MODELS OF TECHNOLOGY ADOPTION UNDER RISK:

A DISCUSSION OF SOME PRELIMINARY RESULTS

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Marra and Carlson attempt to extend the frontiers of our theoretical and empirical understanding of production behavior under risk. Marra and Carlson adequately describe the practice of double cropping soybeans and wheat . This production practice is then the object of their empirical analysis. The paper has two separate thrusts as it analyzes the double-cropping patterns in the Southeastern United States. First, the authors analyze the proportion of soybean acreage double cropped in the Southeast over time. This analysis uses time series state level data and a micro level expected utility maximization model to examine the interstate and interyear variation in the proportion of soybean acreage double cropped. Second, the authors compare the theoretical results of a model developed by Just and Zilberman to some empirical evidence on double cropping and farm size from a 1982 USDA cost of production study. This analysis purports to use cross-sectional farm level data to test relationships between adoption of the double cropping practices and fixed costs of adoption, risk aversion and credit limitations.

The first reading of the paper was enjoyable. The questions the article raises, and the new ideas it presents make it an interesting contribution to the literature. On careful scrutiny, the paper would likely benefit from one central focus rather than two focuses which it presently has. The first analysis of double cropping patterns using the Marra-Carlson model on time series data was extremely brief, as the authors admitted. A great deal of additional information concerning the analysis would be beneficial. Examples of helpful additional information include basic descriptions of the data, assumptions, a more complete discussion of the model derivation, and a more complete reporting of the results. The authors recognize this shortcoming and refer the reader to previous work. Even with this reference, it is questionable if the very brief summary has much significant value other than as an appetizer for the references.

The authors provide some evidence that the predicted results from the Marra-Carlson model track the actual proportion of double cropped acreage fairly well. Comparisons between the models' predictions and the actual values are made for three states. However, a major nagging question remains. Does this model provide results superior to those provided by more conventional supply response models? A complete discussion of the major determinants of double cropping adoption and a better understanding of the problem in the Southeast would be helpful. This would hopefully lead to a clear justification of the inclusion of risk in this particular application. In addition, an interpretation of the elasticities with respect to the moments of the crop return distributions would be helpful. The idea of an elasticity with respect to variance of the crop return is likely valid, but are producers really

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sensitive to these parameters? Or, are they more sensitive to these parameters than to other considerations such as government programs (if they have an impact on acreage of these crops in the Southeast)? What does aggregation do to the estimation of these elasticities if anything? The difficulty of including all of this in this paper is insurmountable given that a second major analysis is included. The value of this work is in the questions it raises and the interest it should generate for the more complete analysis in the references.

The second thrust of the paper is to empirically investigate the relationships suggested by the model developed by Just and Zilberman. This model suggests relationships between farm size and the adoption of a new technology due to fixed costs of adoption, credit constraints, covariance of returns between the technologies, and differences in risk aversion. A general justification for analyzing the problem in this context would be helpful. This would answer questions concerning the need to approach the problem this way and whether the practice of double cropping soybeans is indeed a new technology. After a nice graphical description of the relationships suggested by Just and Zilberman, the authors investigate empirical relationships between double cropped acres and farm size measured as the total number of soybean acres planted. The authors estimate a quadratic function to investigate this relationship. The biggest drawback to the investigation is the lack of data related to fixed costs, credit constraints, covariance of returns, and risk aversion to support the relationships suggested by Just and Zilberman. The authors make attempts to measure the management ability of the operator and the capital endowment of the farm. These attempts improved the results slightly. The major question that remains is whether the theoretical reasons suggested by Just and Zilberman are the correct reasons for the relationships found. One is reminded of some programming studies which used small matrices which would not result in much, if any, diversification when maximizing profits. Additional contraints were added for the inclusion of risk, diversification resulted, and risk got all the credit for the diversification when timeliness and other resource restrictions may be the reason in reality. The authors were cognizant of the many factors which could have resulted in the relationships found until they got to the conclusions. The authors suggest that more complete modeling of the trade-offs involved in the optimal timing of inputs would prove to be very helpful in understanding behavior under risk. A possible suggestion would be to explore some of these relationships with a programming model which incorporates risk.

The authors have taken the necessary first steps in testing the theory suggested by Just and Zilberman. They should be commended for their effort.