Uncertainty, Expectations and Investment Decisions for a Sample Of Central Iowa Farmers

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SUMMARY

Risk and uncertainty present the major obstacles to efficient decision-making by farm managers. Prerequisite to improving decision-making under uncertainty is a knowledge of how decisions are made and an understanding of the reasoning upon which decisions are based. Insights into these areas are provided by the present study, which investigates one particular aspect of decision-making; namely, investment decisions. Data were collected in 1953 for a random sample of four Iowa counties. The sample included only owner-operators under 60 years of age who were operating more than 60 acres of land.

Mean planned investment of farmers in the sample was $9,662 for the 3 years following the study. A multiple regression equation predicting planned total investment as a function of the several variables was attempted. However, problems of measurement of subjective variables reduced the number of significant variables to three: present capital investment, equity ratio and risk discount. The resulting equation is given below where y = total planned farm investment in the next 3 years, x_1 = total present capital investment, x_2 = equity ratio and x_6 = risk discount.

$$\text{(i)} \quad \hat{y} = 0.0936\, x_1^{1.1338}\, x_2^{0.7903}\, x_6^{-0.2349}$$

Of the three independent variables, capital (x_1) explains the greatest proportion of variance in planned investment (y). Together the three variables explain about 37 percent of the total variance in planned investment. More accurate measurements of subjective variables and improved empirical models are required before a larger portion of variance in investment can be more effectively explained. Quantities derived from this equation, as mean predictions, show that a 1-percent increase in present capital is associated with an increase of 14 cents in planned investment. A 1-percent increase in equity ratio is associated with an $87.07 increase in planned investment while a 1-percent increase in risk discount is predicted to decrease planned investment by $118.34.

The study provided evidence that different investment decisions are made by different methods; e.g., some investment decisions are based on detailed formulation of expectations while others are of a "routine" or "forced action" type. The method used revolves particularly around the type of asset and whether it represents a large competitive investment (feeder cattle) or a small complementary capital item (small tools and repairs). Maintaining a high equity, diversifying and buying on a "need" basis are the most common precautionary methods used in meeting uncertainty.

Only about 20 percent of the farmers in the sample could be classed as true innovators; the majority of farmers wanted to withhold investment in new practices until they had been tried by neighbors. The advice of the farm wife was sought more often by farmers in making investment decisions than was the advice of relatives, bankers, county agents and others. Seventy out of 99 farmers indicated that they would depend on advice from their wife in making decisions to buy land. Advice from bankers ranked highest for purchase of feeder cattle while fertilizer use was the most frequent investment decision for which county agents were mentioned.

The majority of farmers ranked themselves as *average* in willingness to assume risk in investment decisions. Only a relatively few ranked their wives as being more *daring* than themselves in willingness to accept investment risks. Data from the study indicate that increased willingness to assume risk is positively associated with amount of capital and equity and negatively associated with time discount.

Farmers, on the average, predicted that the most probable price level in both 1954 and 1960 would be below the index level of 286 prevailing at the time of the survey. The range of degree of uncertainty of future prices increased greatly with the length of time for which the predictions were made. The uncertainty ratio for prices predicted 1 year ahead was 0.26. It was 0.49 for a year 7 years in the future.

Farmers in the low capital and equity groups placed the greatest emphasis on present income; i.e., they had the highest time discount. When selecting from five alternative income streams with equal absolute values but different discounted magnitudes, 56 percent selected the plan with zero variance while 7 percent selected the plan with the highest variance but which provided more discounted income at the end of the period.

A majority of the farmers used the "pay-off period" method in deciding whether to buy a farm. They formulated price expectations and tried to determine if they could buy the farm and pay for it in a specified number of years. Because of uncertainty, farmers felt that the rate of return on land investment should be about 10 percent and that the farm should be paid for in about 15 years. Operators stated that, on the average, the optimum farm size was approximately 225 acres. About 80 percent of the farmers stated that they would not operate a farm under the corporate form of business to obtain equity capital. The main reason given was lack of independence.

In general, farmers indicated that they would be unresponsive to small shifts in interest rates. They would be much more responsive to an upward movement than to a downward movement in the interest rate. Eighty-seven percent of the farmers interviewed said they would need greater returns on capital as the quantity borrowed increased. The farmers in the sample were little affected by external capital rationing; all but one farmer stated that they could have borrowed more capital. The reasons for internal capital rationing were mainly related to uncertainty.

In terms of "risky" enterprises and equity

ratios, farming was considered by 93 percent of the farmers to be more risky than government bonds as an investment alternative. Fifty-two percent looked upon farming as being less risky than working in a factory, while only 21 percent thought their present occupation was more risky than operating a grocery store. While the average "safe equity" ratio expressed by the farmers was 0.60, practically all of the farmers desired 100 percent of equity as an "ultimate goal." In fact, if farmers were provided with additional capital, about 60 percent would be used to increase liquidity by paying off debts or by putting the funds into cash or bonds.

Uncertainty, Expectations and Investment Decisions for a Sample of Central Iowa Farmers[1]

BY EARL O. HEADY, R. J. HILDRETH AND GERALD W. DEAN

The main forces which prevent farmers from making more efficient managerial decisions are risk and uncertainty. Farming is carried on in a choice framework wherein investment commitments must be made at one point in time, with production and revenue forthcoming later. The magnitude of yields, and the price at which products will be sold, can only be established at the time investments are made. The fact that plans must be based on expectations of, or on guesses about, future prices and yields may lead to two possible kinds of errors: (1) If a particular price is expected and plans are made to conform exactly to these expectations, losses or small profits may be realized if the expectations prove to be wrong. (2) If the farmer realizes that his price or yield expectations may prove to be wrong and accordingly selects a compromise plan, his profits will not be maximized even if the expectations prove to be accurate. The possibility of these two types of errors causes investment decisions to be surrounded with confusion. If the farmer is too conservative in his investment policy, he stands to make errors of the second type; if he is not conservative, he stands to make errors of the first type. Most farmers must adopt a compromise course: They do not "step off the deep end" in making the production and investment decisions which appear consistent with expectations of the future. On the other hand, they necessarily must commit funds if they are to carry on farming operations.

OBJECTIVES

While it is known that uncertainty causes difficulty both in arriving at managerial decisions and in making plans which raise income and family living standards, little is known about the investment and planning procedures which are actually used by farmers. Hypotheses exist regarding the relationship of the amount and form of investment to the percentage of equity in capital employed, the total capital possessed, the degree of uncertainty in expectations, the psychological make-up of the manager and the family or household status of the individual. However, there are few empirical indications of the quantitative effect of these several variables on farmers' decisions. With the cost-price squeeze which has prevailed in the last few years and which is in prospect for the foreseeable future, it is important that greater knowledge be obtained regarding managerial decisions under uncertainty. Two types of studies are especially needed: (1) an investigation of how farmers actually make investment and production decisions under uncertain expectations and (2) an outline of procedures which, given the economic characteristics of the farm business and household, can improve the probability of success.

Work is being done on the second type of investigation. However, the possibilities for improving decisions can be assessed only if more is known about procedures currently used by farmers. Also, knowledge of procedures which have been used successfully by some farmers may prove to be useful information which can be extended to other farmers. This study is primarily exploratory and, hence, is designed to improve knowledge of how farmers make decisions and to investigate the nature of the reasoning upon which their investments are based. The study revolves mainly around the amount and form of capital investment. In general, the questions used relate to investment in the form of innovations or new techniques. Models based on economic logic are used in an attempt to isolate relevant variables and to express their empirical effect on total capital investment. Also, selected descriptive characteristics of farmers are related to the patterns of certain types of decisions.

SAMPLE

The geographical universe from which the sample was drawn consisted of 16 townships located in Hamilton, Story, Boone and Hardin counties. The population sampled was further restricted to include only owner-operators, 60 years of age and under, farming at least 60 acres of land. The population was restricted to owner-operators to broaden the range of investment alternatives considered. Tenant-operators were excluded because they seldom make investments in buildings or certain types of soil improvement and investment in various types of livestock is discouraged if buildings are lacking. Farmers over 60 years of age

[1] Project 1135 of the Iowa Agricultural Experiment Station.

were excluded because they are probably anticipating retirement in a few years and undoubtedly follow different investment patterns because of their relatively short planning horizon. Problems of tenant investment (particularly in the first purchase of a farm) and older operators (particularly in investing to provide a satisfactory retirement income) represent decisions equally as important and complex as those for the general age and tenure group sampled in this study. However, to keep the domain of decisions as homogeneous as possible, considering the funds available for the study, the two strata of farmers mentioned were excluded; their unique investment problems might be studied at a later time.

Using the "area method of sampling," the open-country portion of the 16 townships was divided into 2,224 sampling units consisting of one farm headquarters each. A random sample of 374 sampling units was drawn, from which 102 farms were found to be "eligible." Responses in whole or in part were obtained from 99 of the 102 operators of these farms. The objective of the sampling technique used was to eliminate any cluster effect and to insure, as far as possible, the independence of each response. One person served as enumerator for the entire sample so that all questions would be interpreted similarly by farmers.

The survey was conducted at the end of the 1953 calendar year. Investment quantities for the previous 3 years extend over the period 1951, 1952 and 1953; quantities for the 3 years ahead refer to 1954, 1955 and 1956. The sample will be repeated in 1957 to examine the relation of expected capital investments and actual commitments.

SUBJECTIVE VARIABLES

Many of the measurements in this study involve subjective variables. These measurements are not cardinal quantities *known exactly*—such as acres in farm, corn yield or operator's age. Instead they represent judgments of what has taken or will take place and the reasons for the judgments. In other words, they are largely *ex ante* anticipations and rationalizations, rather than *ex poste* historical quantities. Accordingly, the problems and limitations of the analysis are those found in any study dealing with this type of phenomenon. However, the success of people's lives and economic endeavers hinges around exactly these types of subjective expectations and explanations. The problem under analysis would not exist if the relevant quantities could be measured in an exact or historical manner. If such measurements were possible, economic and social attainment would necessarily be stagnant, with little opportunity for continued progress. While difficulty arises in the measurement of subjective variables, as compared with the more easily controlled and more dormant variables of physical experiments, predictions which involve relatively large estimational errors still make important contributions to knowledge.

TABLE 1. SUMMARY OF SELECTED CHARACTERISTICS DESCRIBING THE SAMPLE OF FARMERS.

Characteristic		Mean
Age		47.0
Acres operated		197.4
Acres owned	167.1	
Acres rented	30.3	
Number of years in farming		21.9
Highest year of school completed		9.1
Number of dependents		2.6
Capital employed		$75,821.00
Equity ratio*		0.88

* Total capital owned divided by total capital used by farmer.

