Complex Choices:
Producers Risk Management Strategies

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Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Providence, Rhode Island, July 24-27, 2005

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50 Word Summary

Producers have a wide variety of risk management instruments available. How do producers make a choice among all these possible combinations of risk management instruments? Using the recently developed choice bracketing framework, we examine what risk management strategies producers use and identify the factors that drive their risk management decisions.

Abstract

Producers have a wide variety of risk management instruments available. How do producers make a choice of risk management instruments? Using the recently developed choice bracketing framework, we examine what risk management strategies producers use and identify the factors that drive their risk management decisions. Our results identify that producers use a wide variety of combinations of risk management instruments and that they bracket their choices into sets of alternative risk management instruments. Using multinomial logit models to estimate the choice process provides information about the factors that influence producers' decision making. The results show that broad bracketing producers use different risk management instruments than narrow bracketers. Policy makers and financial institutions can improve the performance of their programs and products when they are able to identify the bracketing level of segments of producers.

Introduction

Farmers in the US continue to identify price and income risk among their greatest management challenges. To address this variability, farmers have numerous price and income risk management tools at their disposal, including: futures, options contracts, basis contracts and a variety of insurance products. While a few studies have examined farmer decision making in the presence of multiple market alternatives (e.g., Coble, et al), most research has examined the relatively simple decision of whether or not to use futures or crop insurance (for an example see Pennings and Leuthold (2000); Knight and Coble provide a review of insurance)**.** However, the results of these studies do not reflect the integrated and complex nature of decisions that producers face. For example, dealing with 6 price risk management instruments, farmers face a total of 64 (2^6) combinations of risk management instruments (e.g., risk management strategies). How do farmers deal with such complex choices? This paper is a first attempt to analyze producers' complex decision process in a systematic way using the recently developed choice bracketing framework (e.g., Read, Loewenstein and Rabin). In addition, we examine the factors that drive producers' decision to use particular combinations of risk management instruments. In this paper we contend that the notion of bracketing provides a useful way to understand how producers deal with complex decisions and how they arrive at the combinations of tools used.

We illustrate the bracketing framework in the context of producers' complex risk management decisions using data obtained from a large-scale survey of U.S. corn, cotton, soybean and wheat producers. The survey data was complemented by accounting data, allowing us to examine actual use of combinations of risk management instruments and the factors (e.g. producer and farm characteristics) that influence their risk management strategies. This research has

implications for financial institutions that provide risk management instruments and for policy makers dealing with risk management in agriculture.

The paper is organized as follows. We discuss how the economics and behavioral literature approaches complex decisions followed by the introduction of the choice bracketing framework in which the framework's properties are discussed in the context of producers facing complex risk management choices. Subsequently the research design and research method are discussed followed by a presentation of the empirical results. Finally we discuss the implications of this work and make suggestions for future research.

Complex Decisions

In the (normative) economic literature it is often assumed that a decision-maker evaluates all available information and alternatives and is able to select that alternative (e.g., choice) that maximizes his/her utility. Various authors have reported that this approach may not be able to reflect actual behavior, as decision makers do not behave according to the proposed models (Rabin; McFadden; Thaler). Rabin, and Thaler provide an extensive discussion on how human behavior differs from that predicted by normative economic models. Behavioral economists have argued that individuals do not necessarily have stable and coherent preferences, and that they do not rationally maximize those preferences. The psychological literature offers some explanations for the existence of these anomalies arguing that there are cognitive limits with respect to human information processing capacities. Experiments have shown that individuals may in some cases simply fail to consider the entire space of choice alternatives (Miller). This notion led Simon to introduce the concept of bounded rationality. Simon's concept of bounded rationality generated

literature that identified heuristics – rules used to solve problems or strategies of behavior - that decision makers use to arrive at their decisions (e.g., Earl).

Decision makers vary with respect to the extent with which they take the consequences of their decisions into account. Each choice may have a very limited consequence. But if all the choices and their consequences are taken into account, the combined consequences can be substantial. This notion motivated Read, Loewenstein and Rabin to introduce the concept of choice bracketing to better understand how decision makers cope with complex decisions and how choices that do not seem rational from a normative point of view can be explained.

Choice Bracketing Concept

Choice bracketing refers to the grouping of individual choices together in sets. Sets of choices are bracketed together by taking into account the effect of each choice on all other choices in the set, but not choices outside the set. Read, Loewenstein and Rabin distinguish between narrow bracketing and broad bracketing strategies. Narrow bracketing refers to the situation when an individual makes decisions from sets that are small (e.g., producers considering only the consequences of using futures, or only the consequences of options, when deciding what risk management instruments to use), while broad brackets refer to the situation where an individual makes decisions from sets that are broad (e.g., considering the consequences of all available risk management instruments simultaneously). Assuming that the transactions costs of the decision making process are zero, broad bracketing allows individuals to consider all consequences of their actions and therefore generally leads to choices that yield higher utility than narrow bracketing.

Most of the literature dealing with producers' marketing choices studies the choice between using or not using a particular risk management. Combinations of different risk

management instruments and the interaction of the consequences of these instruments are usually not taken into account. A property of bracketed choices is the so-called adding-up effect. This effect reflects the fact that non-profitable choices can enhance each other's profitability when they are put together. For instance, high yield variability decreases hedging (i.e., risk-reducing) effectiveness, but if yield insurance is purchased at the same time (i.e., yield stabilization), hedging effectiveness may increase. Another way in which choice bracketing affects individuals' decisions is by taste change. This occurs when present choices influence future preferences. An example is habit formation, where individuals are able to recognize future favorable outcomes by choosing unwanted alternatives in the present (Pollak; Pope, Green and Eales; Dynan). This taste change property may be relevant for new marketing products, e.g. insurance and new derivatives. Producers might not recognize a new marketing product as a feasible alternative when bracketing narrowly (e.g., the choice whether or not to use the new marketing product), but they may acquire the habit of using it when bracketing broadly, even if the isolated consequence of using it is not desirable (e.g., the choice whether or not to use a particular combination of risk management instrument that includes a new product).

