MANAGERIAL USES OF RISK-MANAGEMENT RESEARCH

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My perspective on this topic is based on some academic experience and some more recent experience as a farmer. The academic experience was research and teaching in the Department of Economics at Iowa State University during 1970-78. Since then I have been farming in east-central Nebraska. The farm is a family owned operation involving about 2000 acres. We raise corn, both dryland and irrigated, soybeans, grain sorghum, and some winter wheat. In addition we feed some cattle, have a small seed and farm supply business, and do some construction work (tiling and earthmoving) both for our own operation and on a custom basis. There are two full-time employees in addition to me and some part-time help.

Farming during the last seven years has not been uneventful. As background to some comments on risk-management research let me quickly point out some of the events that have made the biggest impression on me.

The Current Crisis

In the 1970's the farm economy was characterized by expanding export markets, high inflation, and low real interest rates. During 1970-81 exports tripled in volume. Farmers responded to the increased exports and higher commodity prices with heavy investment in land and machinery. Land values appreciated rapidly--as much as 30% in one year in Iowa--and machinery capacity increased substantially. There was, probably not surprisingly, heavy use of debt capital. Consequently debt increased by about 10% per year during the period. Although my timing was such that I got in on only the last two or three years of this, I can recall that the annual review with the lender was usually a pleasant experience. Usually you had an operating profit assuming constant real estate values. But even if you didn't you had the warm feeling that any operating loss had been more than offset by the appreciation in land and machinery values.

The situation has changed drastically in the 80's. There is lower inflation, a much higher real rate of interest, and a much stronger dollar. This has led to a sharp drop in exports and lower commodity prices. The lower commodity prices along with higher interest rates have combined to stop and sharply reverse the appreciation in land and machinery values. In our area land values are about 40% of their peak in 1981 and apparently still falling. The annual review with the lender is much less pleasant. An operating profit with constant real estate values is rare, especially if the operator has significant debt. But, even if there is an operating profit you have the sinking feeling that it is no doubt more than wiped out by the decline in land and machinery values.

The financial stress among farmers brought on by these conditions has been documented by a recent USDA study (1). The study focused on 679,000 "family sized farms" (sales $50,000 to $500,000 annually) which are the mainstream of family farm commercial agriculture. The level of debt is the index of stress. By early 1985, 6.3% of these family farms were technically insolvent (debt exceeds assets), 7.3% were very highly

leveraged (over 70% debt to asset ratio) and thus have extreme cash-flow problems, and 20% are highly leveraged (40-70% debt to asset ratio) with serious cash-flow problems. This implies that fully one third of the commercially sized family farms have financial stress ranging from serious to insurmountable. Further, the authors of the report on the study project that about 13% will be out of business in one year barring a miracle, and perhaps an additional 10% will succomb within two years.

This crisis has become a major national event. Both individual farmers and state and national policymakers are trying to decide what happened and what to do now that it has. Blame has been variously assessed to factors beyond the control of farmers (interest rates, strong dollar) and to farmers themselves (greedy consenting adults). To my knowledge risk management researchers have not been widely cited as villians. This is in spite of the fact that some of those in financial trouble may have made poor use of risk management research, or made use of poor risk management research, or both. But even if this isn't the case, I think this crisis has some implications for risk management research.

Implications for Risk Management Research

I'll begin with the following general observations. First, among the decisions a farm manager must make those concerning acquisition of productive assets appear to have been the most critical in dividing those who are facing financial stress from those who are not. Second, at least for many of those in trouble, the possibility of the current economic environment was not even perceived. That is, the possible states of nature in their decision models didn't include the combination of low commodity prices and high real interest rates that has occurred. And third, on the surface it seems that those who behaved irrationally in the 70's by underusing credit are most likely to be the survivors. Was this underuse of credit irrational or was it the rational result of some more (or less) sophisticated decision model?

More generally, it may be helpful to try to address these questions: What sorts of decision models would have yielded successful strategies for farm operators during the late 1970's and early 1980's? In 1985?

