PRICE RISK MANAGEMENT: ARE FUTURES MARKETS ADEQUATE?

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This paper addresses the issue of the adequacy of commodities futures markets for managing producers' price risk. A proposal is made to extend futures contracts 2 to 3 years compared with the current 12 to 15 months. The cogent question is: do futures markets provide agricultural producers with an adequate method of managing price risk? The answer depends on how one defines the term "price risk".

My interpretation of what most writers mean by the term "price risk" is simply that product prices vary randomly over time. Therefore, prices at some future time cannot be known with certainty. These writers equate price risk with uncertainty about prices at some future time. If one equates price risk with price uncertainty, then the answer to the above question is -- no, the futures markets are not adequate. Because futures markets do not, and cannot be expected to, remove all variation in market prices.

However, the problem is not with the inadequacy of futures markets. Rather the problem is with the definition of price risk. The root of the problem is the failure to distinguish between price risk and price uncertainty. Unfortunately, this is a widespread problem with much of the literature on risk and uncertainty. Because of the failure to distinguish between risk and uncertainty, economists have coined some inappropriate terms like "risky markets". There were at least two invited papers at the AAEA meetings this past summer dealing with something called risky markets (Buccola, and Antonovitz and Roe). I submit there is no such thing as a risky market. There are risky decisions that involve operating in markets with uncertain prices. But, there are no such things as risky markets. I will return to this point later.

Perhaps this may appear to be nit-picking about unimportant definitions. However, the failure to distinguish between risk and uncertainty is a serious shortcoming with much of the literature on risk that often leads to development of inappropriate analysis and conclusions about risk and how decision makers can effectively deal with risk.

There is an important distinction between risk and uncertainty. It is imperative that we understand this difference and keep it in mind as we examine decision problems and develop methods for helping decision makers cope with uncertainty.

Let us begin with a definition of uncertainty. Uncertainty exists because: 1) the decision maker does not have complete control of the process that determines the outcome of a particular action, 2) there is more than one possible outcome associated with an action, and 3) each possible outcome has some non-zero probability of occurring. Uncertainty exists because the decision maker is unable to determine with certainty the outcome that will be realized from the action being initiated by the decision maker (1).

What about a definition of risk? Risk of what? Is the decision maker concerned about the risk of losing more than $50, the risk of losing more than $1,000, the risk of earning less than a 10 percent rate of return on his investment, or the risk of bankruptcy? The existence of uncertainty about the realized outcome of his project may expose the decision maker to all these kinds of risk -- and perhaps other kinds of risk as well.

The decision maker exposes himself to risk by selecting a course of action that has uncertain outcomes. But for risk to exist there must be a subset of possible outcomes that is classified by the decision maker as undesirable. Risk of the probability that the outcome of the selected action will fall in the subset of possible outcomes defined as undesirable by the decision maker (2). Thus, the term price risk has meaning only after the decision maker has defined the subset of undesirable outcomes in terms of some critical value -- for example, all profit levels equal to or greater than some specified value. The critical value will depend on the types of risk considered and may vary between decision makers for the same type of risk, even though they are exposed to the same set of uncertainties.

For example, two farm producers may have identical management skills, identical price forecasting skills, and identical costs of production. However, should financial conditions ratios differ for the two farmers, the risk of insufficient cash flow to meet debt payments will differ. There are numerous possible outcomes with respect to prices prevailing at some future time (3). Price uncertainty is clearly involved when the actual price at some specified target date is unknown (4).

Suppose the two producers are concerned about the risk of loss -- i.e., the risk that realized profit will be negative. Risk of loss based on realized price is then defined as the probability that realized profit will be zero or negative because realized price at the end of some target date is less than the
expected price adjusted for production costs and debt repayment. Price risk exists because of uncertainty of prices and debt repayment schedules. Price risk is the probability that realized prices and, hence, profits will fall within some specified unfavorable range depending on the circumstances of individual producers. Critical value defined as unfavorable depend on debt repayment schedules, cash flow, family subsistence and other obligations.

