KINDS AND SOURCES OF RISK IN LIVESTOCK PRODUCTION AND MARKETING-DISCUSSION

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In the final months of W-149 and during development of S-180, need for additional attention to managing livestock production and marketing risks was noted. Several contributors to S-180 represent areas where livestock farms and ranches are predominant. A work group on livestock risks is anticipated as part of the project. Glenn Helmers and Joe Atwood have made a useful beginning to needed research on risk in livestock production.

The authors outline several reasons why livestock have received little attention in risk analysis. They suggest that livestock risk analysis is difficult, partly because it must incorporate effects of variability in input production and prices. Many of the input prices in livestock production such as for feed are determined in a volatile international market. On the other hand, the rangeland input has partly an institutional and partly a market determined price. The prices for meat products are determined in a domestic market. Variable consumer incomes and uneven technological development in poultry, hog and beef production complicate production and market planning.

The authors and Carl Olson emphasize the long run nature of livestock decisions. The calf producer faces a derived demand for his product based on a fairly long time lag; it takes about 15 months to produce a heifer to breeding age, nine months to produce a calf, six months to get that calf grown and weaned, and another six months to a year to have a finished product.

Variability of crop yields are readily observable and usually can be related to specific causes. Data are not readily available on variability in livestock production, and good scientific information is not available about causes of the variability. For example, the effects of an unfavorable grazing year on calf weights, gains and rebreeding are difficult to estimate at this time. Additional research effort is needed in that area.

The authors provide some measures and comparisons of variability for livestock and crop enterprises in the Great Plains. They question the customary approach to analysis of price and yield phenomena in agriculture in which the trend and cyclical variation is removed and only the random component is left for estimating variance. They suggest that the trends and cycles also are risky, if financial planning does not anticipate these trends and cycles. The trend and cycle could be analyzed for variability, e.g. by estimating the distribution of cycle length and amplitude. Likewise, the probability distribution for projected trends in prices or production over time would be of value.

Helmers and Atwood provided two risk indexes: (1) the coefficient of variation for price and residual returns and (2) the standard deviation of

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the price and residual returns divided by the investment required for the enterprise all times 100. The latter doesn't have the same meaning as the coefficient of variation. For example, a livestock enterprise with a standard deviation of 50 and a residual return of $75, has a coefficient of variation of 66. That value is easily interpreted by saying that a one standard deviation range around the mean would be $75 plus or minus 66 percent of $75 ($25.50 to $124.50). The same kind of interpretation cannot be made for the standard deviation divided by investment. An alternative would be to divide the coefficient of variation of price or return by investment. Then, using the previous example, a one standard deviation range would be 75 plus or minus 66 percent all divided by $200, a range in return per dollar of $.1275 to $.6625. Unlike the authors' Index B, this index would have an easy, direct interpretation.

Records and secondary data are not adequate for estimating variability of livestock enterprises. Work with an animal simulator could be a fruitful approach to estimating risk in livestock production. A simulation model of a stocker or cow-calf enterprise could provide estimates of the growth and production of the animal given a specified set of inputs [1]. The amount and quality of inputs can be varied to determine their effect on production. When probabilities are attached to the qualities and levels of inputs, a distribution for production can be estimated. Animals (particularly beef cows) tend to cushion production variability, as do responses by management. However, production costs may vary widely. A simulator could be used to estimate returns per head under various conditions and provide a distribution of returns.

An advantage of simulation is that it would allow multiple variables to be considered. Disease, grazing conditions, weather conditions, death losses and buying and selling prices could be varied. A correlation matrix for variables could be included. The result would be a sophisticated estimate of the distribution of returns.

Helmers and Atwood appropriately emphasize need to analyze the effect of variability on income and financial results for a firm over time. They point out that usual analyses do not measure the intertemporal effect of strategies such as insurance and diversification. The firm's ability to bear risk changes over time partly because of successes and failures. Risk strategies may have negative and positive intertemporal effects. For example, annual insurance payments by a firm with very meager cash flow may have an effect as bad as an uninsured event that bankrupts the firm. The firm fails in each case.

The usefulness of a model such as PARC described by the authors is partly determined by how well it represents the decision environment. PARC finds a plan for each year to maximize ending net worth, subject to a safety first rule that the equity level be 25 percent or more. The decision rule appears reasonable. However, a farmer might accept a small chance of a bankruptcy-causing, lower equity.

Because the intertemporal programming model is simultaneous, plans made for later years can determine plans for earlier years. It is true that current decisions are influenced by possible future plans based on expectations. However, plans adopted over a period of years are determined by preceding years. Good or bad preceding years leave a financial legacy which determines the planning perspective and growth path for later years. The intertemporal programming model doesn't allow current plans to be adjusted for occurances in preceding years. Thus it is more useful for applications such as Helmers and Atwood present than for prescribing long run farm plans.

The authors believe that the PARC model has an advantage over simulation. For example, they suggest that it is easier to handle fixed costs in PARC than with simulation. I believe it is probably easier to build a simulation model that handles the cash flow and the balance sheet for the firm. The simulation model obviously handles multi-period considerations. A simulation model certainly can be augmented by a model such as PARC to choose the current organization given the current situation of the farm and its future after-tax possibilities.

The price and yield events in PARC are perfectly correlated. They simply represent historical combinations of variables of interest. These data represent the past very well but do not necessarily represent the possible future distribution of events.

The PARC model results presented by Helmers and Atwood are striking in that the additional return from growth diminished quite rapidly as capital was added. The farmer didn't lose a great deal of income when he decreased his amount of growth substantially. The authors observe that it would be possible to place constraints in a regular linear programming model to limit growth. Such constraints could force diversification or impose marketing strategies. In the studies discussed, those constraints would have improved the survival rate of the farm, without the complications of using the PARC model.

Risk management strategies available to livestock producers should be considered in discussion of livestock risk research. One alternative beef producers have is to retain calves through stockering or fattening phases. A number of market imperfections exist in pricing cattle moved from the cow-calf producer through other production phases. A calf producer with animals which perform well in the stocker and feeding phases probably won't be rewarded fully in the market place. One way he can capture those rewards is to retain the cattle. He also has the advantage of lower medical, hauling and marketing costs than incurred by a buyer. The risk and tax implications of retaining calves need to be researched.

The livestock producer also has an opportunity to hedge and contract. Unfortunately the futures market only prices 12 months in advance. As was pointed out earlier, many cattle decisions are for more than 12 months. Market risks may be unavoidable when a farmer decides to buy a set of cows or retain some heifers.

The use of flexibility in the mix of livestock, for example cows, stockers and feeders, to suit the production-marketing environment needs to be researched. In addition to a flexible mix of animals, flexible forage based on forage species and practices used is another way to deal with risk in livestock production.

Some livestock have potential tax advantages. These advantages might be marketed through limited partnerships. Tax advantages of machinery, equipment and real estate ownership are currently being marketed through limited partnerships. Possibilities could be explored in research. Finally, vertical integration, perhaps using cooperatives to change marketing-slaughter structure and reduce market risks, is a possibility in livestock production.

REFERENCE

[1] Brorsen, B. Wade, Odell L. Walker, Gerald W. Horn, and Ted R. Nelson, A Stocker Cattle Growth Simulation Model, Oklahoma Agricultural Experiment Station Publication P-3913, 1981.