CHARACTERISTIC OF FARMERS SAMPLED

Table 1 summarizes the means for easily measured characteristics describing the sample of farmers interviewed. Since the sample was restricted to owner-operators, the means of capital and equity are probably somewhat higher than the comparable means for all farmers in the area. Considerable variation existed in the amount of capital controlled by these owners: The range extended from $30,000 to well over $200,000. Thirty of the 99 farmers reported an equity ratio of 100 percent.

The farmers included in the sample were predominantly grain and livestock farmers. Fifty-nine percent of the farmers in the sample received the major part of their farm income from livestock, while 39 percent received the major part from crops. Very few sold only grain or only livestock. None of the farmers received the major part of the farm income from dairying. One farmer received the major part of his farm income from custom work; another from his turkey enterprise. Several of the farmers had relatively large turkey enterprises.

INVESTMENT ACTIVITY AND EXPECTATIONS

The investment activity of the farmers in the sample during the past 3 years and the planned activity for the next 3 years are summarized in table 2. On the average, planned total farm investment was $3,320 less than past total farm investment. Investment in buildings, machinery and

TABLE 2. MEAN CAPITAL INVESTMENT MADE BY FARMERS IN THE PREVIOUS 3 YEARS AND PLANNED IN THE NEXT 3 YEARS AHEAD (FIGURES ARE TOTALS OVER 3 YEARS FOR EACH OF THE ITEMS SPECIFIED).

Item	Mean	
	Past investment	Planned investment
Land	$ 3,651	$3,505
Buildings, fences and major repairs	3,469	2,614
Machinery and major repairs	3,630	1,859
Tile	494	377
Lime, fertilizer, grass seed for rotations	858	870
Livestock (not including feeder stock)	840	370
Other	—	27
Total farm investment	12,942	9,622
Household items	2,240	1,008

livestock explains a major part of the $9,662 planned farm investment. In the case of lime, fertilizer and grass seed, planned investment was slightly larger than past investment, but the differences are not statistically significant. The planned purchases of household items also were less than past purchases. These figures were obtained before incomes had become severely depressed from drouth conditions in central Iowa and from the cost-price squeeze which became more extreme in 1955 and 1956.

VARIABLES ASSOCIATED WITH PAST INVESTMENT

The figures on planned investment are simply the quantities which the farmers subjectively anticipated investing during the 3 years ahead. In this section we examine the variables related to the magnitude of expected investment. By use of regression procedures, an attempt was made to predict the effect of certain variables on quantity of expected investment over the 3 years following the enumeration. In a sense, the interfarm sample is used to make intrafarm predictions of investment. However, the analysis also can be looked upon as an attempt to account for differences between farms in the amount of new investment expected to be made in the 3 years ahead—1954, 1955 and 1956.

Several relatively complex decision models were considered as a basis for predicting past magnitudes of investment. The basic framework serving for construction of the question dealing with investment might be explained as follows: Optimal investment decisions are made when the farmer maximizes his utility.[2] His utility depends upon various aspects of the stream of prospective withdrawals from profits. These aspects include preferences for size, timing and variation of profit withdrawals. The farmer's utility may also be influenced by non-profit factors such as leisure, size of farm and ownership of certain assets. The stream of prospective withdrawals depends on three types of factors: (a) factors known at the time of decision-making, e.g., the amount and condition of the present assets of the farm firm (initial conditions); (b) unknown factors which are predicted, e.g., prices of inputs and outputs (expectations); and (c) factors which depend on the farmer's decisions (decision variables). The factors which then affect the farmer's decisions and amount of planned investment are (a) initial conditions, (b) expectations and (c) preferences pattern.

The model originally examined included these variables in a system of equations. The attempts were discarded, however, because it was thought that (1) alternative approaches would be just as efficient and (2) the nature of the data did not merit the large investment required in mathematical and clerical manipulations. It was decided that a simple least-square regression equation incorporating somewhat the same general variables outlined above should be used. The variables finally selected were those which were capable of quantitative measurement. Other important variables undoubtedly were excluded because they were not subject to measurement.

The function fitted is linear in logarithms of the form indicated in equation 1 where the variables are those as defined below:

$$(1) \quad \hat{y} = a\, x_1^{\beta_1} x_2^{\beta_2} x_3^{\beta_3} x_4^{\beta_4} x_5^{\beta_5} x_6^{\beta_6}$$

x_1 = total capital currently invested in the farm business and farm household.

x_2 = equity ratio defined as total capital owned by the farmer divided by the total capital employed.

x_3 = the farmer's expectation of the most probable general level of prices paid to Iowa farmers in 1960 (see later discussion). This quantity indicates the level of prices the farmer expected to "be most likely," although he considered that other price levels also were possible.

x_4 = the range of his expectations for the 1960 price level, as an indication of the degree of uncertainty with which expectations were held. The range was measured by the difference between the highest and lowest price level which the farmer expected to be possible in 1960. In defining these limits, an attempt was made to have the farmers include a "subjective probability range" of 0.95 in specifying the range.

x_5 = the farmer's time discount, as a measure of his impatience for income from alternative uses of capital. The time discount or degree of impatience was measured by a series of questions involving the sum which the farmer would pay now to obtain a certain income in specified future years. (See later discussion.)

x_6 = risk discount measured by asking the farmer the amount he would "take off" (discount) the expected income per dollar invested in feeder cattle, a dairy herd and hogs, in deciding whether to invest in each enterprise. This amount was expressed as a percent of the dollar invested or as a discount. The discounts for the three enterprises were averaged to obtain a single variable, the risk discount, measuring the willingness to take chances.

y = total planned investment in the farm over the 3-year period, 1954, 1955 and 1956.

The relationship in equation 1 supposes that planned investment is a function of initial conditions, expectations and preference pattern: x_1 and x_2 represent initial conditions, x_3 and x_4 represent expectations, and x_5 and x_6 represent the preference pattern. The equation derived is equation 2 below.

$$(2) \quad \hat{y} = 0.0060\, x_1^{1.1161} x_2^{1.0151} x_3^{0.2096} x_4^{0.0098} x_5^{0.1252} x_6^{-0.3982}$$

The regression coefficients provide elasticities indicating the relative effect of independent variables (x's) on planned investment ($\hat{y}$); i.e., the percentage change in total planned capital investment associated with a 1-percent change in the variable. On the basis of this equation, a 1-percent increase in current capital (x_1) would provide a 1.1161-percent increase in total expected investment ($\hat{y}$) while a 1-percent increase in equity (x_2) would provide a 1.0151-percent increase in ex-

[2] See the following for more details on these points: Hurwicz, Leonid. Theory of the firm and of investment. Econometrica 14: 109-137. 1946; Tintner, G. Pure theory of production under technological risk and uncertainty. Econometrica 9: 305-312. 1941; Kalecki, M. Essays in the theory of economic fluctuations. Allen and Unwin, Ltd., London. 1939.

pected investment ($\hat{y}$). Equation 2 also suggests that a 1-percent increase in the range of expectations (degree of uncertainty, x_4) and time discount (degree of impatience, x_5) would result in an increase in total investment. Predictions of this type are inconsistent with the logic previously outlined. Accordingly, it appears that these variables might well be dropped from the investment equation.

As far as the measurements developed for this study are concerned, it appears that the three variables x_3, x_4 and x_5 either (1) could not be measured with a sufficient degree of accuracy to allow expression of any relationship between their magnitude and planned capital investment or (2) are not closely related to investment. Considering the subjective nature of the measurements, it is expected that the first is the more logical explanation. Empirical evidence also exists for dropping these variables from the equation. If the assumption of independence and normality of errors is made, the significance of the coefficients may be tested. Table 3 indicates the level of significance for the hypothesis that the β's equal zero. Variables x_1, x_2 and x_6 are significant at probability levels of 5 percent or less. Evidence exists that β_1, β_2 and β_6 are not zero; little evidence exists that β_3, β_4 and β_5 are not zero. Accordingly, a new function was used which includes only x_1, x_2 and x_6. The equation obtained is equation 3 below.

$$(3) \quad \hat{y} = 0.0936\, x_1^{1.1338}\, x_2^{0.7963}\, x_6^{-0.2349}$$

The 5-percent confidence intervals for the regression coefficients in equation 3 are given in table 4. The coefficient of capital remains significant at the same level, while lower probability levels are obtained for the equity and risk discount coefficients. The confidence limits indicate the relatively large uncertainty in the predictions involved. Equation 3 indicates that a 1-percent increase in capital (x_1) provides a mean prediction of a 1.1338-percent increase in expected investment ($\hat{y}$) over the next 3 years; equation 3 also indicates that a 1-percent increase in equity (x_2) provides a 0.7963-percent increase in expected investment and that a 1-percent decrease in risk discount (x_6) provides a 0.2349-percent increase in expected investment.

TABLE 3. LEVEL OF SIGNIFICANCE OF REGRESSION COEFFICIENTS IN EQUATION 2.

β value for	Level of significance (percent)
x_1	1
x_2	5
x_3	*
x_4	*
x_5	50
x_6	5

* Less than 50 percent.

TABLE 4. FIVE-PERCENT CONFIDENCE INTERVALS FOR THE REGRESSION COEFFICIENTS IN EQUATION 3.

β value for	5-percent confidence intervals	
	Lower	Upper
x_1	0.7487	1.5189
x_2	—0.2673	1.8599
x_6	—0.6058	0.1360

TABLE 5. INCREASE IN PLANNED CAPITAL INVESTMENT CAUSED BY A 1-UNIT INCREASE IN EACH INDEPENDENT VARIABLE, WITH OTHERS HELD CONSTANT AT THEIR MEANS.

Variable	Increase in planned capital investment*
Present capital	$ 0.14†
Equity ratio	87.07‡
Risk discount	—118.34§

* Derivatives from equation 3, starting from the mean of the particular variable, and with other variables constant at their sample means.

† Increase in planned investment in 1954, 1955 and 1956 per $1 of present total investment.

‡ Increase in planned investment in 1954, 1955 and 1956 per 1-percent increase in operator's equity.

§ Decrease in planned investment in 1954, 1955 and 1956 per unit increase in risk discount. (If risk discount is decreased, planned investment is predicted to increase by this amount.)

