 | 0 | 0 | 144,353 | 0 | 0 |
| Total Assets | 1,561,580 | 1,166,448 | 1,144,200 | 3,794,480 | 3,463,811 | 3,445,195 | 1,389,544 | 1,121,855 | 1,121,855 | 976,319 | 831,966 | 831,966 |
| Liabilities | 3,358 | 117,325 | 205,388 | 3,778 | 218,424 | 311,614 | 8,647 | 318,220 | 409,662 | 8,647 | 544,863 | 644,459 |
| Net Worth | 1,558,222 | 1,049,123 | 938,812 | 3,790,702 | 3,245,387 | 3,133,581 | 1,380,897 | 803,635 | 712,193 | 967,672 | 287,103 | 187,507 |
| Insurance | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 |
| Son | | | | | | | | | | | | |
| Land | 560,928 | 560,928 | 560,928 | 1,722,240 | 1,722,240 | 1,722,240 | 560,928 | 560,928 | 560,928 | 705,872 | 705,872 | 705,872 |
| Machinery | 121,991 | 121,991 | 121,991 | 121,991 | 121,991 | 121,991 | 121,991 | 121,991 | 121,991 | 121,991 | 121,991 | 121,991 |
| Cash | 0 | 61,558 | 28,724 | 0 | 44,890 | 14,752 | 11,816 | 73,194 | 34,199 | 18,376 | 77,279 | 36,072 |
| Total Assets | 682,919 | 744,477 | 711,643 | 1,844,231 | 1,889,121 | 1,858,983 | 694,735 | 756,113 | 717,118 | 846,239 | 905,142 | 863,935 |
| Liabilities | 890,917 | 1,166,045 | 1,330,170 | 1,248.961 | 1,493.035 | 1,633,668 | 802,709 | 1,080,351 | 1,240,307 | 783,200 | 1,057,075 | 1,214,719 |
| Net Worth | -207,998 | -421,568 | -618,527 | 595,276 | 396,086 | 225,315 | -107,974 | -324,238 | -523,189 | 63,039 | -151,933 | -350,784 |
| Husband's Estate | | | | | | | | | | | | |
| Gross Estate | 1,661,580 | 1,266,448 | 1,244,200 | 3,894,480 | 3,563,811 | 3,545,195 | 1,489,544 | 1,221,855 | 1,221,855 | 1,076,319 | 931,966 | 931,966 |
| Administrative Expenses | 44,156 | 32,344 | 30,576 | 102,205 | 90,710 | 88,968 | 39,611 | 28,472 | 27,238 | 28,868 | 17,509 | 16,531 |
| Taxes | 245.970 | 146.264 | 124.827 | 725,413 | 603,168 | 577,729 | 210,998 | 99,955 | 83,131 | 165,985 | 37,504 | 19,126 |
| Total Cash Needs | 296,771 | 299,220 | 364,078 | 834,683 | 915,589 | 981,598 | 262,543 | 449,934 | 523,318 | 206,787 | 603,163 | 683,403 |
| Liquidity Available | 539.725 | 144,593 | 122,345 | 450,000 | 119,331 | 100,715 | 367,689 | 100,000 | 100,000 | 244,353 | 100,000 | 100,000 |
| To Son at 1st Death | | | | | | | | | | | | |
| Land | 280,464 | 280,464 | 280,464 | 861,120 | 861,120 | 861,120 | 280,464 | 280,464 | 280,464 | 207,992 | 207,992 | 207,992 |
| Cash | -754 | -75,223 | -91,640 | -277,524 | -349,856 | -364,653 | -26,463 | -112,472 | -126,612 | -32,105 | -135,167 | -150,633 |
| Equity | 279,710 | 205,241 | 188,824 | 583,596 | 511,264 | 496,467 | 254,001 | 167,992 | 153,852 | 175,887 | 72,825 | 57,359 |
| Wife's Estate | | | | | | | | | | | | |
| Gross Estate | 805,390 | 560,928 | 560,926 | 1,892,604 | 1,722,240 | 1,722,240 | 719,000 | 560,928 | 560,928 | 517,759 | 415,983 | 415,983 |
| Administrative Expenses | 24,540 | 18,180 | 17,395 | 52,808 | 47,075 | 46,332 | 22,294 | 17,054 | 15,767 | 17,062 | 10,270 | 9,481 |
| Taxes | 234,506 | 137,785 | 117,059 | 699,721 | 579,914 | 554,606 | 200,917 | 92,368 | 76,024 | 157,926 | 32,298 | 14,504 |
| Total Cash Needs | 262,333 | 163,434 | 196,194 | 755,816 | 726,812 | 755,802 | 226,498 | 237,699 | 265,172 | 178,275 | 278,685 | 309,411 |
| Liquidity Available | 244,462 | 0 | 0 | 170,364 | 0 | 0 | 158,072 | 0 | 0 | 101,776 | 0 | 0 |
| To Son at 2nd Death | | | | | | | | | | | | |
| Land | 280,464 | 280,464 | 280,466 | 861,120 | 861,120 | 861,120 | 280,464 | 280,464 | 280,464 | 207,992 | 207.992 | 207,992 |
| Cash | -8,935 | -81,717 | -98,097 | -292,726 | -363,406 | -377,901 | -34,213 | -118,849 | -132,586 | -38,250 | -139,342 | -154,705 |
| Equity | 271,529 | 198,747 | 182,367 | 568,394 | 497,714 | 483,219 | 246,251 | 161,615 | 147,878 | 169,742 | 68,649 | 53,286 |
| Total Equity for Son | 343,241 | -17,580 | -247,336 | 1,747,260 | 1,405,064 | 1,205,001 | 392,278 | 5,369 | -221,459 | 408,668 | -10,459 | -240,139 |