Choice Bracketing Levels in the Context of Producers' Choice of Risk Management Instruments

Using the choice bracketing framework outlined above we discuss different *bracketing levels* in the context of a producer choosing among combinations of risk management instruments. Read, Loewenstein, and Rabin argue that utility is maximized when bracketing is broad, which in terms of risk management decisions implies that the entire set of risk management instruments (e.g., broad level in Figure 1) is considered.

Relevant risk management tools for producers include *forward pricing instruments* and *crop insurance products*. The forward pricing instruments considered in this study are cash forward contracts, futures, options, hedge-to-arrive contracts, minimum price contracts and basis contracts. The crop insurance products included in this study are Catastrophic coverage (CAT), Crop Revenue Coverage (CRC), Income Protection (IP), Revenue Assurance (RA), Group Risk Plan (GRP), and hail insurance. The appendix provides a detailed description of the twelve risk management instruments considered.

Producers may choose any combination of the above mentioned risk management instruments. This implies that producers are implicitly or explicitly making a choice between 4096 (2^6*2^6) combinations of forward pricing instruments and insurance products. The findings in the behavioral economics and psychological literature on human cognitive information processing capacities suggest that producers may have difficulty coping with such a *broad bracketing level*.

One could simplify the choice, and hence narrow the bracketing level, by decomposing the total choice set (e.g., the 4096 alternative combinations of risk management instruments) in two separate groups of forward pricing instruments and crop insurance products (e.g., *medium bracketing level*). This medium bracketing level consist of two separate groups each containing 64 (2^6) alternatives (e.g., combinations of the six price risk management instruments and combinations of the six insurance products, respectively).

One could simplify this medium bracketing level further by decomposing the forward pricing instruments into three groups of exchange, exchange derived, and non-exchange derived tools and by decomposing the insurance products into three groups of catastrophic coverage, yield insurance and revenue insurance tools. The exchange group of forward pricing instruments includes futures and options, the exchange-derived group includes hedge-to-arrive and basis

contracts, and the non-exchange-derived group includes minimum price contracts and cash forward contracts. The catastrophic coverage group includes only one insurance product, catastrophic coverage (CAT), the yield insurance group includes GRP Area yield insurance and hail insurance and the revenue insurance group includes Crop Revenue Coverage (CRC), Income Protection, and Revenue Assurance.

This framework of bracketing levels as shown in Figure 1, is an example of how producers may bracket their choices. Some producers may be broad bracketers (and hence consider the 4096 alternatives simultaneously) other producers may have a medium bracket level. The medium bracketers make two choices in isolation, and hence do not consider the consequence of the other choice on the current choice. The producers that have a narrow bracketing level are dealing with six separate choice sets and hence six choices.

We attempt to answer the following questions, based on the choice bracketing framework, in the remainder of this paper: What combinations of risk management instruments do producers actually use? What bracketing level do producers use? What producers' characteristics are associated with a particular bracketing level? What factors are driving the choice within a particular bracketing level? In the next section we review literature that identified the factors that influence producer's risk management.

Determinants of Risk Management Behavior

Most studies that investigated the determinants of the use of risk management instruments focused on a single risk management instrument. These studies model a producer choice process as a dichotomous choice (whether or not to use the instrument) and use logit or probit models to identify the factors that influence that dichotomous choice. Hence, producers' choice behavior is

examined on a narrow bracketing level. Some studies examined producers' choice on a broader bracketing level. for example Coble, Heifner and Zuniga, and Mahul used choice sets that included crop insurance and futures, Katchova and Miranda used choice sets that included futures, crop insurance, and cash marketing contracts. These studies seem to indicate that the drivers of producers' choice for these larger choice sets are similar to the ones identified by studies that deal with narrow choice sets. Here we hypothesize that the drivers that may be important for small choice sets (narrow bracket level) are the same as for large choice sets (broad bracket level). Here, we hypothesize that the choice of risk management tools on all three bracketing levels is influenced by farm characteristics, operator characteristics, external sources of information, and geographic heterogeneity.

Farm Characteristics

Previous studies identified farm size, diversification, and decision unit composition as *farm characteristics* relevant for risk management decisions. **Farm size** has a positive effect on the use of risk management tools. The costs of learning and implementing such tools every year can be more easily spread with high production, so that their usage is more easily justified in large-scale farms than in small farms. **Livestock diversification** has been shown to have negative and significant affect on crop insurance participation (e.g., Barnett, Skees, and Hourigan; Cannon and Barnett). Pennings and Leuthold (2000) and Pennings and Garcia (2001) showed that the opinions of the members of producers decision making unit, such as spouse, partner and advisors may influence producers' choices. Here we operationalize the concept of the decision making unit by 1) **internal decision makers,** the number of individuals that have access to the producers' satellite

delivered information system (DTN) and 2) **external decision makers**, whether or not the producer hires somebody to market the crops.