The question "price of risk of what?" must be answered before we can compare the riskiness of alternative decisions although all of the decisions may involve the same degree of price uncertainty.

Decision makers are exposed to risk because of the inability to predict outcomes with certainty. Decisions are risky. Realized market prices are uncertain.

Variability in observed market prices is not the source of uncertainty in decision making. Rather, the source of uncertainty is the decision maker's inability to predict changes in prices. Suppose, for example, that observed market prices are highly variable. The existence of a price forecasting system that predicts those variable prices with perfect accuracy removes the uncertainty and hence the price risk. The magnitude of price risk is determined by the accuracy with which decision makers can predict prices — not by the variation in observed market prices over time. Consequently, estimates based on historical prices in the market in which the producers sell their produce provides no information about either the nature, or the magnitude, of price risk associated with their decisions. However, literature on price risk includes estimates based on variability in observed market prices as the indicator of price risk. Moreover, the analyses assume that all decision makers in that market are exposed to the same price uncertainty and price risk.

Decision makers' actions are based on estimates of what the price will be at the end of the production process. Thus, a decision maker with a very accurate price forecasting system will realize an outcome close to expectations. On the other hand, a decision maker with a less accurate forecasting system will realize a wider range of realized outcomes relative to expectations. Thus, price risks increase as the decision maker's ability to forecast prices decreases (5).

Let us now return to our original question. Are futures markets adequate for management of price risk? The answer is yes, provided:

1) There is a futures contract available to producers for hedging.
2) The variance of the expected basis for the producer on the day of settlement is less than the variability of the unhedged returns, and,
3) Producers are informed about possible prices at specified time periods based on information provided by the futures market. Let us now consider the last condition states that the price of the futures contract used by producers in establishing the hedge is reasonably close to predicted prices (6). Well informed farm producers are expected to use predicted prices in making production decisions that are fairly close to those observed for the relevant futures contract.

Producers can use the futures market to manage (i.e., reduce or eliminate) the price risk of loan repayment problems because of an unexpected shortfall in prices relative to their predictions. However, hedging on the futures market also precludes windfall gains from prices higher than those specified in futures contracts.

Moreover, similar lines of reasoning demonstrates that futures markets are indeed adequate for managing other types of price risk, -- provided the decisions for which the risk is to be managed are based on price predictions that are consistent with prices of existing futures contracts.

Options markets also provide producers another tool for managing price risks. When producers trade unhedged activities for hedged activities they forego the possibility of better than originally expected outcomes. Producers are sometimes reluctant to give up these possibilities in order to avoid certain types of price risk. However, options markets provide producers with an opportunity to enjoy the best of both worlds for the cost of an options contract.

Options provide producers with an opportunity to purchase a futures contract at a later date, should prices move against the producer. However, producers can take advantage of higher prices simply by not exercising options to purchase futures contracts. Thus, the options market will enable producers to trade an unhedged enterprise for a position of all favorable outcomes at a cost.

There are, however, limits to the extent that futures and options markets can be used to manage price risk. Futures markets obviously provide no opportunity for managing price risks associated with uncertainty about prices beyond the 12 to 15 months for which contracts are traded. However, futures markets for some commodities should be extended to cover periods of 2 to 3 years (Bullock). Extending the market for futures contracts 2 to 3 years into the future would:
1) provide an institutional mechanism for focusing production decisions over longer time periods, and
2) provide producers with an opportunity to manage various types of price risks over periods more consistent with the length of the production cycle (7).

Information is the fuel on which effective markets operate. Futures markets are simultaneously heavy consumers and producers of imperfect information about the future. But, in an uncertain world, even imperfect information has value. Organized futures markets provide a mechanism for gathering and processing information and more importantly providing individuals with opportunities to make decisions based on that information. Moreover, the markets provide decision makers an opportunity to incorporate reduced price risk into those decisions.
Because of the "public good" character of information, it is not obvious that the extended futures markets would be viable without a fund, something very similar to the base level is required. At a minimum, the government would be expected to be the primary generator of baseline forecasts and of information about future supplies and demands as it currently does for existing markets. That is, USDA projections would need to be extended 2 to 3 years into the future. However, it may also be necessary for a public agency to take a speculative position based on that information in order to create a market in which those forecasts can systematically be exposed to information from other sources and to generate prices that provide: 1) long term signals to producers and consumers, and 2) opportunities to manage various types of price risk associated with longer run price uncertainty.