lowering the equity position. The overall ability of the combined businesses to survive is adversely affected.

Runs 1, 3, and 5 for the son and 2, 4, and 6 for the father indicate the sensitivity of farm growth success, as measured by increasing net worth and ability to continue, to economic conditions in the future and the rate of land appreciation.

All who have been close observers of the agricultural situation recognize the importance of land inflation to the financial position of farmers. Run 11 in Table 6 is designed to approximate as closely as possible the rate of land appreciation necessary for the son to continue in the economic climate depicted. With a 7 percent land inflation rate, the son's expected ending net worth is $103,000 and he would fail about 47 times out of 100 if left on his own. The estate planning model was not run for this situation. Because the value of the father's land would also be inflating and his net worth was positive under the 4 percent inflation rate, it is certain that the ending total equity for the son after settlement of the estate would leave him in a position to continue.

Expectations about future economic conditions and land appreciation rates are certainly implicit in the prices that farmers are willing to pay for land and in other growth decisions they make. A very careful analysis is needed of the future under those expectations. A probabilistic approach is useful in that it identifies the chances and consequences of failure even within distributions with favorable expected values. Some investors would be willing to take the chance and others would not. The models used in the study provide the kind of information needed for the decisions. The data used in the study adequately reflect the economic situation of the decision maker.

## THE EFFECT OF GIFT STRATEGIES ON GROWTH SUCCESS

Runs 7, 9, 10, and 12 use the base assumptions of Runs 1 and 2, respectively, along with the gift strategy indicated in Table 5. The $3,000 annual gifts to the son and the other heir improve the expected net worth of the son's operation and raise his worst ending net worth substantially. Table 7 indicates that, as a result of the $3,000 gift, the son has a positive net worth after receiving his inheritance from the father and the mother. However, the difference compared with the no-gift situation is less than $25,000. The father has substantially more debt under the $3,000 annual gift strategy and his expected net worth is lower than when he makes no gifts. Taxes and administrative expenses for settling the combined estates are lower under the annual gift strategy than under the no-gift strategy. Total cash needs increase because of the higher indebtedness of the father as a result of the gifts.

The gift strategy which includes the $3,000 annual cash gift plus a gift of 80 acres of land to each heir in year 11 improves the net worth expectations of the son substantially, but does not solve all of his problems. The son's net worth is positive only in the high situation. Table 7 indicates that the median situation for the son would result in a negative $151,933 net worth, compared with a negative $324,238 under the $3,000 annual gift strategy.

After the land and cash gifts, the father's net worth is only $287,103, which is considerably smaller than the expected net worth under the no-gift strategy. One would expect the father's net worth to decline because one objective of estate planning is to transfer assets from his estate to that of his son. In this situation, the son needs substantial assistance if he is to continue as an economic entity. The father may be reluctant to increase his liabilities greatly to accomplish the estate planning objectives.