Operator Characteristics

The *operator characteristics* considered here are age, innovativeness, risk aversion, risk perception, and market orientation. Musser, Patrick, and Eckman argued that younger farmers have a longer planning horizon to recover the learning and adjustment costs associated with risk management instruments, and hence **age** may be negatively related with the use of risk management instruments. Goodwin and Schroeder examined the adoption of forward pricing methods. In that context, **innovativeness** becomes an important factor, as more innovative farmers are more likely to adopt new risk management tools. Based on the findings of Huffman and Mercier, and Putler and Zilberman this study uses the possession of a computer as a proxy for producer innovativeness. Pennings and Leuthold (2000) showed a positive relationship between **risk attitude**, **risk perception**, and **market orientation**, and producers' use of risk management instruments. We used the scale developed by Pennings and Smidts (2000) to measure risk attitude and risk perception, and we used the work by Jaworski and Kohli for measuring producers' market orientation. In addition to market orientation this study hypothesizes that producer **involvement** in marketing their crops may play a significant role in the use of risk management instruments. Producer involved in marketing crops are likely to be more aware of the risks in the market place and prone to marketing instruments. We hypothesize a positive relationship between involvement and the use of risk management tools.

External Sources of Information

Davis and Patrick, Pennings et al (2004), Isengildina et al demonstrate that the use of external information affects the use of forward pricing by producers. In this study we hypothesize that university **extension service**, **market advisory services**, **satellite delivery systems** (such as DTN), **USDA reports**, **local elevator**, and the **internet** may affect producer use of risk management tools. The direction of the relationship depends on the informational content of these sources. Table 1 presents the definitions, measurements and descriptive statistics of the determinants discussed in this section.

Geographic Heterogeneity

Pennings and Leuthold (2000) showed that producers are heterogeneous with respect to the use of risk management tools. Part of this heterogeneity may be attributed to **geographic location**, which is associated with particular crops and natural hedge conditions.

Research Design

We conducted in-depth interviews with U.S. crop producers to gain insight in the combination of risk management instrument used, to examine the bracket levels used and to identify producer characteristics associated with a particular bracketing level and the factors driving the choices within a bracketing level. The depth-interviews were conducted with a group of 15 large commercial farmers in Champaign, Illinois and two groups discussions each with 16 large commercial farmers in Omaha Nebraska. During the group discussions the risk management decision-making process was discussed. Most striking during these discussions was the producers' lack of agreement about the appropriate risk management strategy. Different combinations of risk

management instruments were suggested. These in-depth interviews formed the basis of our survey instrument.

Sample and Data Collection Procedure

The details of survey development are available in Pennings, Irwin and Good (2002). The questionnaire was sent to 3,990 US crop producers in January 2000. A total of 1109 usable questionnaires were returned, yielding a relatively high response rate (Jobber; Karimabady and Brunn). The survey data were complemented by accounting data about these crop producers, made available through the U.S. firm that delivers agricultural market information and advisory services via satellite.

Confirmatory factor analysis was used to assess the (psychometric) measurement quality of our latent variables: producers' risk attitude, risk perception, and market orientation (Hair et al). For a detailed description of a factor-analytical model, the reader is referred to Pennings and Leuthold (2000).

Research Method

Bracketing Levels & Choice Sets: Producers' Choice of Risk Management Strategies

As discussed before we hypothesize that producers' complex risk management decision process may take place on three bracketing levels. Figure 2 displays the three bracketing levels, the choice sets within each of these levels and the number of strategies (e.g., alternative combinations of risk management tools) within each choice set:

I. A broad bracketing level which reflects a choice of risk management tools that include combinations of forward pricing and crop insurance (1 choice set, 4 strategies)

II. A medium bracketing level which reflects a combination of (2 choice sets, 16 strategies)

    1) 3 types of forward pricing tools (8 strategies),
    2) 3 types of crop insurance products (8 strategies)

III. A narrow bracketing level which reflects combinations of particular instruments (6 choice sets, 26 strategies)

    1) 2 exchange forward pricing instruments (4 strategies)
    2) 2 exchange-derived forward pricing instruments (4 strategies)
    3) 2 non-exchange-derived forward pricing instruments (4 strategies)
    4) 2 Yield Insurance products (4 strategies)
    5) 3 Revenue Insurance products (8strategies)
    6) CAT insurance use (2 strategies)

Figure 2 displays the bracketing levels, choice sets and strategies within a choice set by means of 0/1 codes, where a 0 indicates not using the particular risk management instrument and 1 using it. We provide now three examples of particular strategies displayed in Figure 2. At the broad bracketing level in choice set A strategy 2 consists of using a forward pricing tool and not using a crop insurance product. At the medium bracketing level in Choice set B strategy 2 consists of using exchange instruments and not using non-exchange derived instruments and not using exchange-derived instruments. At the narrow bracketing level in choice set I strategy 2 consists of using Crop Revenue Coverage, not using Income Protection or Revenue Assurance (RA).

To examine what bracket levels producers use and to identify the factors that drive the choice within a choice set of a particular bracketing level we estimated the choice process for each choice set using a multinomial logit model in which the producer selection of a risk management strategy (e.g., combination of alternative risk management instruments) is explained by the determinants of risk management behavior discussed above. A total of nine models are estimated. The dependent variable in each model is the number of risk management strategies within a choice

set. For example, in choice set C the dependent variables can take on values from 1 – 8 corresponding to the strategies used.

The choices are coded in such a way that the alternatives on the narrower level are embedded into alternatives on a broader level. Thus, the 4 alternatives in the choice set at the broad bracketing level implicitly contains 4096 combinations of risk management tools. Similarly, the 8 alternatives in each of the two choice sets at the medium bracketing levels implicitly contain 64 combinations of risk management tools. The narrow bracketing level is described by the actual or explicit combinations of risk management tools (i.e. the twelve risk management instruments examined here). Hence, narrow choices are nested into the broader choices. The models are estimated using multinomial logit framework because of the discrete nature of the dependent variables. The advantage of this estimation procedure is its ease of application and interpretation. However, this approach assumes that the covariance of errors is a diagonal matrix for each respondent *n* (independence of irrelevant alternatives (IIA) assumption). In the near future we plan to use a multinomial probit modeling procedure that relaxes the IIA assumption.