The multiple correlation coefficient (R) for equation 3 is 0.6086, indicating that about 37 percent of the variation in planned capital investment can be explained by the present capital investment, risk discount and equity of the operator. Of these three variables, capital explains the greatest proportion of variance in planned investment, while a unit change in risk discount has the greatest numerical effect on the mean predicted magnitude of investment. The magnitudes of current capital investment and equity ratio are positively associated with the magnitude of planned investment. However, an increase in risk discount is negatively associated with planned investment. As risk discount increases, planned investment decreases and vice versa. The coefficients in equation 3 provide a basis for predicting the absolute increase or decrease in magnitude of planned investment associated with unit increases in x_1, x_2 and x_6. The increase in planned capital investment, related to increases in these variables starting from their means, are presented in table 5. These figures can be termed *mean marginal investment* quantities and are derivatives of total planned investment with respect to each of the three variables, with the others held constant at their sample means.

With equity ratio and risk discount constant at their means, a $1 increase from the mean present capital investment is predicted to "increase" planned capital investment by $0.14. A 1-unit increase in equity ratio is predicted to increase planned capital investment by $87.07. Or perhaps a more realistic statement, considering the interfarm nature of the sample, is that farms with higher equity ratios had plans for greater total capital investment in the 3-year period. As a marginal quantity, with calculations again referring to the mean, a 1-unit decrease in risk discount is predicted to increase planned investment by $118.34. The qualitative nature of these predictions is perhaps more important than their quantitative magnitudes. The relationships expressed confirm the hypothesis provided by theory: The increasing risk principle, a reflection of the manager's equity and risk discount, have the most

TABLE 6. CORRELATION COEFFICIENTS BETWEEN SELECTED VARIABLES AND TOTAL PLANNED CAPITAL INVESTMENT, PLANNED BUILDING INVESTMENT AND PLANNED MACHINERY INVESTMENT.*

Variable	Total planned capital investment	Planned building investment	Planned machinery investment
Present capital investment	0.5668†	0.3567†	0.2834†
Equity	0.2304†	0.0634	0.0110
Level of 1960 expectations	0.0155	—0.0092	—0.0330
Range of 1960 expectations	—0.1614	—0.0060	0.0820
Time discount	—0.1517	—0.0326	0.0829
Risk discount	—0.2557†	—0.2255†	—0.1414

* Data in logarithms.
† Significant at the 5-percent level of probability.

important quantitative effect on investment commitments.[3] Additional studies of more homogeneous populations of investors are needed to more precisely evaluate the quantitative effect of the above and other variables on investment decisions.

RELATION OF VARIABLES TO SPECIFIC CAPITAL INVESTMENT ITEMS

The association of the variables mentioned above with total planned capital investment, planned building investment and planned machinery investment is indicated in table 6. While the correlations between the selected variables and total planned capital investment are quite low, except for present capital investment, the signs of the correlation coefficients are consistent with the economic logic presented earlier. However, the correlation coefficients for the individual items of planned building and machinery investment do not show this consistency. The correlation coefficients of capital and risk discount with planned building investment were significant at the 5-percent level of probability. Only the coefficient for capital was significant at this level for planned machinery investment.

[3] See Kalecki, ibid.

The investment period under consideration extended for only 3 years. During a period as short as this, machinery and buildings tend to serve as technical complements. That is, if farming of a particular type is to be continued, building repair or machine replacement becomes a necessary expenditure for maintaining the bundle of resources used in production. Hence, the prices of such items may be only slightly related, or not related at all, to the particular purchase. For this reason, a greater association between planned investment and specific variables might be obtained for a period extending beyond 3 years.

CHARACTERISTICS OF INVESTING FARMERS

The means of age, equity, acres operated, current investment in total quantity of capital and liquid assets, 1960 expectations and risk discount are shown in table 7 for farmers whose expectations for investment fell in the indicated categories. Again, of the items indicated, the important variable is current capital investment—expressed either in total investment, in liquid assets or in acres operated. It is very likely true that the farmers operating the largest farms and employing the greatest quantity of capital have the greatest income. These farmers, therefore, have the greatest surplus of revenue over consumption and debt retirement to be invested.

As mentioned previously, no relationship occurred between planned investment and expectations. However, before the survey, prices had been favorable to profits and farmer expectations generally represented only a slight change from this situation. The relationship between expectations and planned investment might have been more pronounced if measured after the period 1954-56, when prices declined and income was depressed. Also, it is likely that questions of expectations should have referred more directly to the years of planned investment; planned investment referred to the period 1953-56, while price expectations were for the year 1960. Price expectations

TABLE 7. MEANS OF AGE, EQUITY, ACRES OPERATED, CAPITAL, LIQUID ASSETS, 1960 EXPECTATIONS AND RISK DISCOUNT FOR FARMERS EXPECTING TO INVEST IN SPECIFIED RANGES FOR PARTICULAR ITEMS.

Range of planned investment in particular items	Age	Equity	Acres operated	Current total capital investment	Current investment in liquid assets	Level of 1960 expectations	Risk discount
Land							
$0	46.6	86.4	191	$ 71,299	$12,777	260	19.4
over $60	47.2	95.3	205	104,117	23,902	255	16.0
Buildings							
$2,500 or less	48.2	86.2	173	65,575	11,310	262	19.9
over $2,500	44.7	89.7	221	90,311	18,553	255	17.7
Machinery							
$1,800 or less	47.8	85.4	169	64,502	11,288	265	20.2
over $1,800	44.7	91.5	236	95,842	19,657	249	16.7
Tile, etc.							
$350 or less	47.5	88.9	178	64,191	12,809	257	19.2
over $350	44.8	84.4	229	104,738	18,054	264	18.5
Fertilizer, etc.							
$800 or less	47.7	85.2	161	61,767	11,049	265	20.9
over $800	45.6	90.5	231	92,526	18,189	253	16.6
Livestock							
$350 or less	47.6	87.9	186	75,431	15,050	254	14.6
over $350	43.7	86.7	217	77,170	11,910	278	17.0

for the year 1960 were used since, in a pretest of questions, it was found that the level of prices farmers expected by 1955 and 1956 generally was closely related to the level expected in 1960. However, there may have been enough farmers in the larger sample expecting prices to move in two different directions over the period 1953-60, to obscure the actual relationship between planned investment and expectations for the general level of farm prices. Too, the price index for which expectations were obtained is highly aggregative. The index may not be sufficiently related to prices of particular products, the expectations for which may have an important effect on investment planning. As table 7 indicates, the means of equity were higher and the means of risk discount were generally lower for farmers expecting to make the largest investment in each category.

TYPES OF DECISIONS

Not all of the investment decisions made by farmers are of a "studied" nature. Some decisions are made with little conscious planning and should therefore be considered as "routine" or "forced action" rather than as "studied" decisions. As considered in this report, a decision can be classified as "studied" only if the decision-maker has evaluated the consequences of this decision in the light of his future expectations. To determine which kinds of decisions are "studied," farmers were asked the highly subjective question of whether or not they formulated expectations about selling prices or yields in making certain decisions. The results are summarized in table 8.

Neither the size of an investment nor the length of time for which an investment is made appears to be the dominant factor in determining whether or not an investment decision is of the "studied" type. From the replies, the setting in which an investment is made, and the need or lack of need for "forced action" or "routine" decisions, seems to be more relevant in this respect than the characteristics of the investment itself. Only those farmers who were in a position to change their plans substantially would make a "studied" decision in replacing a tractor which had broken down or a barn which had burned. Most farmers would expend funds automatically to obtain an asset which provides them with like services in carrying through on a farm plan already underway. Thus, a farmer with a high value of assets typically makes a greater "forced action" or "routine" investment than a farmer with few assets, simply because of the magnitude of depreciation.

TABLE 8. PERCENTAGE OF FARMERS FORMULATING EXPECTATIONS AND MAKING "STUDIED" DECISIONS IN THE PURCHASE OF SELECTED ITEMS.

Items on which decision is made	Percentage of farmers	
	Formulating expectations and making "studied" decisions	Not formulating expectations and using "routine" decisions
Purchase small tools	4.0	96.0
Purchase gasoline and oil	3.0	97.0
Repair or replace tractor	0	100.0
Replace barn	9.1	90.9
Purchase feeder cattle	92.9	7.1
Purchase land	99.0	1.0
Purchase fertilizer	66.7	33.3
Purchase commercial feed	35.4	64.6

In most cases, the purchase of such items as small tools, gasoline and oil are "routine" decisions. Purchase of these items appears to be "routine" because (a) they are purchased frequently and (b) the farmer has no alternative but to purchase such items if he is to carry on the operation of his business. In the short-run, these items are technical complements with other resources committed to the production plan. Hence, if revenue will exceed costs, the item can be profitably purchased regardless of its particular price. Or, the price of the technical complement may be low relative to other assets which have not been expanded or which could be sold in the market only at a lower price than the recovery value of their services. Obviously, then, the price expectations of the technical complement item may not be subjected to great study. In contrast, decisions to buy feeder cattle or land are "studied" decisions for most farmers: Expectations of future prices and yields are generally formulated in the purchase of land and cattle because such investments usually are not essential for the farmer to stay in business or to complete a specific plan already underway. The cattle feeder has the alternative of selling his grain; the prospective land-buyer usually can rent land or postpone investment until a later date.

As shown in table 8, decisions to purchase commercial feed or some quantity of fertilizer are not so easily classified as either "studied" or "routine." Again, the reason for the type of decision made is highly situational. Farmers who are "sold" on the use of commercial fertilizer and consider it an integral part of their crop program probably feel that purchase of this item is a "routine" decision. On the other hand, the farmer who remains skeptical of fertilizer use probably formulates expectations of profits both with and without fertilizer before making his investment; i.e., he makes a "studied" decision. In the case of commercial feed purchases, the availability of substitutes and the possibilities of buying in large quantity (stocking up) are probably the main reasons for making a "studied" decision. Also, feed purchases often can be linked directly to livestock decisions, such as investment in feeder cattle. However, about two-thirds of the farmers interviewed felt that, for their situations, commercial feed purchases were "routine." As used here, commercial feeds refer to minerals and protein supplements. Hence, the main "studied" decisions may come with plans to raise hogs or feed cattle and to use purchased or home-grown grain; commercial feed then is a near-necessity and will ordinarily be purchased, within a reasonable range, regardless of price.

PRECAUTIONARY METHODS USED AND BASIS FOR INVESTMENT DECISIONS

The study included an analysis of selected precautionary methods which farmers indicated they used in making investments. A precautionary measure is a procedure designed to help insure against extreme losses in case price expectations or plans prove to be highly incorrect. To determine the relative importance attached to the selected precautionary alternatives, a card containing the following questions and a checklist of alternative responses was given to each farmer interviewed:

When deciding to invest your own or borrowed money, do you use any of the following methods for taking care of the risk involved?

