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I. Introduction

The area of agricultural options is rich with potential new research directions. One reason is that, relative to financial options, few published studies have dealt with agricultural options. Another reason is the unique characteristics of agricultural markets.

In looking at future research directions, there are many issues of interest beyond the valuation of options, which has been the focus of most options studies in finance and agricultural economics. In an effort to broaden the research agenda, I will examine four major topic areas: (1) general issues, (2) price-support impacts, (3) price discovery, and (4) options valuation.

Please note that I will be discussing research directions for options on agricultural futures contracts. With a few specialized exceptions, it is illegal in the U.S. to trade options on physical agricultural commodities.

II. General Issues

Four general issues are noteworthy:

A. A number of studies of the role of ag options in farm marketing have used mean-variance measures of performance. Bookstaber and Clarke [1984] and Brooks [1989a, 1989b] have shown unequivocally that portfolios including options have significantly skewed distributions. This must be the case, or why would an investor ever pay for an option? Hence, the use of mean-variance measures of performance will lead to significant biases. More general techniques such as stochastic dominance should be employed.

Some have argued that it is sufficient to test for normality of returns and if it is not rejected for the sample, then mean-variance measures can be applied. The proper conclusion is that normality implies that the sample is simply too small and/or idiosyncratic characteristics of the market during the sample period predominate.

B. Empirical studies of agricultural options pricing are deficient from a data perspective. Specifically, studies have used closing price data rather that transactions data. Bookstaber [1981] has clearly documented the importance of minimizing nonsimultaneity problems. Given that many ag options are thinly traded, this is a particularly important issue. Since transaction (or "liquidity") data bases are readily available from the futures exchanges, it is not difficult to employ such data.

C. Very little is known about the composition of traders in the new ag options markets and how the composition is related to underlying economic conditions. Do hedgers tend to buy or write options? Do hedge positions in

the ag options markets follow a similar seasonal pattern to that of the underlying futures market?

D. Another interesting question is who wins and loses in the ag options market. In my experience, farmers, agribusiness persons, and traders have expressed the near-unanimous belief that options writers earn a substantial risk premium. My standard reply to this belief has been, "If you're so sure this is true, then why don't you become an options writer?" Despite the obvious efficient markets counterargument, I have heard the belief enough times from knowledgeable people that it is worth investigating.

In a similar vein, it would be interesting to determine the profits and losses of hedgers and speculators in the agricultural options markets. A good model is Hartzmark's [1987] study of the profits and losses of large traders in futures markets. To the interested researcher, please note that the daily record (anonymous) of the positions of large traders can be acquired from the Commodity Futures Trading Commission (CFTC) through a Freedom of Information Act request.

III. Price-Support Impacts

It is in this area that agricultural options may be of the most interest to financial economists. The government price-support programs for corn, soybeans, and wheat provide free or low-cost put options to farmers (Gardner [1977]; Petzel [1984]). For example, all soybean producers in the U.S. are eligible to take a loan out on their production for a fixed value per bushel. If price rises, the farmer repays the loan plus interest and sells the soybeans in the cash market. If prices fall below the loan value, the farmer may forfeit the soybeans to the government and keep the loan proceeds less interest costs. This is clearly the equivalent to a put option.

A. A number of studies have investigated the role of ag options in farm marketing strategies. It is curious that none have included price-support programs as marketing alternatives, since the programs are competitive with market traded options. It seems unnecessary to state it, but a free put option will always dominate a market put option traded for its fair market value. Hence, it is not surprising to me when a farmer states, "Those corn options are just too expensive!"

B. The put options provided by price-support programs can be valued using standard options-valuation techniques. Marcus and Modest [1986] have shown this in an innovative paper. However, their simulation results should be viewed cautiously since they assumed that the loan program did not impact the distribution of cash prices (footnote 12, p. 81). In actuality, the entire purpose of the program is to directly intervene in the market to support prices. As a result, the volatility of prices will be different with and without the program, and this will have an obvious effect on the value of the price-support put.

C. Since price supports alter the distribution of underlying cash prices, option prices will be affected. This represents a most interesting area for research. Miranda and Glauber [1990] provide an important and innovative

theoretical and simulation analysis. They show that the Black model is significantly biased in the presence of a price-support program. Further development and testing of theoretical models is needed.