Results

Table 2 provides descriptive statistics of the sample. The sample can be classified as relatively large commercial farmers with experience (median age class is 40-44 years). The major crops (expressed in acreages) are corn, soybeans and wheat. Cash forward contracts are a popular risk management instrument (80.7% of the crop producers used them during the two year period 1999-2000), followed by basis contracts (41.8%), futures contracts (40.1%) and (put) options (36%). Hedge-to-arrive contracts and minimum price contracts are less popular (19.9% and 13.6% respectively). Catastrophic coverage and crop revenue coverage are the most popular insurance

products. Insurance products directly related to income, such as the income protection, revenue assurance and group risk plan, are less popular insurance products.

Combinations of Forward Pricing Instrument Used by Producers

Crop producers have in theory 64 (2^6) possible combinations of forward pricing instruments. The data shows that only 54 combinations are actually used. Interestingly, and in line with the results of the group discussions, there is no clear dominant combination. It appears that 23 price risk management instrument combinations account for 88.5% of all combinations used, as displayed in Table 3.

Combinations of Crop Insurance Products Used by Producers

Since there are 6 relevant insurance products, and a producer can choose any combination (or not use them at all), there are 64 (2^6) alternatives available. Of the 64 possible combinations, 41 combinations are actually being used. The distribution of the different insurance product combinations is less flat than that of the forward pricing instrument combinations. Table 4 shows that 13 combinations account for 91% of all combinations used.

Combining Forward Pricing Instruments and Insurance Products

When considering both forward pricing instruments and insurance products crop producers implicitly or explicitly choose from 4096 (2^6*2^6) combinations of forward pricing instruments and insurance products. Their decision, then, consists of choosing one risk management strategy out of 4096 possible strategies. The crop producers in our sample used 375 different combinations of price risk management instruments and insurance products. Thus, only 10.4% of the total

combination space (4096) is actually being used by crop producers. The distribution of these 375 combinations is flat, i.e., there are not many dominant combinations. Table 5 displays those combinations used by more than 1% of the crop producers. 14 combinations meet these criteria, together accounting for 28% of all applied combinations.

What Factors Drive Producers Risk Management Choices?

Results of Multinomial Logit models

Parameter estimates of the multinomial logit models are presented in Tables 6-8. The results of all nine models (e.g. the choice sets at the different bracketing levels) are relative to the choice set that has no risk management instruments, as described by strategy 1 on all bracketing levels (Figure 2). All nine models perform reasonably well. The predictive validity on the broad bracketing level was 75%, on the medium bracketing level it ranged from 34 to 40%, on the narrow bracketing level it ranged from 53 to 74%.

The proposed framework allows us to examine whether the same drivers affect producer's decision making on various bracketing levels and choice sets. The results presented in Table 6 suggest that *broad bracketing* decisions are affected by farm size, operator age, use of external decision makers, use of satellite delivery systems, information from local elevators and geographic heterogeneity. Consistent with our expectations, younger operators of larger farms, who are more involved in marketing their crops appear more likely to use risk management tools. Contrary to our expectations the use of satellite delivery systems decreased the probability of use of risk management instruments.

On the *medium bracketing* level (Table 7), all variables except for university extension services and the use of computers have a significant (at the 90% level or better) influence on

producer risk management decisions. The signs of the estimated coefficients are consistent with those at the broad bracketing level with one exception, the use of external decision makers has a positive impact on the use of risk management tool in the medium bracket level and negative on the broad bracketing level. Similar to the broad bracketing results, younger operators of larger farms appear more likely to use risk management instruments. The composition of decision making unit is also important on this bracketing level: the use of external decision makers increases the likelihood of using risk management instruments and the greater number of internal decision makers increases the use of crop insurance products. Producers that are more involved in marketing their crops and those who use MAS and internet as their source of information are more likely to use risk management instruments, regardless of their insurance choices. The use of satellite information systems and local elevators appear to discourage the use of forward pricing instruments and encourage the use of yield insurance products. The use of USDA reports increases the probability of combining exchange and exchange-derived pricing tools and discourages the use of yield insurance products in combination with CAT coverage. More risk averse producers appear more likely to combine all thee types of crop insurance. Risk perception increases the probability of using non-exchange derived pricing instruments and using only a CAT coverage crop insurance. Greater market orientation increases the probability of combining CAT coverage and revenue insurance products. Producers in the Great Plains are less likely to use certain combinations of forward pricing instruments and more crop insurance while producers in the Southeast use more strategies that include forward pricing instruments and less crop insurance combinations relative to Midwestern producers.

On the *narrow bracketing* level all variables except for the number of internal decision makers are significant (at the 90% level or better) for forward pricing decisions (Table 8, panel A)

and all variables except for the use of external decision makers, operator involvement and USDA reports are significant for crop insurance choice decisions Table 8, panel B). Directions of the effects are consistent with the broader bracketing levels described above for farm size, operator age, use of external decision makers (but become insignificant in crop insurance choices), operator involvement, use of MAS, satellite information systems, USDA reports (but become insignificant in crop insurance choices), local elevator, and geographic location. Diversification (with livestock) discourages strategies that include both yield insurance products, isolated use of income protection insurance, hedge-to-arrive contracts or in combination with basis contracts, and combinations of minimum price and cash forward contracts. Risk perception discourages risk management strategies that involve combining futures and options, and combining CRC and Revenue Assurance products. Risk aversion has a negative significant relationship with the use of exchange forward pricing instruments while market orientation has a positive relationship. University extension service tends to lower the use of futures and increase the use of income protection insurance. The use of internet as a source of information has a positive relationship with the use of revenue insurance instruments.

