# The Role of Alternative Risk Programming Models in Empirical Research: Discussion

by

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The topic assigned, "Strengths and Weaknesses of Alternative Risk Models," is very large. Professor Boisvert chose a very useful course for the development of his paper. In narrowing the topic from a broader range of models, he was able to provide some insight into the potential application of alternative risk programming models for micro prescriptive applications. I am in general agreement with the points he makes. Instead of belaboring minor disagreements, I will use my allotted time to mention two areas that deserve additional emphasis. One is an evaluation of the strengths and weaknesses of simulation models. The other is a discussion of the necessity to think broadly in building models. This is an elaboration of a point raised in this paper.

## Simulation Models

Whole-farm simulation models can evaluate a wide range of production, marketing and financing alternatives in a whole-farm context--an important characteristic for risk models. In addition the simulation models currently being used produce rather detailed analyses of the impact of alternative strategies analyzed on the profitability, liquidity and solvency of the farm. It is difficult to build these considerations into programming models and report the results at the same level of detail as can be accomplished with simulation models.

Simulation models offer the potential to consider uncertain technical coefficients, the $a_{ij}$'s, and resource availabilities, the $b_i$'s. The technical coefficients can be made a function of environmental variables. For example, the amount of irrigation water or field time can be made a function of stochastic weather conditions, and the cost of purchased inputs may vary depending on stochastic input prices. The amount of equity capital and other resources available in future periods can be modeled as a function of environmental

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variables. Furthermore, simulation models offer the potential for modeling feedback phenomena and adaptive control processes. Thus simulation models can be made responsive to changes in $b_i$'s and $a_{ij}$'s either within one production period or over several periods.

Two perennial problems with the use of simulation models are: (1) the difficulty of specifying strategies to evaluate; and (2) the cost of developing and running these models. Programming models have an advantage in identifying efficient strategies as Boisvert discusses. The recent trend toward the use of single period linear programming models to identify strategies maximizing short-run expected returns and then simulating those strategies is a first step toward combining the strengths of mathematical programming and simulation. We will see more use of programming techniques which identify stochastically efficient plans, such as target MOTAD, with simulation. The combination of correctly specified risk programming models and simulation should enable us to move another step toward identifying optimal strategies.

Consideration of the more advanced programming techniques will, unfortunately, make the combination simulation and mathematical programming models more expensive to build and run. As long as we use risk, programming models solved by linear programming algorithms, however, the additional costs will be limited primarily to model development. The additional computer time should not be a major item.

## Model Breadth

The paper urges that we develop broad models for prescriptive research at the micro level. Perhaps it is useful to comment on each of these aspects of model breadth: development of the resource constraints; specification of the production, marketing and financing alternatives; and incorporating the effect of the external environment on management of the firm. These aspects of model breadth are of importance in developing both mathematical programming and simulation models.

Failure to specifying the resource situation and the resulting constraint set rather completely may result in the solution being sensitive to changes in risk and other parameters. For example, failure to specify the financial constraints completely may increase the sensitivity of marketing strategies to changes in price and risk considerations.

The model should also incorporate the major production, marketing and financing alternatives available to the farmer. Failure to do so may reduce the model's ability to respond to changes in resource requirements and availabilities as an operator can respond.

Third, it is important to incorporate how changes in the firm's external environment will affect the factor and product markets as well as the constraints facing the firm. There is current interest in studying the effect of alternative commodity programs on the financial progress representative farms can be expected to make over the next several years. The alternative commodity price scenarios and the macro economic scenario on which they are based may have very different effects on some of the factor markets--notably the market for (rented and purchase of) land, machinery and livestock facilities. Modeling these markets with constant rates of change in price per year is unlikely to adequately reflect the way these markets will respond. Modeling in these simple ways may lead to selection of very different strategies and very misleading financial results for the firm.

## Summary

The comments Professor Boisvert makes suggest reasonable direction for the application of programming models in micro prescriptive research. Many of the suggestions he makes are also applicable to future development of simulation models. The developments in programming models he describes should be very complementary to the continued development and use of simulation models.