1. Keep the percent of money borrowed low (have most of the money on hand before buying).
2. Diversify or spread investment between enterprises and practices.
3. Don't buy an item unless you can't get along without it.
4. Invest in those enterprises and practices which paid in the past.
5. Figure what the interest would be, and make sure you will make more than enough to pay back the investment.
6. Increase the expected costs and reduce the prices (i.e., discount or lower net returns) in deciding the amount to invest, or whether to invest.
7. Select only a highly certain enterprise for investment.
8. Invest less than the total amount profitable.

The farmer then was asked to specify whether he used the precautionary method (a) in general and (b) for particular investments. The responses are summarized in table 9.

Maintaining a high equity, diversifying and buying on "a need basis" ranked in that order as the methods of decision-making which were mentioned by the most farmers for one or more investment decisions. Roughly the same pattern holds true for the *one* method used most often, in general, in making decisions.

Methods 4 through 8 involve a more refined formulation of expectations than the first three. Even investment in highly certain enterprises (method 7) or investment based upon past experience (method 4) are forms of decision-making involving expectations, since the farmer is assuming that the future will be similar to the past. Livestock decisions appear to involve more formulation of expectations than other types of decisions. Past experience was the most important element in decisions of farmers for fertilizer purchase. Again, it appears that refined formulation of expectations evidently plays a minor role in the investment decisions involving only machinery or buildings. Given the short-run framework in which this study was conducted, almost two-thirds of the farmers interviewed stated that decisions on investment in machinery and building were primarily dictated by needs.

TABLE 9. PERCENTAGE OF FARMERS LISTING VARIOUS METHODS OF DECISION-MAKING IN INVESTING UNDER UNCERTAINTY.

Method	Percent using method for one or more investment purposes	Percent using method in general	Percentage of farmers listing method as first choice in buying		
			Machinery and buildings	Livestock*	Fertilizer†
1	93.9	33.3	27.3	14.1	14.1
2	88.9	16.2	0	6.1	1.0
3	83.8	22.2	62.6	2.0	4.0
4	76.8	18.2	6.1	20.2	55.6
5	75.8	3.0	2.0	12.1	4.0
6	62.6	3.0	2.0	26.3	1.0
7	40.4	3.0	0	12.1	2.0
8	25.3	1.0	0	3.0	5.1

* Four percent of the sample did not give a response for various reasons.

† Thirteen and one-tenth percent of the sample did not give a response for various reasons including non-purchase of fertilizer.

An attempt was made to determine if the precautionary methods differed depending on the use of borrowed funds or owned funds. Farmers were asked whether they would change the emphasis on the precautionary methods used if (1) where the funds are now predominantly owned, borrowed funds were used and (2) where the funds are predominantly borrowed, owned funds were used. The question is, of course, highly subjective and was answered in terms of the farmer's current financial position and his psychological attitude toward the risk involved in the two situations. His attitude might actually change if the financial setting were switched. However, in terms of the manner in which the question was posed, indications were that the source of the funds had little influence upon the precautionary methods used. On the other hand, 96 percent of the farmers indicated they would be more conservative if borrowed funds were substituted for owned funds but that they would not change the precautionary methods used. Of the four farmers who stated they would change their method, one said he would seek the advice of his banker; the other three said they would not used borrowed funds unless they were almost absolutely certain of the success of the venture.

The previous discussion suggests reasons why it is difficult to effectively predict or quantitatively explain investment with an equation using simple quantitative variables which are easily measured. Not only are decisions affected by highly subjective variables which are not easy to measure, but also quite different empirical models need to be used for different categories of investment. Further research is needed to determine how and whether the important variables can be effectively included in any regression equation. Given the phenomena concerned, the explanation of 37 percent of the variance in expected future investment by the three variables of equation 3 is perhaps a considerable success.

DECISIONS ABOUT INVESTMENTS IN INNOVATIONS

An innovator can be defined as a person who relies largely or entirely upon his own judgment in making a decision about investing in a new prac-

tice or piece of equipment. In other words, he is a person who formulates a fairly definite pattern of expectations of outcome and, on this basis, is willing to commit his capital to a new practice or technique. In contrast, the non-innovator withholds adoption of a new practice until it has been tried and proven on other farms; or, until the uncertainty in adoption is now near zero for his farm.[4]

Questions were designed to determine the willingness of farmers to invest in innovations. For this purpose, farmers were presented with a list of seven alternative methods of making an investment decision in a new practice. While the list does not exhaust all possibilities, it appears to cover most of the categories employed and suggests whether farmers fall in the "innovator" or "imitator" class, in respect to investment. Farmers were first asked which method they had used predominantly in making past investment decisions and, then, which method they now considered best. Following is a list, in abbreviated form, of the seven alternatives:

1. Wait until all your neighbors have tried it out.
2. Wait until a few neighbors have tried it out.
3. Ask the extension specialist if it is a good practice, and don't pay any attention to your neighbors.
4. Ask the salesman if it is a good practice.
5. Figure out for yourself, from various sources of information, if it is a good practice without the help of neighbors and extension people.
6. Ask extension people, and wait until a few neighbors have tried it.
7. Ask salesmen, and wait until a few neighbors have tried it.

The results are summarized in table 10. The table can be interpreted in this manner: Thirty-nine farmers had predominantly used method 2, "waiting until a few neighbors have tried the innovation." However, only 26 of the 39 now thought that this was the best method. Two of the 39 indicated method 3, 10 indicated method 6 and one indicated method 7, in their current appraisal, as being the best method in deciding on innovation investments.

Table 10 suggests that relatively few innovators existed in the sample. At the time of the survey, 24 of the 96 farmers felt that method 5, relying on your own judgment alone, was the best method. However, only 20 farmers said they actually had used this method in the past. Combining methods 2 and 6 led to the conclusion that more than 60 percent of the farmers now would wait until their neighbors had used the practice before they tried it. Only one farmer was extremely conservative in wanting to wait until all of his neighbors had tried out the new practice before he adopted it. Not a single farmer stated that he was willing to adopt a new practice solely upon the recommendation of a salesman, and only about 20 percent of the farmers would adopt a new practice on the basis of a recommendation by the extension specialist alone. However, perhaps this latter group should be considered as near-innovators.

Little inconsistency is observed between the methods farmers think are best and those which they say they actually use. The main inconsistency appears in method 6, "ask extension people, and wait until a few neighbors have tried it." Twenty-four farmers said this was the best method, but only 14 farmers said it was the method they actually used. Ten of the farmers who recommended this method said that they relied only upon the experience of neighbors.

Only about 20 percent of the farmers examine a practice and adopt or reject it solely upon the basis of their own judgment. These farmers, in effect, provide a demonstration and empirical evidence which serves as the basis of decision by other farmers. If the innovation proves successful, neighbors also adopt the practice after varying periods of time. As has been suggested elsewhere, this aspect of innovation investment has important implications for extension work.[5] The innovators appear to be persons who can think deductively and in terms of general principles. The followers appear to more nearly be persons who think inductively and use the empirical evidence of outcomes from nearby farms in predicting to their own units. They evidently make inferences from a particular demonstration to a general situation including their own farm. In contrast, the innovator may infer from a general principle or set of phenomena to his own particular situation.

[4] For additional information regarding innovation and adoption of farm practices, see: North Central Regional Publication No. 1 of the Agricultural Extension Services. How farm people accept new ideas. Special report No. 15. Iowa Agr. Ext. Ser. 1955.

TABLE 10. NUMBER OF FARMERS USING DIFFERENT METHODS IN MAKING PAST INVESTMENT IN AN INNOVATION, AND NUMBER WHO NOW BELIEVE A PARTICULAR METHOD TO BE BEST.

Method	Number of farmers using method	Method now believed best by farmers who have previously used method in column 1						
		1	2	3	4	5	6	7
1	1	1	—	—	—	—	—	—
2	39	—	26	2	—	—	10	1
3	18	—	6	7	—	4	1	—
4	—	—	—	—	—	—	—	—
5	20	—	1	—	—	19	—	—
6	14	—	—	—	—	1	13	—
7	4	—	1	—	—	—	—	3
Totals	96	1	34	9	—	24	24	4

SOURCES OF ADVICE FOR INVESTMENT DECISIONS

A number of individuals are available in the community to whom the farmer may turn for advice in making investment decisions. To determine which of these several persons might have the greatest effect on investment decisions, each farmer was asked to name the one individual who helped him most, or whose advice he mainly sought, in making decisions to invest in various items. The list refers only to the advice on whether the investment should be made. It does not refer to other advice regarding things such as

[5] Ibid.

TABLE 11. PRINCIPLE SOURCES OF ADVICE SOUGHT BY FARMERS IN MAKING SELECTED INVESTMENTS.

Investment	Wife	Relatives	Banker	County agent	Other person	No one
Household items	84	6	1	—	—	5
New car	69	4	1	—	—	22
Feeder cattle	25	8	21	—	6	36
More land	70	3	10	1	2	10
New tractor	30	7	3	—	4	52
Portable hog house	13	7	2	1	1	72
Fertilizer	10	6	—	14	8	58
Fence	8	2	—	2	—	84

the kind, size, location or other characteristic of the asset. If the latter type of information had been considered, a large number of other persons, such as dealers, might have been included.

Farmers indicate that their wives are the persons whose advice is most often sought in deciding to make purchases of household items, a car or land (table 11). This heavy dependence on the advice of the housewife may be explained by the fact that household items and the car are used considerably by the wife. The decision to buy land is one which affects the life of the entire family for some time. Hence, it is not surprising that this is a purchase in which the wife is extremely concerned. Four of the five farmers receiving advice from "no one" on household items did not have wives.

For the purchases considered in table 11, the advice of relatives does not play an important role. Surprisingly few farmers named bankers and county agents as important sources of advice in actually deciding to make an investment. However, these sources undoubtedly are much more important for details on the time, kind or nature of the item after the decision has been made to invest in it. More farmers turned to the banker for advice when purchasing feeder cattle than in making any other purchases, perhaps because banks often provide the capital for this investment. Even in this decision, however, the wife was mentioned more frequently than the banker as the major source of advice. The advice of county agents is used by more farmers in the purchase of fertilizer than in any other decision, perhaps because this item involves technical information related to crop response and soil tests. As mentioned earlier, however, most farmers appear to base initial decisions to purchase fertilizer upon their own studied procedures.