## SUMMARY AND IMPLICATIONS

The decision process and information used by farmers to make growth plans in an uncertain economic environment are not clear. Land prices increasing faster than warranted by agricultural incomes and serious financial problems on the part of low-resource investors suggest that some decision makers do not adequately analyze alternatives. Analysis is made very difficult by the multiplicity of variables and uncertainty involved. The models used in this study are designed to provide research results and direct applications for farmers with growth and estate planning questions. Stochastic computer simulation provides a means to introduce many variables and economic conditions, trace growth over a planning horizon, estimate the distributions of outcome variables, and experiment with alternative growth-estate planning strategies. Clearly, the resource base and economic situation assumed affect the final results obtained.

A limited number of firm growth and estate transfer strategies are evaluated in this study. The models do not optimize, but simply provide data for analyzing growth and estate strategies. The models used in the analysis are capable of analyzing a wide range of risk transfer alternatives, including diversification, crop insurance, government disaster payments, sequential marketing of products, contracting, hedging, and others. The estate planning model can consider proprietorship,

partnership, and corporation forms of business organization. The effects of incorporating the business, the new current use value assessment provision of the estate tax law, and property ownership methods and wills could also be evaluated. The purpose of this study is not to perform an exhaustive investigation of all possible firm growth and estate transfer strategies. Rather, father-son arrangements are considered on the assumption that the son wishes to take over the farm operation as a viable economic unit. The results might differ for alternative organizational arrangements.

Results presented indicate that the rates of increase in land prices and other agricultural prices are very important to farmers' growth and investment decisions and to the ability of the son's farm business to continue. In the base analysis presented, the farmer buying land is paying 8.5 percent for the money and receiving a 4 percent appreciation rate plus modest agricultural returns. After meeting living needs and capital replacement, his net worth declines. Because of the association with his parents, a young farmer might expect that the inheritance would ensure economic viability. However, this outcome is by no means assured. The higher the land appreciation rate, or the more favorable agricultural prices in relation to costs, the better the son's chance to succeed. The gift strategy and estate plan employed can affect the amount of the estate passed forward and the ability of the farmer to continue.

Success for young people attempting to become established in farming in the face of high and rising capital requirements and variability in yields, prices, net returns, and institutional constraints is becoming increasingly difficult. Good timing with respect to the level and variability of net returns is important. A series of years of low yields and unfavorable prices can upset the most careful of growth and coordination plans. Farmers who become established and expand successfully must, of course, be good managers. But they may also need good luck and family financial backing.

Careful planning is an important component in the successful growth and transfer of the farm estate. Plans which lead to high levels of growth also result in high levels of net value of assets transferred to the heirs. However, ever-increasing land values complicate the problem of the beginning farmer wishing to purchase land. Conventional amortized loans for land purchases may create cash flow problems. Longer repayment periods and/or variable principal and interest arrangements designed to reduce the cash drain during the first few years of the loan may be required as young farmers attempt to overcome the formidable barriers to entry into farming.

Research and extension program needs of farmers and their agribusiness associates to improve entry-growth-estate transfer decisions are substantial. Programs that explicitly evaluate alternative futures and strategies and their effects on firm success and other goals are needed. Such research also would improve ability to anticipate future aggregate structural developments in agriculture. Farm size distributions, ownership-rental patterns, business organization, and capital structure are affected by the conditions of establishment, growth, and transfer of farm firms. New and innovative arrangements for contemporary business conditions might be discovered.

## REFERENCES


[1] Baker, C. B. "Credit in the Production Organization of the Firm," *American Journal of Agricultural Economics,* Volume 50, 1969, pp. 507-521.

[2] Baker, C. B. "Financial Organization and Production Choices," *American Journal of Agricultural Economics,* Volume 50, 1968, pp. 1566-1577.

[3] Baker, C. B. "Firm Growth, Liquidity Management, and Production Choices," *Production Economics in Agricultural Research,* AE-4108, Proceedings Department of Agricultural Economics, University of Illinois, 1966.

[4] Baker, C. B., P. J. Barry, W. F. Lee, C. E. Olson, E. Hochman, G. S. Rausser, and M. W. Kottke. *Economic Growth of the Agricultural Firm,* Washington State University Technical Bulletin 86, 1977.

[5] Barry, P. J. "Asset Indivisibility and Investment Planning: An Application of Linear Programming," *American Journal of Agricultural Economics,* Volume 54, 1972, pp. 255-260.

[6] Barry, P. J. *Contracting for Crops and Credit Proceedings,* Farm and Ranch Credit School for Commercial Bankers, Texas A&M University, February 1975.

