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Financial and Risk Management Assistance: Decision Support for Agriculture

Steven L. Klose and Joe L. Outlaw

The Financial and Risk Management (FARM) Assistance program created by Texas Cooperative Extension is a strategic analysis service offered to farmers and ranchers in Texas. The program serves as an example of large-scale, focused programming by extension agencies, as well as the implementation of technical stochastic simulation methods for use on the farm.

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JEL Classifications: Q16, Q12, C15, D83

An important aspect of the agricultural economics profession is the connection of research and outreach. The land-grant system itself was designed to ensure that the information from innovative research flows to the general public. The common model is for extension agencies to disseminate relevant information developed or learned through research. Outreach occurs through many other channels, and most often it is the information or the newly discovered answer that is shared with the agricultural community. It is less common, however, for agricultural producers to be given access to the actual research methods or analytical tools used in the profession.

Applying research methods to specific individual problems or situations is what commonly happens when private companies fund research projects or hire research consultants. In this sense, applied research is very common, but tailoring a research method to a specific problem or application is time consuming and expensive. When the work is concluded, the resulting model is often so specific that it has few other applications. Delivering applied research tools and capacity to the general public is less common because creating a single model or tool that is flexible enough to handle the variety and uniqueness of many applications is difficult at best.

Texas Cooperative Extension has developed a program that delivers powerful analytical capacity to the hands of farmers and ranchers in Texas. The program known as Financial And Risk Management (FARM) Assistance is founded in stochastic farm-level research methods. Developed as an outreach program, the complex research tool is made available to any Texas producer.

Research Foundation

The FARM Assistance program is technically a 10-year pro forma financial analysis that incorporates the research methods of stochastic

Steven L. Klose is assistant professor and extension economist and Joe L. Outlaw is associate professor and extension economist, Department of Agricultural Economics, Texas Cooperative Extension and the Texas A&M University System, College Station, TX.

simulation. Stochastic simulation has long been an effective tool in investment analysis. Reutlinger (1970) describes the benefits of stochastic simulation in analyzing risky investment projects and goes on to provide several case examples of how the World Bank has used simulation risk analysis to aid in project-funding decisions. Pouliquen (1970) discusses the technical concepts of risk analysis. He explains the importance of correlation to the overall risk assessment of an investment and describes the trade-off between model complexity and the value of isolating individual sources of risk.

In essence, FARM Assistance is a decision support system (DSS). The foundation of decision support and decision theory covers a broad spectrum of literature. FARM Assistance as a DSS addresses the decision steps of formulating and evaluating business alternatives. A survey of business managers conducted by Nutt (2000) focused on the evaluation of strategic alternatives. An interesting finding was that managers spent the most time, effort, and resources on the evaluation step in the decision-making process. A DSS like FARM Assistance can simplify the evaluation step for farm managers, increasing the likelihood that they will use more formal and accurate evaluations of alternative strategies.

Backus, Eidman, and Dijkhuizen (1997) point out the problems in production agriculture that can be viewed as a call for development of systems similar to FARM Assistance. They explain that farmers typically spend insufficient time and effort forming and evaluating alternative plans, often because they lack the confidence to do so accurately. They also specifically point out the value of a DSS helping producers to avoid costly mistakes.

Although FARM Assistance is a unique combination of methodology and application, it is preceded by many other simulation applications. Most directly, the experience with simulation and policy analysis in the Agricultural and Food Policy Center (AFPC) of the Texas A&M University System has contributed to the foundation of FARM Assistance. Richardson and Nixon (1981, 1986) provide a description of the Farm Level Income and Policy Simulation (FLIPSIM) model used for policy analysis conducted in the AFPC. Given the program leadership experience and continued contribution of FARM Assistance in the AFPC, the FLIPSIM model provided a conceptual and literal starting point for program development. In addition to contributing to FARM Assistance methodology and model design, the AFPC experience provided a working knowledge of effectively communicating simulation results to decision makers.