Interrelationships between the firm and the household are extremely important in investment decisions. This fact is illustrated in table 11 by the heavy reliance placed upon wives in making investment decisions. It would be highly unusual if the farmer considered his wife as a greater authority on portable hog houses than, say, the county agent. Hence, if only the profitability of the hog house were involved, the operator might place more reliance upon the county agent and less upon the wife. However, a more important decision concerns the relative benefits to the entire family of using limited funds in the purchase of a hog house, as compared with using these same funds in the purchase of a refrigerator or television set. Only the values and preference system of the family can decide the best allocations of funds between the firm and household.

EXPECTATIONS OF PRICES

Investment rests upon the important bases of expectations and uncertainty of future prices. If the farmer knew with certainty that prices of particular products were to increase, his decision would be easy: Invest as much capital as can be obtained in each. If a price decline were certain, decision to withhold investment would be similarly easy. However, it is the uncertainty of the expectation, and the chance of error and loss from the investment decision, which causes conservatism in investment and use of precautionary measures. To obtain better knowledge about farmers' expectations of future prices, information on price expectations was obtained as outlined below.[6]

EXPECTATION QUANTITIES

As a preliminary question on expectations, the farmers were asked if they considered the future to be favorable or unfavorable for capital investment in farming. They also were asked their reasons for the viewpoints expressed. Seventy-eight percent of the farmers viewed the outlook for the future as favorable. The major reason for optimism appeared to be faith in a high future level of demand due to continuance of government programs and population growth. Those farmers with an unfavorable outlook mentioned the downward inflexibility of costs along with an anticipated decline in demand as reasons for their position.

More explicit information was needed, however, before a measure of the expectational pattern held by farmers could be devised. Given the current (at the time of the survey) price index of 286 for all products sold by Iowa farmers, operators were asked to predict the most probable "index level of prices received" by Iowa farmers in 1954, 1960 and 1970. They also were requested to predict the highest and lowest index level expected, with only 1 chance in 100 that the index would go higher or lower. Both the level and range of expectations for each farmer were developed from the answers given. The range of expectations (the highest probable price minus the lowest probable price) is the measure of the uncertainty of expectations mentioned earlier. Another measure of uncertainty which was used is the ratio of the range to the

[6] The most probable expectation of price level or the uncertainty of expectations, as measured by the range of possible outcomes, showed no relationship with planned investment in equation 3. However, there are reasons why this difficulty arises: The expectations obtained were for an index of all prices and may not have been sufficiently related to the expectations for the particular products and assets for which decisions related. Also the time of expectations (1960) may have extended too far beyond the period (1954-56) for which the planned investment was enumerated. Finally, the psychology of the manager and his particular visions of uncertainty may need to be related to expectations before they can be used in any precise prediction of investment. However, the price expectation data are of interest in their own right and are presented in the following section.

TABLE 12. MEAN VALUES OF SELECTED CHARACTERISTICS OF THE INDEX OF PRICES EXPECTED BY FARMERS IN 1954 AND 1960.

Characteristic	Mean*	
	1954	1960
Most probable level of prices expected	272.3	259.3
Highest level probable	299.3	306.4
Lowest level probable	228.1	186.2
Range (highest probable level minus lowest probable level)	71.2	120.2
Uncertainty ratio (range divided by most probable level)	0.26	0.49

* Number of observations was 98 for 1954 and 95 for 1960.

most probable price (i.e., the range divided by the most probable price): The higher the ratio, the greater is the degree of uncertainty associated with the expectations. The most probable level of the price index was used as the measure of a farmer's level of expectations. The mean values of selected characteristics for expectations of the index of prices in 1954 and 1960 are shown in table 12.

Table 12 shows that, on the average, farmers predicted that the most probable price level in both 1954 and 1960 would be below the index level of 286 prevailing at the time of the survey. A decline in prices between 1954 and 1960 also was anticipated by the farmers. Both the 1960 range and uncertainty ratio increased greatly over those of the 1954 expectations. Only 15 percent of the uncertainty ratios were above 0.5 for 1954, while 42 percent of the 1960 ratios were above 0.5. These results indicate that a higher degree of uncertainty existed for the 1960 expectations than for the 1954 expectations. The majority of farmers in the sample were so uncertain about 1970 prices that they would give their expectations only in qualitative terms. Farmers were about equally divided in predicting an upward or downward trend in agricultural prices by 1970. Theoretical statements suggest that the degree of uncertainty associated with future events increases with the span of time for which predictions are made. The figures on uncertainty cited above provide positive empirical support for this hypothesis.

TIME DISCOUNT

Theory also suggests that most individuals receive greater utility from present income than from the same income forthcoming in some future period. An attempt was made in this study to "subjectively" measure the time discount (degree of impatience) associated with the income stream. Each farmer was asked a series of questions involving the sum he would be willing to pay at the present time to obtain a certain income in specified future years. Discount rates based on these figures were computed for each year separately; then the resulting values were averaged to obtain a single variable representing the "degree of impatience" of the farmer. Obviously, a high time discount rate indicates a greater "degree of impatience" than a low time discount rate. This measure of time discount was one of the variables originally used in the prediction for planned investment. It should be noted that this measure is not a "pure" time preference relating alone to utility or the indifference map, since the farmer was requested to consider alternative investment opportunities in answering the question. The mean time discount for the sample was 19.2 percent.

As the simple statistics in table 13 indicate, age and number of dependents were not associated with the magnitude of time discount. However, the levels of capital and equity appear to be inversely related to the rate of time discount. This relationship provides evidence that the measure of time discount is probably quite reliable; it is expected that farmers in a relatively sound financial position would place a lower preference on present income than farmers who have a less secure financial position.

A second question also was used in an attempt to measure farmers' discount rates. The farmer was asked to indicate the income needed to induce him to make an investment giving a lump-sum return in 5 years, rather than an investment which would give him a specified income in each of the 5 years. The higher the lump-sum needed, the greater the rate of discount expressed by the farmer.[7] The year-by-year investment alternative supposed that $1,000 would be committed each year as an annual cost and would return $1,050 in the same year. The lump-sum investment supposed that $5,000 would be committed in the first year, with no return forthcoming until the end of the fifth year. The mean premium required for farmers to choose the lump-sum investment was $1,230. In other words, the lump-sum return at the end of 5 years would need to be $6,480; $5,000 to return the capital invested, $250 to substitute for the 5-percent return on the year-by-year investment and $1,230 for the time discount. Figures in table 14 show the relation-

[7] Very similar relationships existed between this measure and average time discount, as can be seen by comparing tables 13 and 14. This consistency provides a basis for greater confidence in the measure of average time discount than if the consistency did not exist. However, it was decided to use the measure of average time discount in prediction equation 3, since this measure appeared to have slightly more relationship to planned capital investment than the "extra income needed" measurement.

TABLE 13. MEAN AGE, NUMBER OF DEPENDENTS, CAPITAL AND EQUITY FOR FARMERS FALLING IN TWO INTERVALS OF AVERAGE TIME DISCOUNT.

Average time discount	Percent of all farmers	Mean			
		Age	Dependents	Capital	Equity
20 or less	71	47.1	2.6	$81,807	91.8
Over 20	29	46.9	2.9	$66,146	78.6

TABLE 14. MEAN AGE, NUMBER OF DEPENDENTS, CAPITAL AND EQUITY FOR FARMERS FALLING IN TWO INTERVALS OF INCOME PREMIUM.

Extra income needed to make the lump-sum investment acceptable	Mean			
	Age	Dependents	Capital	Equity
$800 or less	47	2.2	$85,528	92.5
Over $800	46	3.1	$66,866	83.2

ships between selected characteristics of the farmers and "high" and "low" discount rates (i.e., "large" and "small" premiums required to cause the lump-sum investment return to be equally as desirable). As is expected, farmers with high discount rates tend to have more dependents, less capital and a lower equity than the group with low discount rates.

WILLINGNESS TO TAKE RISK

A measure of willingness to take risk was obtained by asking the farmers to rank themselves in this respect, as compared with the average of farmers they knew. Each higher rating in table 15 indicated an increasing willingness to take risks. While over half of the farmers placed themselves in the average category, 35 percent ranked themselves below and 13 percent ranked themselves above the average. The two characteristics associated with willingness to take risk appear to be total capital of the farmer and magnitude of his risk discount (explained earlier). These results are generally consistent with those expected: The person with the greatest amount of capital can take more risks, without bringing on bankruptcy, than the person with fewer funds. Similarly, the person who discounts the future least for risk generally has most confidence in his expectations and is willing to commit a plan based on them.

A comparison was made between the risk ratings given by the husband to himself and to his wife. Table 16 indicates that very few husbands considered their wives to be more willing to take chances than themselves. For example, two farmers gave themselves a rank of 5 relative to the average rank of 3. However, neither of these ranked his wife as high in her willingness to take risk. Of the 11 giving themselves the rank of 4 (one rank above the average of their acquaintances), only two ranked their wives this high. In view of the importance of the wife as a source of advice in decision-making, the greater conservatism expressed for the operator's wife may have important effects on the type of investment actually made.

LAND INVESTMENT

Typically, the most important single economic decision made by farmers is that of land purchase. Except for those few who inherited their land, all of the farmers in the sample had made the decision to purchase the land at some time in the past. Several questions were designed to obtain information about decision-making procedures in land purchases.

Farmers in the sample were asked to name the main methods which they used in deciding to purchase a farm; i.e., the methods used in bringing them to a final decision. Practically none indicated waiting a determinate period for a favorable price/cost ratio, other than a period of 3-5 years. Mainly, the problem was one of accumulating sufficient funds for an equity base before buying a farm. Ordinarily, the decision to buy a farm was made first; then detailed examination was given of where to locate a good buy or a favorable community location. The questions asked emphasized the "fairly final" procedures used in coming to a decision to buy. Open questions were asked to avoid suggestive answers, and the replies were "probed" until it appeared that the final bases had been indicated. Of course, the answers sometimes required that the farmer delve into his decisions of several years back. It is likely that some memory bias thus creeps into the answers, and some important reasoning may be excluded accordingly.

As table 17 indicates, a number of farmers simply waited until they had enough money for

TABLE 15. MEAN AGE, CAPITAL, EQUITY AND RISK DISCOUNT FOR FARMERS GIVING THEMSELVES INDICATED RANKS IN WILLINGNESS TO TAKE RISKS.

Ratings*	Percentage of all farmers	Mean			
		Age	Capital	Equity	Risk discount
1	8	51.1	$41,660	82.0	20.3
2	27	46.8	$65,541	94.2	19.6
3 (average)	52	46.6	$73,380	86.3	18.6
4	11	46.5	$127,567	81.5	18.4
5	2	42.0	$130,037	99.1	16.6

* The ratings used are as follows: 1-extremely conservative; 2-fairly conservative; 3-average; 4-fairly daring; 5-extremely daring.