The consistencies between the models (e.g., choice sets) with respect to the factors that influence the use of risk management strategies on the different bracketing levels show that the decisions in general are driven by the same factors. Some differences exist though. These differences suggest that decisions on the broad bracketing level are affected by more general characteristics (e.g., age and farm size), while decisions on the narrow bracketing level are associated with relatively more specific features, such as risk aversion, risk perception, and producer's innovativeness. Two factors, the use of external decision makers and satellite services appear more relevant on the broader bracket levels than on the narrower ones. The fact that the

direction of some relationships changes across bracketing levels illustrates the adding-up effect: non-profitable choices can enhance each other's profitability only when they are considered simultaneously in the choice set. On the other hand, choices that are attractive on the narrow bracketing level may become redundant when combined with other choices on a broader level. Next we examine whether producers that differ regarding their bracketing level have different characteristics. Furthermore we examine the risk management strategies that are chosen at different bracketing levels.

Broad vs. Narrow Choice Bracketers

Choice bracketing may be an attractive approach to model complex decisions. The difficulty is that bracketing is an abstract and unobserved concept. An individual may have a hard time classifying him(her)self as a broad or narrow bracketer. However, it is the choices that individuals make that reveal tendencies to bracket broadly or narrowly. Here we identify the bracketing level of producers based on the choices they made and our ability to predict their choices. Figure 3 presents the results of our multinomial logit models for the choice sets for the three bracketing levels in terms of predictive ability.

Figure 3 shows the number of actual versus predicted choices for all models (e.g., the different choice sets at the three bracketing levels) described in the previous section. The results are used to classify producers as broad, medium, or narrow bracketers in the following manner: if the models correctly predicted at least one choice (e.g., the choice within a choice set) on a particular bracket level, a producer is assumed to be bracketing on this level. Using this procedure, 839 producers may be considered broad bracketers, 652 medium bracketers and 1106 narrow bracketers. This classification produces a wide overlap between brackets, that is the procedure may classify a

producer as being both a broad and medium level bracketer. This may be consistent with the fact that producers may approach a complex choice by using various bracketing strategies. Our sample contained 565 producers that bracket their choices on all three levels. To further increase our insight in the bracketing level of producers we identified producers that bracket consistently on the same level. Our sample contained 3 producers that bracket exclusively on a broad level, no producer bracketed only on a medium level and 131 producers bracketed exclusively on a narrow level. We discuss the characteristics of the narrow bracketers. Table 9 shows that 33% did not use any forward pricing tools, 74% did not use any crop insurance products and 8% did not use any risk management tools. The choices of the narrow bracketers in both forward pricing and crop insurance are dominated by not using these risk management instruments. The distribution of the risk management strategies is more flat than the broad bracketers, with no dominant strategies. However, most of these choices may be characterized by the limited use of risk management tools with the five most common strategies (which comprise 37 percent of all used alternatives) combining only two instruments or less. This finding supports the notion that risk management products may be less attractive when viewed individually or on a narrow bracketing level. Broad marketers use significantly more tools then narrow bracketers, which reflects the adding-up effect of choice bracketing.

Conclusions & Discussion

Previous studies examining producers' risk management decisions often dealt with the relative simple choice whether or not producers used a particular risk management instrument. In practice producers are confronted with a much more complex decision context. For example, producers in the U.S. have about six relevant price risk management instruments and six insurance products at

their disposal, resulting in a decision space of 4096 alternatives. While economic theory assumes that decision-maker evaluate all available information and hence all available alternatives, the behavioral economics, decision sciences and psychological literature have shown that cognitive limitations make it impossible for humans to make such "full information" choices. Various authors have argued that decision makers simply the complex choice process by using heuristics. Recently Read, Loewenstein, and Rabin introduced the concept of choice bracketing. This concept suggests that decision makers "bracket" their choices into sets, so that the effect of each choice in the set is taken into account on all other choices in the set but not between choice sets. Bracketing can be seen as a means to simply the complex decisions in terms of the number of alternative outcomes that decision makers face. Here we use the choice bracketing concept to better understand how producers arrive at their risk management choices, in particularly how they arrive at the combination of risk management instruments used.

For our sample we propose that risk management choices may take place on three bracketing levels: broad, medium, and narrow. The broad level includes one choice sets each containing four strategies (combinations of risk management instruments). The medium level consists of two choice sets each containing eight strategies. The narrow level consists of six choice sets that contain between two to eight alternatives. Producer choices are evaluated in terms of the use of risk management strategies in terms of a combination of risk management instruments rather than the use of (single) products, as has been done in previous studies.

We estimated for each choice set the influence of a number factors associated with risk management. The results showed that the choice sets for the different bracketing levels are generally driven by the same factors. Our results suggest also that on the broad bracketing level choices are affected by more general characteristics (e.g., age and farm size), while decisions on

the narrow bracketing level are associated with relatively more specific producer's characteristics, such as risk aversion, risk perception, and innovativeness. Some factors, such as use of external decision makers and satellite services appear more relevant on the broader levels than on the narrower ones.

Various caveats of the research should be mentioned. We assumed that there are three bracketing levels and created the various choice sets at each bracket level. For example, on the medium bracket level we assumed that the choice sets could be defined based on whether price risk management instruments were exchange traded, derived from exchange traded instruments or non-exchange derived instruments. While such a classification of price risk management instruments seems intuitive, we did not actually validate whether such classification reflects the way producers think when they bracket their choices. Further research needs to identify what choice sets are relevant for producers by having a qualitative research design that allows producers to indicate their relevant choice sets.