Program History

In 1997, Texas Cooperative Extension was provided funds from the 75th Texas Legislature to develop a pilot risk-management education program to address increased financial and marketing risk, as well as the high level of risk associated with production agriculture in Texas. Events in 1996 and early 1997 provided a unique environment in which a program of such magnitude could be funded and initiated. The implementation of the "Freedom to Farm" provision of the 1996 Farm Bill ushered in a new policy era in which farmers would, to a greater extent, react to the market signals of fluctuating prices. Price risk management suddenly became more important than ever. At the same time, many regions of Texas had experienced prolonged drought conditions. Texas agricultural leaders in extension, the state legislature, and producer organizations saw the need for a program designed to help producers plan and prepare for the increasing risks they were facing.

The broad program, referred to as the Texas Risk Management Education Program (TRMEP), was designed to assist Texas farmers and ranchers to better identify sources of risk, inform producers of how to use the tools and strategies available for managing risk, and help producers quantify the financial effects of alternative risk-management strategies. The vast majority of the TRMEP effort was directed toward creating and delivering the FARM Assistance program. The previously established and successful Master Marketer Program of Texas Cooperative Extension, de-

scribed by Amosson and Waller (2004), helped secure the confidence of program supporters and is an important part of the TRMEP umbrella. TRMEP also established the development of an extensive library of risk management educational materials. Edited by McCorkle (1998–2005), the *Risk Management Education Curriculum Guide* was designed to be a comprehensive set of materials covering a wide range of risk-management topics. The fact sheet publications include teaching materials and outlines designed for independent study by producers and producer groups.

The initial FARM Assistance pilot effort was planned for the Panhandle, South Plains, and Rolling Plains regions of Texas. To initiate program planning and development, the FARM Assistance team conducted 17 focus group meetings in the pilot areas with groups of producers, lenders, and agribusiness interests. The meetings were held to determine the sources of risk they, or their clientele, face in their operations and what capabilities would enable a computer-assisted decision tool to aid them in making better management decisions.

Development of such an extensive program is an evolving and, at times, a slow process that includes much more than the computer programming of analytical capabilities. Development means getting the word out in promotion activities, assessing focus group feedback, staffing, product testing, implementation, and the continual process of adapting and changing products and services. In many ways, a new in-depth service program is just like a new entrepreneurial business venture.

The first full year of the program was devoted to staffing, model development, training, and testing. Initially, the pilot effort included approximately six professional staff members. Although the first year saw limited field testing, early tests were successful and the program was under way. In late 1998, FARM Assistance was ready to shift into full delivery mode for the pilot region. At the same time, drought conditions continued across the state. Given early reports of program successes and the desire to help a struggling industry, the legislature expanded the pilot program funding to deliver the program statewide.

While the expansion broadened the program's scope, in some ways it was premature in the sense of programmatic development. Having just completed field testing of the model, the next logical step was for the program leaders to work closely with existing staff and provide intensive training through actual program delivery. In short order, the program more than doubled in professional staff to 13 and added assistants, staff, and graduate students. Expanded staffing efforts and statewide promotion spread the program leadership thin, leaving less time for intensive training of both new and existing staff. In spite of challenges, the program successfully managed the expansion, continued model development and training, and serviced 92 clients across the state in 1999. The program has since continued development, gaining new capacities in analysis and efficiencies in delivery. Through 2004, the program has conducted and delivered nearly 700 analyses for agricultural producers in Texas.

Challenge of Scope

Although the FARM Assistance analytical model has foundations in previously developed research methods, the scope of program delivery presented new methodology challenges. Two significant simulation innovations were developed to help address the unique situations and strategic questions of individual producers. Although less academic, general programming problems associated with creating the flexibility to analyze any agricultural operation also proved challenging.

Spatial Correlation

One of the unique methodology innovations in the FARM Assistance model is its capacity to correlate stochastic yields for multiple crops that are raised on numerous locations. A reality of working with individual farmers is the fact that production occurs on multiple farming units. A typical medium-sized farm is geographically diversified over many miles and 10–20 different locations. Each farm unit has unique production characteristics and repre-

sents several ownership or rental arrangements. At the same time, yields are not independent because they exist in a common region.