TABLE 16. COMPARISON OF RISK RATINGS GIVEN BY FARMERS TO THEMSELVES AND TO THEIR WIVES.

Rating of husband*	Number farmers†	Husband's risk rating of wife‡				
		1	2	3	4	5
1	8	4	2	—	—	—
2	26	7	14	2	—	—
3	51	2	21	19	1	—
4	11	2	1	6	2	—
5	2	—	1	1	—	—

* For definition of ratings see footnote, table 15.
† Number not same as in table 15 since two farmers ranking themselves were not willing to rank their wives.
‡ Because not all farmers have wives, the total number of wife ratings is unequal to the total of farmers in each rank.

TABLE 17. METHODS USED BY FARMERS IN MAKING PAST AND FUTURE DECISIONS TO BUY LAND.

Method	Percent of all farmers	
	Used this method in the past*	Would use this method in the future*
Have enough for down payment and buy then	17.2	32.3
Figure if could make payments over "safe" number of years	51.5	36.6
Compare estimated long-run land value with market price	13.1	7.1
Compare owning to renting	5.1	—
Had the long-run value of land appraised and compared with market price	16.2	—
Bought below market price from relative	15.2	—
Inherited all or part	13.1	—
Had to move and could not find a farm to rent	7.1	—
Consider buildings available for type production preferred	3.0	6.1
Would not consider buying more land	—	6.1
Consider location	7.1	11.1
Other	9.1	7.1

* Totals are not equal to 100 percent because some farmers indicated more than one method.

a down payment and then purchased land. From the total sample of farmers, 17.2 percent thought that having the down payment was the final determining factor in deciding to purchase land. Rather than using any refined discounting procedure, they evidently purchased when funds were available for this purpose. The largest group, 51.5 percent, tried to figure out whether, given the purchase price and their expectations of commodity prices, they could buy the farm and make annual payments. This is more or less a "pay-off period" approach, such as is frequently used by business firms. While not a highly refined expectation mechanism, this system does rest on a definite formulation of expectations. Use of expectations also is suggested by the 13.1 percent of farmers who themselves made an appraisal (i.e., calculated through discounting expected returns) of the farm's long-run expected value and compared this with the market price. Expectations were also used by the 16.2 percent of farmers who hired an appraiser to estimate the long-run land value as compared with the market price. Of course, all methods cited undoubtedly involve some aspects of expectations. However, it appears that only 29.3 percent (13.1 plus 16.2) actually used a formal discounting procedure. The main method used appears to be one of simply figuring out whether it appears the purchase price and interest can be recovered in a "safe number of years," or of having a large enough down payment to safeguard against income decline and bankruptcy. The farm is then purchased if the outlook is "otherwise favorable."

The figures on the method which would be used in the future (table 17) suggest that most farmers would be more conservative in making future land investment decisions than they were in the past. Of course, many farmers purchased land in a period of rising prices while, at the time of the survey, the expectation of declining prices was held by the majority of farmers. In comparing notions of past and future methods of land buying, an increase in the number of farmers who would use the method of a large down payment perhaps indicates greater reluctance of farmers to take chances once they have achieved land ownership. These findings also may partly explain the inability to predict a relationship between expectations and planned land investment in the previous regression analysis.

ATTITUDES ON RETURNS, PAY-OFF PERIOD AND RISK ASSOCIATED WITH SIZE

Table 18 summarizes the results from six questions designed to obtain farmers' attitudes toward certain aspects of land investment. The first question concerned the rate of return necessary to make land purchase attractive and profitable, considering time, uncertainty and discounts attached to these phenomena. The average rate of return needed before additional land would be purchased was 10 percent. This is approximately twice the interest rate on land mortgages. The surplus is necessary, in the minds of farmers, to compensate for the long investment period over which funds are committed in land purchase, the uncertainty involved in long-range predictions, and the alternative returns possible from investments in short-run and working assets. As table 18 suggests, farmers expressing need for a return over 10 percent had somewhat higher average discount rates than those specifying a lower return.

TABLE 18. MEAN TIME DISCOUNT, RISK DISCOUNT AND AGE OF FARMERS INCLUDED IN SELECTED CATEGORIES OF ANSWERS TO QUESTIONS ABOUT LAND PURCHASES.

Item	Percent of all farmers	Mean		
		Risk discount	Time discount	Age
Annual return necessary to buy more land				
10 percent or less	56	18.4	18.2	46.5
Over 10 percent	44	19.7	19.8	47.1
Pay-off period required for farm investment				
15 years or less	58	20.9	17.7	46.6
Over 15 years	42	16.2	10.8	47.0
Size of farm for greatest financial success				
225 acres or less	52	19.9	21.0	46.0
Over 225 acres	48	17.9	16.7	47.5
Large farms more risk if borrowed capital used				
Yes	84	17.6	17.4	47.7
No	16	21.1	21.4	45.2
Large farms more risk if own capital used				
Yes	16	15.6	21.7	45.5
No	84	19.6	18.4	47.0
A larger farm can be operated under corporation with less risk				
Yes	18	17.0	15.0	44.8
No.	82	19.4	19.8	47.2

The second question dealt with the "pay-off period" which should be considered in buying a farm. In industry, a "pay-off period" is considered as the number of years in which sale of product will cover annual variable expense, plus original investment in plant. Some business managers, for example, invest in new plants only if the "pay-off period" appears to be as short as 5 years. The average "pay-off period" specified in the sample was 15 years. Nearly 60 percent of the farmers thought the "pay-off period" should be 15 years or less if the investment were to merit the uncertainty involved. Again, farmers specifying that a longer "pay-off period" might be acceptable were those with somewhat lower discount rates.

OPTIMAL FARM SIZE FOR INVESTMENT

Since size of farm is of great importance in land investment, operators were asked what size was optimal from the standpoint of purchase and a prospective favorable financial outcome. The mean size indicated was 225 acres, with 52 percent indicating less than 225 acres. As in previous cases, farmers specifying a larger farm size tended to be less conservative in their discount rate, or had a smaller aversion to risk. Over three-fourths of the farmers thought large farms involved more risk

than small farms, from an investment standpoint, if borrowed funds were used. The same three-fourths did not consider large farms to be more risky if they were purchased only with equity funds. This finding is in line with Kalecki's increasing risk principle which supposes that, starting out from a base where the manager owns all of the assets, the probability of loss and bankruptcy increases as more borrowed funds are used and the percentage equity declines.[8]

The problem of equity and uncertainty can be met partly by use of the corporate form of business organization. In this case finances are obtained through the sale of stock ownership, rather than through a bond or mortgage which has prior claims on the firm's assets in case of financial difficulties. Hence, farmers were questioned about the advisability of operating a larger farm under a corporate form of business organization as a means of circumventing risks in borrowing. Seventy-seven farmers (80 percent) indicated that they would not operate a farm under this method. The reasons given by the 77 farmers are summarized in table 19. The main objection to corporate farming centered around the lack of complete independence on the part of the operator. The objection was expressed in terms of not wanting to "fool" with the corporate form of doing business. Although the question stated that they would retain a controlling interest, many of the farmers expressed the idea that they would not even want to report to minority stockholders.

Of the 20 percent who believed a corporate form of business useful, the most common reason given for preferring this method were: (a) it would be more profitable and (b) it would be a good method of obtaining capital. However, from the answers to these questions, it appears that the corporate farm as a method of meeting financial risk has little favor with owner-operators.

ECONOMIC HORIZON

Several questions were asked in an attempt to determine the economic horizon of the farmers in the sample. The economic horizon refers to the length of time into the future for which plans are made. It is generally considered that this time span is largely a function of uncertainty. Specifically, the length of the planning horizon is determined by the point at which a future return, because of time and uncertainty discounts, has a zero present value. As one measure of this phenomenon, farmers were asked to indicate at what point in the future a return of $1,000 would be considered to have zero present value. The mean for the sample was 11.5 years.

A second concept of economic horizon was obtained by asking the farmers if they planned to be in farming in certain specified future years. On an average, the operators expected to continue in farming for about 13 years. The age of the farmer was the primary factor considered in this answer. The relationship between length of time in farming and length of plans indicated that those farmers who plan to farm for only a few years make relatively short-run plans.

INTEREST RATE

Present day farming techniques require a large investment in durable and working capital. Most farmers must rely to some extent upon outside sources for a part of this capital. Theoretically, the interest rate is one of the main determinants of the level of investment. However, empirical studies in industry have found that the interest rate is relatively unimpotant in its effects upon investment.[9] The present study attempts to obtain evidence upon this as related to interest rates for production loans and real estate loans.

Although the sample included only owner-operators, 61 out of 99 farmers indicated that they usually obtained production loans from banks. The average amount borrowed annually was $4,261, with about half of the farmers paying 5 percent interest. A few paid less than 5 percent interest, and the rest paid 6 or 7 percent. Only one farmer stated that he could not borrow more money at his bank if he wished to do so. Accordingly, risk aversion (internal capital rationing) rather than external capital rationing appears to be the dominant force limiting the amount of capital used. In other words, the uncertainty facing the typical farmer of the sample causes him to limit the amount of borrowed funds he uses. Leading agencies would, in his opinion, loan him more capital than he is using if he requested a loan.

PRODUCTION LOANS

Only 26 percent of the farmers indicated that they would borrow more money, even if the interest rate on production loans were zero (table 20). At 4 percent interest, 1 percent below the common rate, only 8 percent of the farmers would borrow more money. But if the interest rate were

[8] See Kalecki, op. cit., and Heady, Earl O. Economics of agricultural production and resource use. Prentice-Hall, New York. 1952. chs. 16-18.

TABLE 19. FARMERS' REASONS FOR "NO" ANSWERS TO QUESTIONS ON OPERATING A FARM UNDER THE CORPORATE FORM OF BUSINESS.

Reasons	Percent of 77 farmers listing reason
Don't want to "fool" with corporate form of business because of lack of independence	53.4
Object to large land holdings which would result under corporations	16.7
Would not be as profitable to operate as corporation	10.4
Too satisfied with present situation to want to change	9.1
Would involve too much work and management	7.8
Other	1.4

[9] See: H. D. Henderson, "Significance of the interest rate," and J. E. Meade and W. H. Andrews, "Summaries of replies to questions on the effect of interest rates," Oxford Economic Papers, No. 1, pp. 1-32.

TABLE 20. ACTIONS AT SELECTED INTEREST RATES FOR PRODUCTION LOANS, AND MEAN QUANTITIES OF CAPITAL AND PLANNED CAPITAL INVESTMENT FOR FARMERS TAKING THESE ACTIONS.