The purpose of the government agency would be to "make a market" based on the best information available about market clearing prices in the future. To accomplish this, the agency would stand ready to purchase or sell unlimited quantities of target contracts 2 to 3 years in the future at a predetermined interval (say, + 50%) around the forecasted market clearing price for that period based on the best information available. If the forecasts are high compared to realized prices about as often as they are low (i.e., an unbiased price forecasting system evolves), then we would expect the agency to break even in its trading operations over time excluding operating costs. The agency would liquidate its long or short positions in an orderly manner over the life of the contract as it became evident that the forecasts were incorrect. Profits and losses would be taken accordingly. By liquidating their position prior to delivery date, the government would acquire no stocks as a result of their trading program. The existence of this market would, however, provide the type of long term information and risk management opportunities needed for longer term agricultural investment and management decisions.

Summary

This paper reviews concepts and definitions used in the risk and uncertainty literature and examines the question of the adequacy of futures markets in risk management posed in the title. The following axioms were established:
1. There is a difference between risk and uncertainty. "Uncertainty" exists because the decision maker cannot predict with certainty the final outcome of his economic activity. "Risk" is the probability that the realized outcome will fall in the range of possible outcomes defined by the decision maker as undesirable.
2. There are no risky markets. Decisions are risky. Market prices are uncertain.
3. Price risk exists because of decision makers' inability to predict prices into the future with perfect accuracy.

4. Futures markets are an adequate mechanism for managing price risk provided:
   a) An appropriate futures contract exists, and
   b) decision makers have to take into account price information provided by futures markets as economic activities are selected.

5. Futures markets cannot be used to manage price risks that are generated by decision makers' failure to recognize and accept market realities.

6. Futures markets for agricultural products should be extended 2 to 3 years into the future in order to provide opportunities to manage price risks over longer periods than is currently possible.

Notes

1. Uncertainty is not removed by providing decision makers with knowledge about the probability distribution of possible outcomes. Even with this knowledge, the outcome of a particular action cannot be predicted with certainty. Knowledge of the probability distribution enables decision makers to derive the "expected value of the outcome" for each action. But, it does not remove uncertainty.

2. If all possible outcomes are classified as undesirable, then there is no risk. We are certain that an undesirable outcome will occur. However, there is uncertainty about exactly which undesirable outcome will occur. Similarly, there is no risk if all possible outcomes are classified as desirable. In this case, we are certain that a desirable outcome will occur. But, we are uncertain about which outcome will actually be observed.

3. There is a unique distribution of expected outcomes for each price forecaster. We have assumed that the two producers have identical price forecasting abilities. The distributions reflect the price forecasting ability of the decision maker. In this example there is a central tendency near the average reflecting that the decision maker has an unbiased forecasting system and realized prices tend to be clustered around his forecasted price. It is possible that the expected price could be one of the tails of indicating that the producer is always overly optimistic or overly pessimistic about future prices. As we will see, futures markets will be of little help in managing risk for producers who are consistently unrealistically optimistic about futures prices.

4. We are, of course, ignoring all possible impacts on profit of physical performance (production risk) in order to focus on price uncertainty and price risk.

5. Recall that we assume all producers have identical price forecasting abilities. The reason for that assumption should now be clear.

6. Numerous studies (including Just and
Rausser) have shown that even though futures markets do not provide perfect predictions of prices at distant points in time, futures prices are no less accurate price forecasts than econometric models or other types of price forecasts.

(7) The lengthening of the period covered by futures contracts would also develop an appreciation and a demand for long term forecasting.

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REFERENCES

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