To analyze the production risk on a geographically diverse operation accurately, each farm unit must have a separate but correlated stochastic yield. Crop insurance products allow separate farming units to be insured independently. Land tenure and rental arrangements often hinge on the production-risk characteristics of a farm, and share rent arrangements on individual farms affect the overall production risk faced by the farmer. Additionally, questions of adding or releasing a single farm unit not only have an effect on the profit level of the entire operation but the change in geographic diversification affects the farm's overall production risk. New methodology innovations allowed FARM Assistance to assess production risk accounting for these realistic situations.

Richardson, Klose, and Gray describe the difficulties of dimensionality when correlating large numbers of stochastic variables. Klose (2001) describes in greater detail the two-step correlation method that allows FARM Assistance to analyze the stochastic yield of 20 different crops and several livestock production variables on a virtually unlimited number of farm units. Experience with participants suggests that the average operation has more than 10 farm units, but the program has encountered operations with more than 60 farm units.

Stochastic Futures Prices

A second methodology development was needed to analyze the effect of seasonal price changes on a farm. From simple forward contracting and other marketing strategies to the linkage to crop revenue coverage (CRC) insurance, seasonal cash and futures prices are critical for accurate farm-level analysis. A great deal of research has focused on predicting the stochastic nature of futures and option pricing. Typical methods include using the data of a currently traded contract and its derivatives to estimate the distribution of the price at contract end. The fact that FARM Assistance was intended to provide a long-range (10-year) financial forecast presented a unique challenge. Full seasons of futures' prices would need to be simulated for contracts that are years from trading. Additionally, futures prices needed to be correlated or otherwise linked to season-average cash prices projected and simulated for future years. A stochastic state methodology was developed (Klose 2001) to incorporate patterns of seasonal futures and cash prices for major crop and livestock markets.

Other Capabilities

Setting out to deliver an analysis program to any agricultural producer in Texas is difficult if any level of specificity is to be afforded the producer. Flexibility is the most important characteristic of a widely used model. With flexibility and adaptability in mind, the FARM Assistance model was developed to handle a wide range of enterprises. Most any crop activity can be analyzed along with cow-calf, stocker, feedlot, hogs, sheep, goats, and dairy enterprises. The FARM Assistance model has been used to analyze everything from the simplest crop farms to non-traditional enterprises such as orchards, vegetables, crawfish, catfish, emus, poultry, free-range poultry, and ecotourism enterprises such as hunting or bird watching.

Beyond the production and enterprise capacity, the FARM Assistance model also accommodates many different business and financial possibilities. Partnerships and other multiperson organizations are commonplace in agriculture. Family members often find entering business together is more efficient than operating several independent sole proprietorships. Varying entity structures presented another challenge for the development of FARM Assistance. In addition to analyzing a farm as a sole proprietorship, partnership, or corporation, the possibility of a single individual being involved in multiple entities had to be addressed. One of the analysis goals of the program is the ability to incorporate all the activities of the decision maker because even

marginal decisions can be affected by diversification of risk across business activities.

Other minor issues also presented interesting challenges. During the first two years of implementation, the FARM Assistance model was continually changing as the program encountered new individuals and unique situations. Some of the simpler nuances include discovering and modeling unique debt payment plans or unique landlord agreements such as a provision for a maximum out-of-pocket expenditure for the landowner.

The more difficult processes to model were management decisions. A set strategic plan is fairly simple to model over a number of years. However, when the strategy itself calls for the farm manager to assess current conditions, the strategy is more difficult to model. For example, it is fairly common for wheat/stocker operators to graze a wheat field through the winter. In the spring, the manager must decide whether to graze out the crop or pull the stockers and harvest the crop. A static strategy that always grazes or always harvests is not realistic. To accommodate a realistic strategic plan, the FARM Assistance model includes an evaluation and decision within each stochastic iteration for the wheat/stocker enterprise. Other management decisions include planting a contingent crop in the event of an early crop failure and simple cash management decisions allowing early debt retirement or savings contributions.

Program Delivery

While model capacities and flexibility are critical, the most important assets to the FARM Assistance program are the people performing the analyses. Analysts, or extension program specialists, typically have one or two advanced degrees. Successful analysts have good one-on-one people skills, financial analytical skills, and the aptitude for long stretches of manipulating data and computer models.