Interest rate	Type of action	Percent of farmers	Mean	
			Capital	Planned investment in next 3 years
0%	Borrow more	26	$68,417	$ 9,133
	Borrow same	74	86,564	10,699
1%	Borrow more	25	66,529	8,715
	Borrow same	75	85,263	10,801
2%	Borrow more	21	73,458	9,839
	Borrow same	79	84,065	10,410
3%	Borrow more	16	74,519	11,451
	Borrow same	84	83,252	10,021
4%	Borrow more	8	73,357	13,789
	Borrow same	92	82,647	9,976
8%	Borrow less	67	92,079	11,912
	Borrow same	33	60,739	6,959
10%	Borrow less	90	84,115	10,834
	Borrow same	10	60,617	5,271
12%	Borrow less	95	83,403	10,560
	Borrow same	5	50,861	5,053

increased above the common rates, fewer farmers would continue to borrow the same amount of money. Sixty-seven percent of the farmers would borrow less money at 8 percent interest, while 95 percent of the farmers would borrow less money if the interest rate went as high as 12 percent. These figures provide evidence that, while a decrease in interest rates below the common rate may cause few farmers to use more borrowed capital, an equally large increase in interest rates might be quite effective in lessening the amount of borrowed capital used for production purposes.

Relationships of capital and planned investment to varying rates of interest also are summarized in table 20. At each interest rate below the common rates, those people who would borrow more capital had a lower equity and less capital than those people who would borrow the same amount. But as the interest rate goes above the common rates, it is this same group which appears unresponsive to changes in the interest rate. Relatively high interest rates are probably irrelevant for many low-capital farmers: They have many investment opportunities in which the expected return is extremely high. Also, the fact that the planned investment for this group tends to be lowest is further indication that many opportunities for high return on capital have not been exploited. Too, farmers in the lower capital group need a basic amount of working capital and must rely on the banking system to obtain it regardless of the interest rate. Low interest rates do not seem to induce high-capital farmers to borrow more money. Borrowing by these farmers is probably influenced more by capital rationing because of risk aversion than by the level of interest rates.

REAL ESTATE LOANS

Reactions of farmers to questions about various levels of the interest rates for real estate loans follow much the same general pattern as for production loans: Farmers appear more responsive to an increase in the interest rate than to a decrease (table 21). However, it appears that the interest rate may have a greater quantitative influence on the magnitude of land loans than on production loans. Lower interest rates would induce a greater percentage of farmers to increase investment in land than was the case for production loans. Farmers who would buy more land at the lower interest rates have slightly higher equities and planned more investment in the 3 years ahead than farmers who would make no change in capital used. Bankers or other loan firms would be willing to make land loans to farmers in the high capital and equity groups. However, the interest rate may be one of the factors preventing these farmers from buying more land.

Again, farmers would be much more responsive to an upward movement in the interest rate than to a downward movement. However, it is doubtful that future adjustments in the interest rate on loans will be sufficiently large to appreciably influence borrowing by farmers. Given relative stability in the interest rate, the principle of increasing risk probably will continue to be the more important force in limiting the use of borrowed capital.

PRINCIPLE OF INCREASING RISK

The preceding discussions provide evidence that the principle of increasing risk has an important effect on investment decisions. However, in a more direct attempt to analyze this principle, farmers were asked to give the return they would need, with a fair degree of certainty, before they would borrow and invest an additional $5,000, $15,000 and $40,000. If the principle of increasing risk is in operation, the required percent return should increase as the amount of borrowed capital increases.

A difficulty encountered in this procedure was the unwillingness of farmers to borrow the large amounts of capital—at any rate of return—or to specify the rate of return which would cause them to use more capital. Consequently, it was im-

TABLE 21. ACTIONS AT SELECTED INTEREST RATES ON LAND LOANS AND MEAN QUANTITIES OF EQUITY, CAPITAL AND PLANNED CAPITAL INVESTMENT FOR THE FARMERS TAKING THESE ACTIONS.

Interest rate	Type of action	Percent of all farmers	Mean		
			Equity	Capital	Planned investment in next 3 years
0%	Buy more land	36	93.9	$76,898	$11,349
	Buy same land	64	84.5	75,944	8,790
1%	Buy more land	33	94.0	78,846	11,449
	Buy same land	67	84.8	75,014	8,857
2%	Buy more land	28	94.2	79,562	10,232
	Buy same land	72	85.4	75,001	9,519
3%	Buy more land	15	93.2	94,283	12,021
	Buy same land	85	86.9	73,078	9,310
7%	Buy less land	58	89.3	73,480	10,072
	Buy same land	42	86.0	80,110	9,244
8%	Buy less land	83	89.3	77,190	9,934
	Buy same land	17	81.2	71,955	8,691
10%	Buy less land	96	88.7	77,696	9,808
	Buy same land	4	67.5	42,928	7,649

possible to compute a numerical estimate of the rate of increase in returns which would be needed before larger amounts of capital would be borrowed. To overcome this difficulty, the farmers were asked simply to indicate whether (1) an increasing rate of return, (2) a decreasing rate of return or (3) a constant rate of return would cause them to borrow more.

Eighty-seven percent of all the farmers interviewed needed increasing returns before they would borrow larger amounts of capital. This "ordinal" result provides additional evidence of the operation of the increasing risk principle for the vast majority of farmers in the sample. However, it does not indicate the "cardinal" value of the increase in returns required to encourage greater borrowing and use of capital.

USE OF ADDITIONAL CAPITAL

Opinions of the farmers' ability to profitably use additional capital were obtained by asking them if they could have profitably used more capital for various enterprises and services during the past year. About 29 percent of the farmers in the sample stated that they could not have profitably invested more capital for any of the enterprises and services listed in table 22. Nearly half (48 percent) of the farmers indicated that they could have profitably invested more in fertilizer, while 38 percent thought they could have profitably invested in more livestock. Relatively few farmers thought they could have used capital for more machine services, buildings, labor and other items.

Most of the answers were given on the assumption that other resources remained fixed. Lack of building space was a limitation to increased livestock numbers on some farms. Hence, some farmers indicated that more livestock would be profitable if added building space were already available. However, all of these same farmers expressed the belief that investing in building space at the time involved too much uncertainty and might be a poor long-run investment. The fact that many of the farmers indicated both that

TABLE 22. MEAN CAPITAL AND EQUITY OF FARMERS INDICATING ABILITY TO USE MORE CAPITAL FOR SELECTED ITEMS.

Item	Percent of all farmers	Mean	
		Present capital	Equity
Fertilizer			
Could not use	52	$83,903	89.1
Could use	48	67,056	86.1
Livestock			
Could not use	62	76,661	89.0
Could use	38	74,511	85.4
Machine services			
Could not use	97	76,306	87.5
Could use	3	61,627	93.1
Buildings			
Could not use	83	74,506	87.7
Could use	17	82,327	87.5
Labor			
Could not use	97	75,684	87.7
Could use	3	80,513	84.4
Other purposes			
Could not use	89	75,633	88.7
Could use	11	77,559	78.1

TABLE 23. REASONS GIVEN BY FARMERS FOR NOT BORROWING PROFITABLE ADDITIONAL CAPITAL.

Reason	Percent of farmers
Could not profitably use more capital	28.7
Could profitably use more capital	72.3
Own labor not available	19.1
Didn't foresee big returns	28.7
Too risky to borrow at the time	29.8
Didn't want to borrow more money because of uncertainty	16.0
Other	14.9

(1) the added capital would return more than it cost and (2) they could borrow more funds, suggests again that the limit on scale and capital use is the farmer's own risk aversion. It appears that he simply takes a conservative investment course by applying a heavy uncertainty discount on the prospective returns from borrowed funds. Hence, farmers who indicated that more capital could be profitably used (in the sense mentioned above) were asked why they did not borrow more.

The reasons indicated by farmers for practicing this internal capital rationing are summarized in table 23. Excluding the group which could not have used more capital, the main reasons given for not borrowing profitable additional capital were related to uncertainty. The farmers who "didn't want to borrow money because of uncertainty," or "thought the use of extra capital too risky," clearly limited their use of capital mainly because of the *ex ante* uncertainty of returns. Farmers who "didn't foresee big returns" simply had formed pessimistic expectations but also were faced with uncertainty. Some of those who gave "lack of own labor" as the reason also were undoubtedly faced with uncertainty; otherwise they could have borrowed funds and hired labor to complement the capital. However, some farmers objected to using hired labor on the grounds that it interfered with living and household goals. The majority of those giving "other" reasons had "elimination of debts" as a foremost financial and family goal. A few were "against" borrowing in any form. However, both of the latter reasons also may reflect "uncertainty fears."

OPINIONS ON SELECTED ASPECTS OF UNCERTAINTY IN FARMING

Farmers were asked to compare the uncertainty of farming with that of various other investment activities. The data in table 24 show that over 90 percent believe farming to be more risky than investment in government bonds but less risky than investment in grain futures (or betting on horse races). Seventy-eight percent indicated that they thought farming was less risky than operating a grocery store. However, farmers were rather evenly split on the comparative risk of farming compared with working in a factory.

While the statement is often made that "farming is nothing but a big gamble," there is little evidence that farmers in the sample generally hold this view. Most farmers consider operating a

TABLE 24. PERCENTAGE OF FARMERS RATING FARMING AS INVOLVING MORE, LESS OR THE SAME RISK AS SELECTED INVESTMENT ACTIVITIES.

Investment activity	Percent of farmers rating farming compared with other activities		
	Farming more risky	Farming same risk	Farming less risky
Government bonds	93	6	1
Grain futures	3	5	92
Working in a factory	52	3	45
Operating a grocery store	21	1	78
Betting on horse races	1	—	99

farm to be less risky than certain other alternative occupations open to them. If farmers widely held the view that other types of work were less risky, a much greater migration of workers out of agriculture would probably be taking place.

The farmers generally agreed upon the relative risk of government bonds and investing in the grain futures market as compared with farming. Hence, these activities were used as benchmarks for further questioning. The farmers were asked to list the farm enterprises and practices which they thought were as risky as investing in the grain market and those which they considered to be as safe as government bonds.

As table 25 indicates, diversified farming was considered by 66 percent of the farmers to be nearly as safe as government bonds. This result is highly consistent with the "methods used by farmers in making investments" studied earlier. Diversified farming was one of the most popular methods named for reducing the risk involved in farm investments. The risk associated with cattle feeding, hogs and other livestock enterprises was listed by about 70 percent of the farmers as being comparable to that of investing in the grain market (table 25). These results are consistent with the explanation given by many farmers for not having used extra capital for livestock. It is interesting to note that hogs and crops were listed in both the risky and safe categories.