Asset Acquisition. It seems clear that decision models need to address investment/disinvestment in productive assets head on. For land and many types of machinery there are many possible alternatives ranging from cash purchase/sale, to various purchase/sale contracts, to a host of rental arrangements. There is no doubt room for progress in identifying the pertinent alternatives and devising ways to measure and compare risk among them. In addition there is need to consider relationships between production and financial risk of certain activities. For example, an investment in irrigation equipment may significantly reduce production risk by reducing the variability (and increasing the mean) of yield. But this reduction in production risk may be more than offset by an increase in financial risk, especially if it is a cash purchase financed by debt capital.

Financial Leverage. The level of financial leverage must be monitored. But the use of an arbitrary limit is somewhat troublesome. A limit (e.g., 40% debt to assets) that everyone would have considered to be

conservative in 1979 now might be considered irresponsibly high. Even if there is some rationale for a specific limit it is likely that there would be situations in which it would be prudent to exceed it. On the other hand, unwise investments should not be given a better chance just because financial leverage is low. The limit on financial leverage should therefore be endogenous to the model. The mechanism for setting the limit should take into account that over the long pull, return on assets in agriculture has been less than in most other industries. Thus survivable levels of financial risk are probably less in agriculture than in most other industries.

Planning Horizon. Decision makers, I believe, tend to take an incremental approach; they attempt to commit themselves to as little as possible for as short a time as possible especially when they perceive the risk to be high. But a multiperiod model is necessary because, although the activity levels for only the first period are relevant, the impacts of activities in the first period on opportunities available in later periods must be considered. The multiperiod strategy must be arrived at, then, by reformulating and resolving the multiperiod model each period.

Objectives and Attitude Toward Risk. I am woefully unqualified to comment on the theoretical appropriateness of alternative specifications of decision maker utility functions. I can, however, comment with some authority on my own views about objectives and choices among risky prospects. I am comfortable with an objective of maximizing the present value of the firm's net worth. In attempting to achieve this objective I tend to make choices in the following manner. I tend to focus on what I expect the outcome to be and on what I perceive to be the worst possible outcome of an activity. Thus, for me semivariance is probably a more appropriate measure of risk than variance. I have not been a heavy user of either federal crop insurance or hedging in the futures market. In my situation it usually seems the price is high for the coverage afforded. In the case of government wheat and feedgrain programs, on the other hand, the price has seemed quite reasonable and I have participated. When comparing alternatives, other things equal, I prefer the one that requires commitment over a shorter time period (or offers more frequent opportunities to bail out or change direction). Quite often this leads to a choice of more labor rather than more capital in a production process. Also, I prefer a smaller commitment to a larger one. These two preferences usually lead me away from the least-cost production process-large scale and capital intensive. Finally, other things equal I prefer activities with which I have had some experience - on the presumption I may be able to avoid making some of the mistakes twice.

States of Nature. It may be that the success of decision makers in recent years has hinged on their abilities to recognize possible states of nature and to assign and revise probabilities. The difficulty of the agricultural production environment was first that states of nature which were assigned a zero probability by many occurred, and now there is less uncertainty especially about commodity price levels and real interest rates but the likely state of nature is undesirable. I think most farm managers are not good at incorporating all the available and relevant historical information about the economic environment into their probability distributions over states of nature. Research efforts to provide this information could make a valuable contribution.

Issues. The events of recent years suggest some issues that might be addressed by those interested in applied research. Perhaps the major issues are those that deal with acquisition and pricing of major inputs and pricing of services rendered and products produced. Some specific questions are the following. What is the best combination of debt and equity capital? How should major productive assets like land and machinery be acquired (or disposed of)? How should outputs be priced? To what extent should producers attempt to sell services (e.g., custom farming or feeding) rather than finished products?

Summary

I believe that risk management research has been of value to farm decision makers and those who advise them. I also believe that the current financial crisis and the events that have led up to it provide a good opportunity to re-examine what has been done and to add significantly to it. I urge you to take advantage of this opportunity.

References

(1) The Current Financial Condition of Farmers and Farm Lenders. Economic Research Service, U.S. Department of Agriculture. Agriculture Information Bulletin No. 490. Washington, D.C., March 1985.