Extension specialists work with producers one-on-one, so the entire FARM Assistance analysis is an individualized process. Before the process begins, program subscribers are asked to do a little homework by gathering specific data. The required data are readily available from crop insurance agents, the Farm Service Agency, accountants, and loan officers. Often the information needed has already been compiled for financing purposes. The producer's cost of the FARM Assistance analysis includes the time spent gathering data, the time spent with the extension specialist, and a subscription fee of $250.

The analysis begins with initial data collection and is usually finalized in two subsequent meetings. The information collected in the initial meeting is used to develop a preliminary baseline projection for the operation. In the second meeting, the extension specialist and the subscriber review the input data, verify preliminary results, and develop any alternative strategies to be analyzed. Finally, in a third meeting, the extension specialist delivers and explains the FARM Assistance analysis report.

The total time required for the process depends on the complexity of the operation and the completeness of the information provided. In the simplest of situations, the process can be completed in two or three days. More commonly, the process takes several weeks because analysts are juggling meeting schedules and analyses for many clients at once. In most cases, the approximate time invested by the producer will be three hours gathering requested information, four hours for the initial meeting, two hours for the review, and one hour for the final report delivery.

Decision Information Analysis

The philosophy of the FARM Assistance analysis process is to provide information to help producers choose among long-term strategic alternatives. To accomplish that objective, the first step is to create a baseline. The baseline represents the current strategic plan for moving the operation through a 10-year planning horizon. The baseline then serves as a benchmark for comparing the financial implications of alternative plans.

At its core, the FARM Assistance analysis is most comparable to capital budgeting or investment analysis. Specifically, the farm or

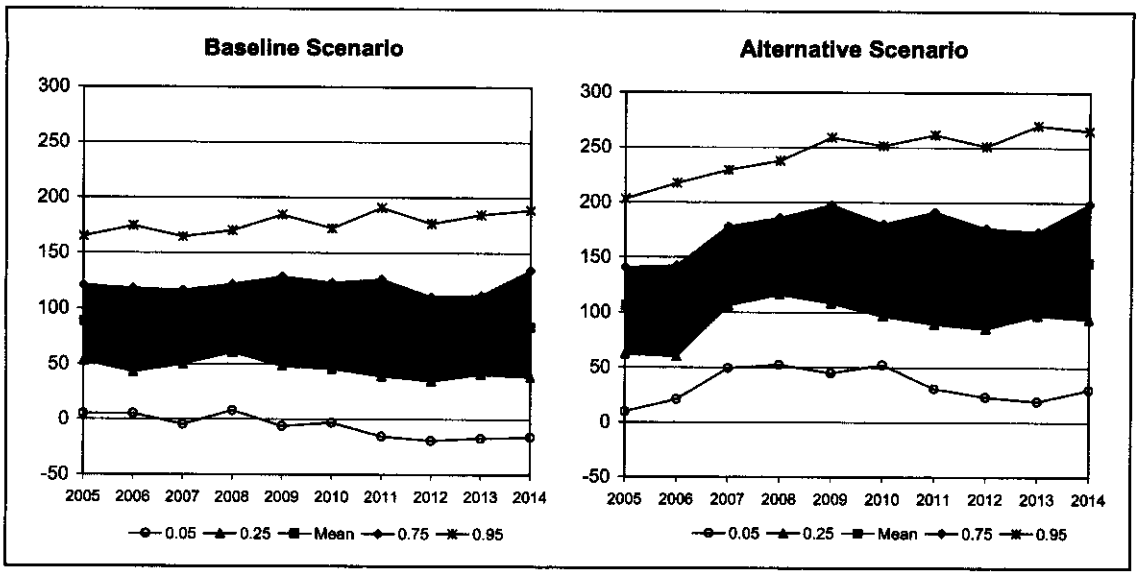

Figure 1. Sample Illustration of Baseline versus Alternative Projected Net Cash Farm Income ($1,000)

ranch manager has a set of resources available and alternative strategies in which to invest or implement those resources. While extremely detailed production and accounting variables are involved in the simulation analysis, results are generally communicated with a few simple bottom-line variables. Results and comparisons of alternatives focus on the profitability and feasibility of alternative strategies. Projected distributions of net cash income, net farm income, and net worth illustrate profitability and the operation's retention of profits.