While the concept of choice bracketing is helpful in understanding how producers deal with complex choices, we find individual producers that are broad, medium and narrow bracketers. These results may indicate that producers decision making process can best be described as a ongoing, dynamic process, in which the producer may first tackle the complex decision by bracketing narrow, and after that "exercise" may decide to bracket more broadly.

We were unable to identify *a priori* what bracket level and hence what choice sets are relevant for different segments of producers. Here we attempted to determine the producers' bracket level *ex-post*, using predictive validity of the models. Based on the predictive ability we classified a producer as being a broad or narrow bracketer. This procedures assumes that the factors associated with risk management strategies, our independent variables in the multinomial

logit model, are equally important for all producers, an assumption that may not hold (e.g., Pennings and Garcia, 2004). Research that will allow these factors to have different influence across producers and choice sets is called for.

The results have implications for financial institutions that provide risk management instruments and for policy makers dealing risk management programs in agriculture. Our results indicate that exchanges and brokerage firms need to know whether a producer is a broad or narrow bracketer because of the adding-up effect described above. Furthermore a broad bracketer will evaluate the consequences of a variety of risk management instruments simultaneously and the interaction between them. Hence complementarity among instruments becomes an important issue when designing new risk management instruments. For policy makers it is important to understand how their programs may enter producers' choice sets. Producers who bracket narrowly may fail to see the complementary between the program and, for example, existing risk management tools and may decide not to participate in the program. Knowledge about the size of the segments of producers with respect to bracketing levels and how these segments can be identified is crucial for successful risk management policy.

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Table 1. Independent Variable Definitions and Descriptive Statistics (*N*=1109).

Variable	Definition	Mean	Std. dev.
Farm Characteristics			
Farm Size	Total acres (owned and rented): 1= over 2,000 acres, 2=1,999 to 1,5000, 3=1,499 to 1,000, 4=999 to 500, 5=499 to 300, 6=under 300, 7=none	1.88	1.01
Diversification	1 if a crop farm included a livestock operation, 0 otherwise	0.43	0.50
Decision Makers	Number of individuals with access to your DTN unit	2.70	1.38
External Dec. Makers	1 if hire someone to market any or all of your crops, 0 otherwise	0.15	0.36
Operator Characteristics:			
Age	approximate age of primary subscriber: 1=less than 25 yrs, 2=25 to 29, 3=30 to 34, 4=35 to 39, 5=40 to 44, 6=45 to 49, 7=50 to 59, 8=60 to 64, 9=65 and older	5.06	1.62
Innovativeness	1 if and operator owns or leases a computer, 0 otherwise	0.66	0.47
Risk Aversion	See scale developed in Pennings and Smidts (2000) (where 1 indicates relatively risk averse and 9 relatively risk seeking)	6.44	1.48
Risk Perception	See scale developed in Pennings and Smidts (2000) (where 1 is not at all risky and 9 is very risky)	5.98	1.87
Market Orientation	See scale developed in Pennings and Leuthold (2000) (where 1 indicates relatively less market oriented and 9 relatively more market oriented)	7.28	1.23
Involvement	"How often do you follow cash or futures market prices?" 1=several times a day, 2=once a day, 3=once to several times a week, 4=once to several times a month, 5=never	1.31	0.61
External Sources of Information:			
Extension		3.90	2.33
MAS		5.85	2.50
Satellite	"How much do you rely on the following sources of market information?" 1=do not rely, 9=rely heavily	7.83	1.55
USDA		5.48	2.25
Elevator		5.06	2.54
Internet		3.14	2.56
Geographic Heterogeneity:			
MIDWEST	1 if producer is from the Midwest, 0 otherwise	0.57	0.49
GPLAINS	1 if producer is from the Great Planes, 0 otherwise	0.34	0.48
SEAST	1 if producer is from the South East, 0 otherwise	0.08	0.28

Table 2 Descriptive Statistics of the Sample

Percentage of crop producers that used one of the following price risk management instruments in 1999/2000		Insurance		Age		Gross annual farm sales	
Cash forward contract	80.7 %	Catastrophic coverage	42.4 %	Younger than 25 years	0.8 %	Over $ 1,000,0000	17.3 %
Basis contracts	41.8 %	Crop Revenue Coverage	47.7 %	25 – 29 years	4.2 %	$ 999,999 - $ 500,000	26.0 %
Futures contracts	40.1 %	Only hail insurance	21.1 %	30 – 34 years	12.4 %	$ 499,999 - $ 400,000	13.3 %
Put options	36.0 %	Group Risk Plan (GRP)	9.4 %	35 – 39 years	20.3 %	$ 399,999 - $ 300,000	15.0 %
Hedge-to-arrive contracts	19.9 %	Income protection (IP)	5.6 %	40 – 44 years	19.7 %	$ 299,999 - $ 200,000	16.9 %
Minimum price contracts	13.6 %	Revenue assurance (RA)	5.1 %	45 – 49 years	17.6 %	$ 199,999 - $ 100,000	10.0 %
				50 – 59 years	19.6 %	$ 99,999 - $ 50,000	1.3 %
				60 – 64 years	3.5 %	Less than $ 50,000	.2 %
				65 years and older	1.9 %		

Crop acreage (planted annually)

	Corn	Sorghum	Soybean	Wheat	Cotton	Rice	Hay
Over 2,000 acres	4.5 %	1.1 %	2.9 %	9.1 %	2.2 %	.4 %	5.2 %
1,999 – 1,500 acres	16.3 %	1.5 %	10.9 %	14.7 %	3.7 %	1.3 %	3.1 %
1,499 – 1,000 acres	42.3 %	3.0 %	34.2 %	16.3 %	4.7 %	1.8 %	5.4 %
999 – 500 acres	7.9 %	5.1 %	14.4 %	8.0 %	1.5 %	1.1 %	7.1 %
499 – 300 acres	6.9 %	8.3 %	9.9 %	13.3 %	.6 %	.8 %	14.9 %
Under 300 acres	2.9 %	6.6 %	4.6 %	12.4 %	.4 %	.1 %	21.3 %
No acres	19.3 %	74.5 %	23.1 %	26.2 %	87.0 %	94.6 %	42.9 %

Notes: The sample consists of 1109 US crop producers in the Midwest, South East and Great Plains. The crop producers' age, gross annual farm sales, and crop acreage were obtained from accounting data. Data on usage of price risk management instruments and insurance products were measured during the survey.