OPINIONS ON SAFE EQUITY RATIOS

Opinions about a safe equity ratio were obtained by asking each farmer what ratio he considered

TABLE 25. ENTERPRISES CONSIDERED BY FARMERS TO BE AS SAFE AS GOVERNMENT BONDS AND AS RISKY AS SPECULATION IN THE GRAIN MARKET.

Enterprises	Percent of farmers listing enterprises
As safe as government bonds	
Diversified farming	66.0
Crop production	6.2
Raising own livestock	19.6
Fertilizer	12.4
Hogs	7.2
Dairy	2.1
Chickens	2.1
Other	1.0
None	4.1
As risky as investment in grain market	
Cattle feeding	18.6
Crop production	16.5
Hogs	11.3
Turkeys	3.1
Specialized farming	5.2
Other	9.3
None	5.2

to be safe for his own firm, given his particular financial situation and price outlook. The mean of the ratios given was 0.60. Exactly half of the ratios were below 0.50 and half above 0.50. Capital appeared to be the only factor related to the answer given to this question. Farmers who thought an equity ratio below 0.50 was safe had a somewhat smaller amount of capital than those who thought the ratio should be above 0.50 to be safe.

Farmers also were asked why their present equity differed from the ratio which they considered safe. Only five farmers had an equity ratio below that which they considered to be safe. Four of the five (4.3 percent of all farmers) mentioned the recent purchase of a farm as the reason for their present equity being lower than they considered desirable. Ninety-one farmers had an equity ratio above that which they considered to be safe. A majority of these farmers indicated a high equity ratio was consistent with their goal of 100 percent equity. In other words, a 100-percent equity ratio becomes a near "ultimate end" for most farm families. Some of these farmers were surprised that the question was asked: They expressed belief that all farmers wanted to be completely free of debt. The "ultimate goal" of 100 percent equity undoubtedly is an uncertainty precaution for most farmers. They expect to retire on income from the farm and consider that full ownership of assets is important for security during this period. At the sacrifice of present income, an individual farmer may place strong emphasis upon debt-free resources as a precaution for income in retirement. Given this individual's particular set of values and the uncertainty which faces him, such a choice may be quite rational.

INCOME FLOW

Ordinarily, people prefer present incomes to future incomes. Also, many people prefer a steady income to one which fluctuates. Investments may be made accordingly. Suggestions of preference patterns in respect to income flows were obtained by asking farmers to select the most desirable income plan from the alternatives shown in table 26. Income Plan 1 consists of a steady income of $5,000 per year for each of the next 25 years. Plan 4 contains considerable variation in income, with the largest incomes forthcoming in the first years and declining steadily thereafter. Income plans 2, 3 and 5 also contain considerable year-to-year variation, but with lower incomes resulting in the first years and increasing through the years. The farmers were informed that the plans total the same amount over the 25 years and that they were to assume that each plan (1) would take the same initial investment and (2) would leave their farm with the same final value. These assumptions were imposed to equalize the plans in every respect but the timing of income. The farmers were given no idea of the present value or the variation in income of the different plans.

TABLE 26. FIVE ALTERNATIVE INCOME PLANS FROM WHICH FARMERS SELECTED THE MOST DESIRABLE FLOW OF INCOME OVER A 25-YEAR PERIOD.

Year in the future	Profit in each year				
	Plan 1	Plan 2	Plan 3	Plan 4	Plan 5
1	$5,000	$2,000	$3,000	$5,000	$1,000
2	5,000	2,000	3,000	6,000	1,000
3	5,000	3,000	3,000	7,000	1,000
4	5,000	3,000	4,000	8,000	1,000
5	5,000	3,000	4,000	9,000	1,000
6	5,000	4,000	4,000	8,000	2,000
7	5,000	4,000	5,000	7,000	2,000
8	5,000	4,000	5,000	7,000	3,000
9	5,000	5,000	5,000	6,000	3,000
10	5,000	5,000	5,000	6,000	4,000
11	5,000	5,000	6,000	5,000	4,000
12	5,000	5,000	7,000	5,000	5,000
13	5,000	5,000	8,000	5,000	5,000
14	5,000	5,000	9,000	5,000	5,000
15	5,000	5,000	7,000	5,000	6,000
16	5,000	5,000	6,000	5,000	6,000
17	5,000	5,000	5,000	4,000	7,000
18	5,000	6,000	5,000	4,000	7,000
19	5,000	6,000	5,000	3,000	8,000
20	5,000	6,000	5,000	3,000	8,000
21	5,000	6,000	5,000	3,000	9,000
22	5,000	7,000	5,000	3,000	9,000
23	5,000	7,000	5,000	3,000	9,000
24	5,000	8,000	5,000	2,000	9,000
25	5,000	9,000	3,000	2,000	9,000
Total	$125,000	$125,000	$125,000	$125,000	$125,000

Table 27 gives the present value and the coefficient of variation of each income plan, as well as the percentage of farmers choosing each plan.

As shown in table 27, a majority of the farmers chose Plan 1, the stable income plan. For these farmers, the negligible income variability of Plan 1 presumably offset the fact that another plan (Plan 4) provided a higher present income value. Plan 4 which had the highest present value but the second highest variation, was the second most popular plan. The farmers who chose this plan apparently recognized the higher present value and gave this aspect more weight than the variation.

The assumption is often made in the field of public policy that farmers, in general, desire income stability. A majority of the farmers chose Plan 1, giving considerable support to this contention. However, a total of 22 percent of the farmers chose plans 2, 3 or 5 which have both a lower present value and a higher variance than Plan 1. These results may indicate that stability of income is not the universal goal of farmers. It it possible, of course, that some of the farmers were unable to organize the relevant characteristics of the various income plans in time to make a logical response.

TABLE 27. DISCOUNTED PRESENT VALUES AND COEFFICIENT OF VARIATION OF THE FIVE INCOME PLANS, AND THE PERCENTAGE OF FARMERS CHOOSING EACH.*

Income plan	Discounted present value†	Coefficient of variation (percent)	Percent of farmers naming each plan
1	$70,469	0	56
2	62,810	28.6	6
3	68,808	30.2	10
4	77,848	40.4	20
5	56,426	88.2	7

* See table 26 for details of the five income plans.
† Discount rate was 5 percent.

The choice of an income plan by a farmer was found to be closely related to his rate of time discount. By definition, farmers with a high time discount tend to heavily discount future income. Thus, as would be expected, farmers choosing the plan with the highest present value had the highest average time discount; farmers choosing the plan with the second highest present value had the second highest average time discount, etc. Such a relationship provides a basis for considerable confidence in the measure of time discount developed earlier, since each of these measures of impatience was determined independently.

BARN INVESTMENT IN RELATION TO UNCERTAINTY AND FLEXIBILITY

As an alternative measure of preference for timing of cost commitments and income flows, farmers were asked which they would prefer building: a barn to last 60 years at a cost of $6,000 or a barn to last 30 years at a cost of $4,000. The annual depreciation on the first barn would be $120, while annual depreciation would be $133 for the 30-year barn. In the latter case, the extra $2,000 could be invested, and after 30 years the principle and interest from this investment would be enough to build a second barn. Ninety-three farmers answered the question and a majority of these (60 percent) stated that they would prefer two barns over the 60-year period. The reasons given by the farmers for their answers are presented in table 28. Preference for nice looking buildings and objections to the "bother" of building the second barn were given as the major reasons for choosing a barn of long life. The added flexibility in building two barns was the major reason for choosing two short-life barns. With this choice, the farmer can change the style or type of barn to handle different livestock enterprises if a major long-run shift in relative prices should occur. Apparently a great many farmers recognize the value of flexibility as a precautionary measure in meeting the uncertainties of demand, price and other economic variables.

TABLE 28. REASONS GIVEN BY FARMERS FOR PREFERENCE ON TYPES OF BARNS.*

Reason	Percent listing reason
Long-life barn preferred by 38 farmers or 40 percent	Percent of 38 farmers preferring long-life barn
Like good buildings	35.1
Object to the work and bother of building another barn in 30 years	43.2
Increase the value of the farm	8.1
Other	18.9
Short-life barn preferred by 55 farmers or 60 percent	Percent of 55 farmers preferring short-life barn
Will need barn for 30 years or less; can't plan beyond forseeable limit	21.8
Could use saving to invest in bonds for reserve and greater certainty	16.4
Uncertainty of future production pattern and hence may wish to change types of barn	41.8
Other (flexibility, may move, price uncertainty, etc.)	30.9

* Long-life barn costs $6,000 with an expected life of 60 years. Short-life barn costs $4,000 and has an expected life of 30 years.

PAY-OFF PERIODS AND ADDED CAPITAL

Opinions of farmers as to the length of time selected investments should pay for themselves (i.e., the period required for investment decisions) were obtained. The average pay-off period indicated necessary for drainage tile was 7.2 years. While farmers generally thought that a tile system would last longer, a pay-off period much shorter than the expected life was indicated as a necessary condition for making an investment under uncertainty conditions. This same reasoning held true for the other investments considered. The average pay-off period indicated for a dairy herd was 5.5 years; the pay-off period was 6 years for a machine and 11 years for a building.

USE OF EXTRA CAPITAL

Information was obtained about possible future investment patterns and goals by asking farmers how they would spend various amounts of added capital. As table 29 indicates, about 60 percent of an added $1,000 would be used either to repay debts or to be put into cash or bonds (i.e., increase liquidity). Again, these figures suggest the strong desire of farmers to be out of debt. As the amount of available extra capital increases, the percent of extra capital put into cash or bonds increases. The percent spent for buildings on the farm and for buying land also increases as the amount of available extra capital increases. Most farmers evidently put little premium on more machinery and livestock, since the percent allocated to these items is small and fairly constant.

TABLE 29. PERCENTAGES OF AN ADDITIONAL $1,000, $5,000 AND $10,000 CAPITAL WHICH FARMERS WOULD INVEST FOR VARIOUS ITEMS.

Item	Amount of capital to be invested		
	$1,000	$5,000	$10,000
	(percent)	(percent)	(percent)
Land	1.0	4.9	7.7
Livestock	3.6	0.7	4.5
Machinery	1.0	2.3	1.7
Buildings	1.6	9.5	8.6
House	10.3	5.1	4.1
Car	4.1	1.6	0.9
Cash or bonds	29.4	41.9	41.2
Repay debts	29.4	32.4	25.4
Other	19.6	1.6	5.9
Total	100.0	100.0	100.0