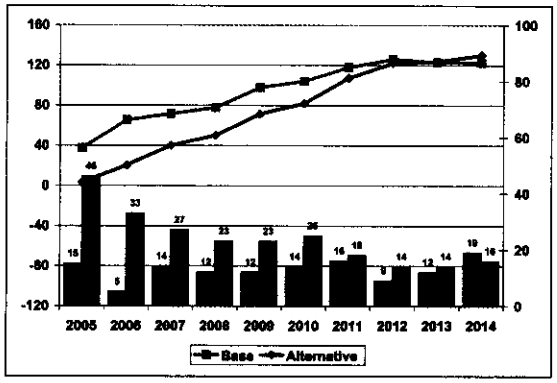

Figure 2. Sample Illustration of Baseline versus Alternative Projected Cash Flow and Probability of Cash Flow Deficit

When necessary, other measures such as an expense-to-receipts ratio or the forecasted return on assets may be included to better describe or explain the financial differences between alternative plans. The cash and working capital positions are presented to illustrate liquidity and the financial feasibility of alternative plans.

The communication of model results includes the risk of financial projections as well as average levels. Figure 1 is a sample graphic presentation of FARM Assistance model results. In this specific example, the model generates a forecasted distribution of net cash income for each projected year. The illustration represents the averages of the forecasted distributions, as well as specified points on the distributions' cumulative density functions. With this graphical presentation, a producer can quickly assess the 90% and 50% confidence intervals on the projected profit measure. More specifically, when the baseline projection is presented with an alternative projection, the differences in both average performance and risk are readily apparent. Figure 2 is another FARM Assistance graphic style used to represent projected cash flow. The graph includes the average cash position in

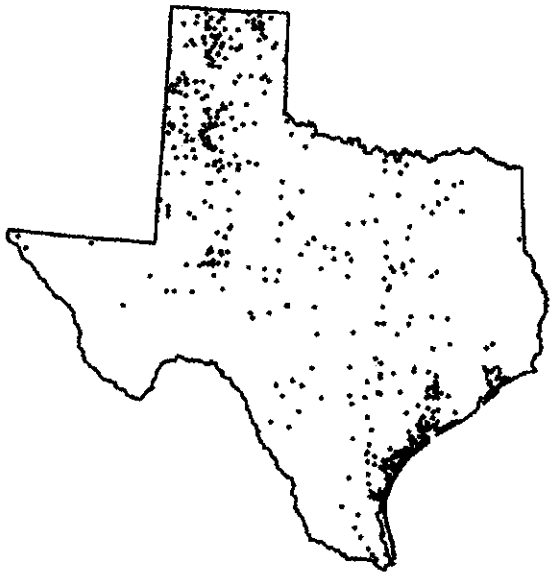

Figure 3. Financial and Risk Management Assistance Program Participation, 2000–2004

each year, and instead of presenting the full range of possible cash positions, the bars represent the probability of a cash shortfall in each year. When the baseline and alternative projections are presented together in this format, the feasibility and liquidity risks are easily compared.

Program Results

FARM Assistance has been used to analyze all types and sizes of crop and livestock operations. Close to 2,000 scenarios with their associated risks have been analyzed in completing more than 700 client reports for individual producers statewide. Figure 3 illustrates program participation across the state from 2000 through 2004. The location of participation across the state, as expected, closely follows the areas of intensive commercial agricultural production. In addition to being mostly full-time commercial farms and ranches, the early program participants tended to be the more successful and innovative managers.

Attracting new participants and selling the idea of the program was an early focus of the FARM Assistance team. By design, the team targeted innovative managers and opinion leaders in local communities. As the program matured and participation increased, participants more often came to the program after hearing of the program benefits from friends and neighbors. Agricultural lenders have been, and continue to be, essential proponents of the financial analysis service. Lenders have an interest in their customers becoming more informed managers, and they are uniquely able to help target interested participants.