Table 3. Combinations of Forward Pricing Instruments Used by Crop Producers in 1999-2000.

Combination strategy	Cash Forward Contract	Hedge using futures	Buy put option	Hedge-to-arrive contract	Minimum price contract	Basis contract	Percentage	
							%	Σ %
1	1	0	0	0	0	0	19.6	19.6
2	1	1	1	0	0	0	7.6	27.1
3	1	0	0	0	0	1	6.9	34.1
4	0	0	0	0	0	0	6.8	40.8
5	1	1	0	0	0	0	6.3	47.2
6	1	1	1	0	0	1	6.0	53.2
7	1	0	1	0	0	0	4.0	57.2
8	1	1	0	0	0	1	3.5	60.7
9	1	0	0	1	0	1	3.4	64.1
10	1	0	1	0	0	1	2.9	67.0
11	1	1	1	1	0	1	2.9	69.9
12	0	0	0	0	0	1	2.4	72.3
13	1	1	0	1	0	1	2.3	74.7
14	1	1	1	1	1	1	2.2	76.8
15	1	1	1	1	0	0	1.5	78.4
16	1	0	0	0	1	0	1.4	79.8
17	1	0	0	0	1	1	1.4	81.2
18	1	0	1	0	1	1	1.4	82.7
19	0	1	1	0	0	0	1.4	84.0
20	0	1	0	0	0	0	1.2	85.2
21	0	0	1	0	0	0	1.1	86.3
22	1	0	0	1	0	0	1.1	87.4
23	1	0	1	1	0	1	1.1	88.5

Note: N=1109: 1=use, 0=do not use.

Table 4. Combinations of Insurance Products Used by Crop Producers in 1999-2000.

Combination strategy	Catastrophic coverage	Crop Revenue Coverage (CRC)	Income protection (IP)	Revenue assurance (RA)	GRP area yield insurance	Only hail insurance purchased	Percentage	
							%	Σ %
1	0	1	0	0	0	0	25.7	25.7
2	0	0	0	0	0	0	14.1	39.8
3	1	0	0	0	0	0	13.6	53.4
4	1	1	0	0	0	0	10.5	63.8
5	1	0	0	0	0	1	7.5	71.3
6	1	1	0	0	0	1	4.1	75.5
7	0	1	0	0	0	1	3.1	78.5
8	0	0	0	0	1	0	3.0	81.5
9	0	0	0	0	1	0	2.8	84.3
10	0	0	1	0	0	0	1.7	86.0
11	0	0	0	1	0	0	1.6	87.6
12	1	0	0	0	1	0	1.5	89.2
13	0	1	0	0	1	0	1.4	90.6

Note: N=1109: 1=use, 0=do not use.

Table 5. Combinations of Forward Pricing Instruments and Insurance Products.

Combination strategy	Cash forward contract	Hedge using futures	Buy put option	Hedge-to-arrive contract	Minimum price contract	Basis contract	Catastrophic coverage	CRC	IP	RA	GRP	Only hail insurance	Percentage	
													%	Σ %
1	1	0	0	0	0	0	0	1	0	0	0	0	5.0	5.0
2	1	0	0	0	0	0	1	0	0	0	0	0	3.1	8.0
3	1	0	0	0	0	0	0	0	0	0	0	0	2.5	10.6
4	0	0	0	0	0	0	0	1	0	0	0	0	2.2	12.7
5	1	1	1	0	0	0	0	1	0	0	0	0	2.2	14.9
6	1	0	0	0	0	0	1	1	0	0	0	0	2.0	16.9
7	1	0	0	0	0	0	1	0	0	0	0	1	1.9	18.8
8	1	0	0	0	0	1	0	0	0	0	0	0	1.5	20.3
9	1	1	0	0	0	0	0	1	0	0	0	0	1.5	21.8
10	1	0	0	0	0	1	1	0	0	0	0	0	1.4	23.3
11	1	1	1	0	0	0	1	1	0	0	0	0	1.3	24.5
12	0	0	0	0	0	0	0	0	0	0	0	0	1.1	25.6
13	1	0	1	0	0	0	0	1	0	0	0	0	1.1	26.7
14	1	1	1	0	0	1	0	0	0	0	0	0	1.1	27.8

Note: N=1109: 1=use, 0=do not use.

Table 6. Estimated Coefficients of the Multinomial Logit Estimation of Broad Level Bracketing.