[7] Barry, P. J. and C. B. Baker. "Reservation Prices on Credit Use: A Measure of Response to Uncertainty," *American Journal of Agricultural Economics,* Volume 53, 1971, pp. 222-228.

[8] Barry, Peter J. and David R. Willmann. "A Risk Programming Analysis of Forward Contracting with Credit Constraints," *American Journal of Agricultural Economics,* Volume 58, 1976, pp. 62-70.
[9] Boehlje, M. D. "The Entry-Growth-Exit Process in Agriculture," *Southern Journal of Agricultural Economics,* Volume 5, 1973, pp. 23-37.
[10] Boehlje, M. D. and L. M. Eisgruber. "Strategies for the Creation and Transfer of the Farm Estate," *American Journal of Agricultural Economics,* Volume 54, 1972, pp. 461-473.
[11] Boehlje, M. D. and T. K. White. "A Production Investment Decision Model of Farm Firm Growth," *American Journal of Agricultural Economics,* Volume 51, 1969, pp. 546-564.
[12] Bostwick, D. *Farm Financial Management Research: A Theoretical Analysis,* ERS-389, USDA, 1968.
[13] Boussard, J. M. "Time Horizon, Objective Function and Uncertainty in a Multi-period Model of Firm Growth," *American Journal of Agricultural Economics,* Volume 53, 1971, pp. 467-577.
[14] Boussard, J. M. and M. Petit. "Representation of Farmers' Behavior under Uncertainty with a Focus Loss Constraint," *Journal of Farm Economics,* Volume 49, 1967, pp. 869-881.
[15] Brake, J. R. "Firm Growth Models Often Neglect Important Cash Withdrawals," *American Journal of Agricultural Economics,* Volume 50, 1968, pp. 769-771.
[16] Butcher, W. R. and N. K. Whittlesey. "Trends and Problems in Growth of Farm Size," *Journal of Farm Economics,* Volume 48, 1966, pp. 1513-1519.
[17] Chien, Ying I. and Garnett L. Bradford. "A Sequential Model of the Farm Firm Growth Process," *American Journal of Agricultural Economics,* Volume 58, 1976, pp. 456-465.
[18] Dobbins, C. L. "The Intergeneration Transfer of the Farm Firm: A Recursive Goal Programming Analysis," Ph.D. thesis, Oklahoma State University, 1978.
[19] Eddleman, B. R. "Increased Uncertainty in Agriculture," unpublished manuscript. Department of Agricultural Economics, Mississippi State University, 1977.
[20] Forster, D. L. and R. D. Duvick. "Farm Real Estate Disinvestment Strategies," *Southern Journal of Agricultural Economics,* Volume 10, 1978, pp. 1-7.
[21] Fruend, R. J. "The Introduction of Risk Into a Programming Model," *Econometrica,* Volume 24, 1956, pp. 253-262.
[22] Halter, A. N. "Models of Firm Growth," *Journal of Farm Economics,* Volume 48, 1966, pp. 1503-1510.
[23] Hardin, L. "A Simulation Model for Analyzing Farm Capital Investment Alternatives," Ph.D. thesis, Oklahoma State University, 1978.
[24] Harrison, G., J. T. Scott, and C. B. Baker. "A Decision Model for Estate Planning," *Trusts and Estates,* Volume 107, 1968, pp. 523-526.
[25] Hazell, P. B. R. "A linear Alternative to Quadratic and Semivariance Programming for Farm Planning Under Uncertainty," *American Journal of Agricultural Economics,* Volume 53, 1971, pp. 53-63.
[26] Heidhues, T. "A Recursive Programming Model of Farm Growth in Northern Germany," *Journal of Farm Economics,* Volume 48, 1966, pp. 668-685.
[27] Hinman, H. R. and R. F. Hutton. "Returns and Risks of Expanding Pennsylvania Dairy Farms with Different Levels of Equity," *American Journal of Agricultural Economics,* Volume 53, 1971, pp. 608-612.
[28] Irwin, G. D. "A Comparative Review of Some Firm Growth Models," *Agricultural Economics Research,* Volume 20, 1968, pp. 82-100.
[29] Johnson, S. R., K. R. Tefertiller, and D. S. Moore. "Stochastic Linear Programming and Feasibility Problems in Farm Growth Analysis," *Journal of Farm Economics,* Volume 49, 1967, pp. 908-919.
[30] Lee, W. F. and J. R. Brake. *Conversion of Farm Assets for Retirement Purposes,* Research Report 129, Michigan Agricultural Experiment Station, January 1971.
[31] Levi, D. and J. Allwood. "Legal-Economic Models as a Tool for Optimizing Intergeneration Property Transfers." *American Journal of Agricultural Economics,* Volume 51, 1969, pp. 1393-1398.
[32] Martin, J. R. and J. S. Plaxico. *Polyperiod Analysis of Capital Accumulation of Farms in the Rolling Plains of Oklahoma and Texas.* USDA Technical Bulletin 1381. September 1967.
[33] Minden, A. J. "Dynamic Programming: A Tool for Farm Firm Growth Research," *Canadian Journal of Agricultural Economics,* Volume 16, 1968, pp. 38-45.
[34] Minnick, D. L. "Financial Alternatives and Minimum Resource Requirements for Low Resource, Beginning Farmers in Oklahoma," M. S. thesis, Oklahoma State University, 1975.
[35] Patrick, G. F. "Some Impacts of Inflation on Farm Firm Growth," *Southern Journal of Agricultural Economics,* Volume 10, 1978, pp. 9-14.