Qualitative Program Impacts

An important aspect of operating an in-depth extension program such as FARM Assistance is communicating program effects. Participant reactions and comments regarding their experience can be a valuable tool in telling the story of a successful program. Participant Kevin Huffman highlighted the value of providing a public service through extension programming when he commented, "Most businesses would have a paid staff member to do this type of detailed analysis. Thanks to FARM Assistance, I can afford this type of professional service." Steve Raymond described the program's value as a management tool by saying, "This program can give you the confidence to make the tough choices to insure your farm's future profitability." Larry Romine added, "It will make future decisions easier to pencil out and make me a better manager." Subjective responses by participants can describe the value individuals receive from program participation, and illustrate the nonquantifiable aspects of program impact.

Quantitative Program Impact

Quantitative measures of impact are also necessary to communicate a program's achievement. Since FARM Assistance focuses on analyzing alternative strategies, one measure of the program's impact is the projected net worth consequences of alternative scenarios analyzed for each subscriber. The impact measure indicates the gain in net worth a producer would likely see, at the end of the 10-year planning horizon, resulting from choosing the better of two alternatives. Just looking at the

difference between the base situation and one alternative scenario implies that producers going through the program, on average, could expect a $28,000 per year difference in net worth compared with the baseline situation. For the 10-year planning horizon, that's almost $300,000 per subscriber. While the value of producers' decisions does not directly value the program, it helps objectively illustrate program effect on the farm or ranch manager.

Broader Program Perspective

Although FARM Assistance has tremendous benefits for individual participants, it also has unlimited potential to support the entire agricultural economy of Texas. As a result of conducting more than 700 analyses across Texas, an extensive database has been developed portraying the wide range of operations that exist in Texas agriculture. While the individual data remain confidential, the collection of data can provide priceless information and research capabilities to aid federal and state policy makers. The aggregate data also benefit the individual producer by identifying the characteristics and factors that make some producers more successful than others. The following are a few examples of the function and output of the FARM Assistance's aggregate database.

Farm Bill Research

During the debate process leading up to the passage of the 2002 Farm Bill, the FARM Assistance team in partnership with the AFPC provided critical analysis to U.S. representatives from Texas regarding the potential effect of farm policy provisions on the farmers and ranchers of Texas.

State Tax Policy

Texas agriculture has a keen interest as the state legislature takes up the issue of school finance and related tax alternatives. In 2003 and 2004, Texas agricultural leaders in the legislature and in commodity and livestock organizations called on the FARM Assistance team to evaluate specific tax proposals and the value of current exemptions that benefit the agriculture industry. The FARM Assistance database should continue to be a valuable resource for producer organizations and lawmakers in future tax-policy planning and debates.

Identifying the Successful Producer

Like any other type of business, farmers and ranchers in Texas operate with varying degrees of financial success. Participants in the FARM Assistance program have access to reports that enable them to compare their operation to similar farms or ranches in Texas. In addition, extension specialists have begun and continue to research the extent to which various business characteristics and factors are related to financial success.

Risk and Profits

One of the more unique aspects of the FARM Assistance program is the ability to analyze financial performance while accounting for production and market risk. Extensive information and research is available concerning the relationship between the risks and returns associated with investing in financial markets. FARM Assistance creates the data that can explain the same relationships as they occur in agricultural production. The risk versus return area of research has the potential to help producers identify opportunities to improve profits without taking on too much risk or, conversely, to reduce their risks without giving up too much return.

Summary

The FARM Assistance program of Texas Cooperative Extension is conducting strategic farm-level analyses for individual farm and ranch managers using financial simulation methods. Taking advantage of the rich data collected in individual analyses, the program also conducts aggregate research and analyses benefiting the entire agricultural industry in Texas. With a solid foundation in simulation methodology, the program has overcome the

challenges of delivering a research-based analytical service to a broad and diverse clientele. In-depth programs, such as FARM Assistance, that focus on decision support, should become increasingly important for extension agencies as agriculture continues the long-term trend of fewer and larger farms and as producers become more technologically advanced in their business management and decision making.

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