One study has conducted an empirical examination of the effect of support and release prices on agricultural options prices. Taylor [1989] found that the price support was a significant factor in explaining the difference between model and actual soybean option prices. Additional work is needed to more precisely document such effects.

IV. Price Discovery

Please note that when I use the term *price discovery* I do not mean the valuation of ag options. I use it to refer to an economic process whereby price is "discovered" in a market.

A. An ongoing question in all markets is the impact of the opening of derivative markets on the underlying cash market. First, theoretical models need to be formulated that allow the introduction of futures and options trading. Then, similar to existing literature on the effect of the introduction of futures trading (i.e., Turnovsky [1983]), the impact of options trading on the distribution of spot prices could be analyzed. Second, agricultural markets provide a unique opportunity for empirical study, in that futures trading was established long before the introduction of options trading. Hence, the impact of futures options trading (if any) on the underlying cash market can be isolated. I believe a particularly interesting question is whether the introduction of option trading has a perceptible impact on the efficiency of cash and futures price movements.

B. The direction of causality between futures and options prices is an interesting question. I have yet to come across a floor trader who believes that the options lead futures—ever. A closely related question is whether futures volume leads or follows options volume.

C. Another issue is whether the introduction of options trading has had an impact on the *level* of futures volume. Conceptually, it seems likely that options trading increases the volume of futures trading. The reason is that (1) a substantial number of options are traded in hedged portfolios with futures, and (2) options trading makes possible a quantum leap in the possible number of hedging and speculative strategies.

D. A crucial question is the level of liquidity costs in ag options markets. I am not aware of any evidence on this question. There are substantial differences in trading volume across markets, puts and calls, maturity, and moneyness. It would be interesting to relate these differences to liquidity costs.

E. The introduction of options trading allows a much richer investigation of the reaction of market participants to new information. Specifically, option prices can be "inverted" to derive the expected distribution of prices (Fackler and King [1987]; Sherrick, Irwin, and Forster [1989]). The impact of new information on the expected distribution of prices can be analyzed, rather than simply the impact on the expected value of prices.

V. Options Valuation

Studies show that the Black model with a frequently updated volatility estimate values agricultural options reasonably well (Jordan, Seale, McCabe, and Kenyon [1987]; Irwin, Pelly, and Zulauf [1989]; Taylor [1989]). Of course, accuracy is measured over a large sample in these studies. Substantial deviations are evident, and it is here where many challenges remain.

A. Improved volatility forecasting models need to be investigated. GARCH models are likely candidates for testing in that they have been shown to fit other speculative price series reasonably well (stocks: Akgiray [1989]; exchange rates: Hsieh [1989]). Further work is needed in determining the fundamental factors that determine agricultural futures price volatility. Structural models have been developed with endogenous price volatility (i.e., Glauber [1984]), but richer specifications need to be investigated. Kenyon, Kling, Jordan, Seale, and McCabe [1987] conducted a valuable *ad hoc* analysis that should be helpful in identifying important variables.

B. Tests are needed to determine if the incorporation of "adjustment factors" for moneyness, liquidity costs, etc. can improve the accuracy of Black model estimates of agricultural options premiums.

C. Efficiency-type tests of the Black model need to be conducted. While the subject of considerable controversy in the financial literature, such tests have been an important source of information concerning the economic value of option pricing models.

D. A number of alternatives to the Black model have been proposed, including the CEV model (Beckers [1980]) and stochastic volatility models (i.e., Wiggins [1987]). Valuable knowledge could be gained by applying these models to agricultural options pricing, especially in light of the serial correlation in agricultural price volatility (Hall, Brorsen, and Irwin [1989]).

E. Figlewski [1989] recently made an important contribution regarding how option pricing models are actually used by traders. He suggested there is a large difference between the theory and use of models. In light of this observation, I think it would be useful to conduct a comprehensive survey of agricultural options traders to determine how they use option pricing models. Possible questions include: (1) Does the trader ever use pricing models? (2) If so, which models does the trader use? (3) Are the models used for predicting prices? (4) Are the models used for calculating implied volatility? and (5) How much confidence does the trader have in model predictions?

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