[36] Patrick, G. F. and L. M. Eisgruber. "The Impact of Managerial Ability and Capital Structure on Growth of the Farm Firm," *American Journal of Agricultural Economics,* Volume 50, 1968, pp. 491-507.
[37] Reid, D. W., W. H. Musser, and N. R. Martin, Jr. "Income Tax Aspects of Liquidation in Multiperiod Linear Growth Models," *Southern Journal of Agricultural Economics,* Volume 10, 1978, pp. 29-34.
[38] Renborg, U. "Growth of the Agricultural Firm: Problems and Theories," *Review of Marketing and Agricultural Economics,* Volume 38, 1970, pp. 51-101.
[39] Roush, G. E. "Economic Evaluation of Asset Ownership Transfer Methods and Family Farm Business Arrangements After the Tax Reform Act of 1976," Ph.D. thesis, Oklahoma State University, 1978.
[40] Roush, C. E., H. P. Mapp, and C. D. Maynard. "Implications of the Tax Reform Act of 1976 for Estate Planning," *Western Journal of Agricultural Economics,* Volume 4, 1979 (forthcoming).
[41] Sadan, E. "The Investment Behavior of a Farm Firm Operating Under Risk," *American Journal of Agricultural Economics,* Volume 52, 1970, pp. 495-505.
[42] Scott, J. T. and C. B. Baker. "A Practical Way to Select an Optimum Farm Plan Under Risk," *American Journal of Agricultural Economics,* Volume 54, 1972, pp. 657-661.
[43] Shechter, M. and E. O. Heady. "Response Surface Analysis and Simulation Models in Policy Choices," *American Journal of Agricultural Economics,* Volume 52, 1970, pp. 41-50.
[44] Spence, L. C. "An Analysis of Investment Strategies for Retiring Farmers," M. S. thesis, Oklahoma State University, 1976.
[45] Spence, L. C. and H. P. Mapp, Jr. "A Retirement Income Simulation Model for Farm Operators," *Southern Journal of Agricultural Economics,* Volume 8, 1976, pp. 163-168.
[46] U.S. Department of Agriculture. *Agricultural Finance Outlook,* AFO-19, ESCS, 1978.
[47] U. S. Department of Agriculture. *Balance Sheet of the Farming Sector,* 1978, Supplement No. 1, Agricultural Information Bulletin No. 416, ESCS, 1978.
[48] U. S. Department of Agriculture. *Farm Real Estate Market Developments,* ESCS, 1978.
[49] Vandeputte, J. M. and C. B. Baker. "Specifying the Allocation of Income Between Taxes, Consumption, and Savings in Linear Programming Models," *American Journal of Agricultural Economics,* Volume 52, 1970, pp. 521-528.
[50] Walker, Odell L. and Dale L. Minnick. *Resource Requirements and Income Opportunities for Beginning Farmers in Selected Areas of Oklahoma,* Oklahoma Agricultural Experiment Station Bulletin B-729, 1977.
[51] Zusman, P. and A. Amid. "Simulation: A Tool for Farm Planning Under Conditions of Weather Uncertainty," *Journal of Farm Economics,* Volume 47, 1965, pp. 574-594.