	Choice Set A. Risk Management Tools		
Strategy*	**2**	**3**	**4**
Constant	12.971 **	8.508	13.049 **
Farm Size	-0.754 **	-0.479	-0.783 **
Diversification	0.223	0.094	0.405
Decision Makers	-0.275	-0.344	-0.229
External Dec. Makers	-1.430 *	-2.386 **	-0.911
Age	-0.405 *	-0.218	-0.474 **
Innovativeness	-0.044	-0.089	-0.045
Risk Aversion	0.100	0.163	0.169
Risk Perception	0.177	0.263	0.212
Market Orientation	0.247	0.359	0.310
Involvement	-0.017	0.481	-0.149
Extension	0.038	0.048	0.055
MAS	0.165	-0.088	0.181
Satellite	-1.105 **	-1.088 **	-1.030 **
USDA	0.061	0.040	0.005
Elevator	-0.225 *	-0.099	-0.151
Internet	0.167	0.093	0.175
GPLAINS	-1.279 **	0.546	-0.679
SEAST	27.997	27.478	27.738

Notes: Strategies correspond to broad level bracketing strategies described in Figure 2.

Table 7. Estimated Coefficients of the Multinomial Logit Estimation of Medium Level Bracketing.

	Choice Set B. Forward Pricing Tools							Choice Set C. Crop Insurance Products						
Strategy*	2	3	4	5	6	7	8	2	3	4	5	6	7	8
Constant	1.914	4.717 *	3.373 **	1.771	3.541 **	0.780	3.343	-2.292 **	-1.978	-0.600	-1.544	-0.704	-2.673 **	-3.642 **
Farm Size	-0.346	-0.782 **	-0.296 **	-0.345 **	-0.589 **	-0.461 *	-0.278 **	-0.086	-0.015	-0.058	-0.099	-0.312 *	-0.029	-0.124
Diversification	1.195 **	0.877 *	0.543 *	0.115	-0.007	0.494	0.266	0.192	-0.024	0.373 *	0.265	-0.258	0.156	-0.516
Decision Makers	-0.111	0.183	0.071	0.047	-0.031	-0.065	0.074	-0.042	-0.043	0.025	-0.032	-0.176	0.169 **	-0.063
External Dec. Makers	1.165 *	1.775 **	1.029 *	0.226	1.136 **	0.697	0.251	0.185	-0.085	0.500	0.789 **	0.678 *	0.210	-0.171
Age	-0.250 *	-0.594 **	-0.309 **	-0.344 **	-0.325 **	0.026	-0.210 *	0.066	-0.225 **	-0.054	-0.018	-0.218 **	-0.119	-0.208 **
Innovativeness	0.207	-0.386	0.101	0.048	0.110	0.037	0.002	0.043	-0.007	0.022	0.195	-0.339	-0.004	-0.035
Risk Aversion	-0.133	-0.047	-0.062	0.044	-0.041	-0.024	0.164	0.016	-0.046	0.105	0.089	0.056	0.089	0.212 *
Risk Perception	0.020	-0.162	-0.051	-0.020	-0.065	0.092	0.023 **	0.125 **	0.018	0.070	0.002	0.067	-0.007	0.012
Market Orientation	0.023	-0.098	0.038	0.084	0.107	-0.097	-0.110	0.057	0.176	0.007	0.052	0.260	0.171 *	0.152
Involvement	-0.530 *	-0.881 *	-0.833 **	-0.326 *	-0.782 **	-0.491 *	-0.466 **	-0.074	0.096	0.004	-0.126	-0.401	-0.093	-0.176
Extension	0.123	-0.153	-0.026	0.055	-0.026	-0.047	0.062	0.076	-0.044	0.013	0.086	-0.042	-0.072	0.067
MAS	0.281 **	0.188 *	0.370 **	0.216 **	0.391 **	0.173 **	0.133	-0.027	-0.013	0.059	-0.048	0.011	0.020	0.039
Satellite	-0.071	-0.087	0.012	0.045	0.015	0.030	-0.068 **	0.039	0.242 **	-0.038	0.086	-0.046	0.098	0.069
USDA	-0.157	0.266 **	-0.012	-0.020	0.063	-0.144	-0.054	0.014	-0.165 **	-0.019	-0.105 *	-0.031	-0.087	0.016
Elevator	-0.219 **	-0.070	-0.150 **	-0.056	-0.126 **	-0.013	-0.031	0.006	0.124 **	0.065	0.025	0.065	0.122 **	0.043
Internet	0.173 **	0.017	0.096	0.100	0.127 **	0.159 **	0.041	0.013	-0.040	-0.010	0.002	0.059	0.010	0.097
GPLAINS	0.076	-0.892	-1.090 **	-1.352 **	-1.678 **	-0.939 *	-1.173 **	0.676 **	0.197	0.483 **	0.314	0.695 **	0.640 **	1.050 **
SEAST	0.954	1.748 *	-0.392	1.165	0.531	1.302	0.202 **	0.681 *	-0.872	-1.679 **	0.045	-2.103 **	0.584	0.035

Notes: Strategies correspond to medium level bracketing strategies described in Figure 2.

Table 8. Estimated Coefficients of the Multinomial Logit Estimation of Narrow Level Bracketing.

Panel A: Forward Pricing Tools.

	Choice Set D. Exchange			**Choice Set E. Exchange-Derived**			**Choice Set F. Non-Exchange-Derived**		
Strategy*	2	3	4	2	3	4	2	3	4
Constant	0.311	-2.211 **	1.000	-2.424 *	-1.177	-1.047	-3.289	1.760 **	-1.232
Farm Size	-0.220 **	-0.115	-0.215 **	-0.062	-0.218 **	-0.355 **	-0.039	-0.093	-0.089
Diversification	0.076	0.414 **	-0.059	-0.611 **	-0.141	-0.526 **	0.025	-0.261	-0.406 *
Decision Makers	-0.007	-0.086	-0.012	-0.034	-0.060	-0.032	-0.188	0.047	0.059
External Dec. Makers	0.526 *	1.271 **	0.746 **	-0.003	0.147	0.363	1.390 **	-0.151	-0.150
Age	-0.032	-0.067	-0.202 **	-0.160 *	-0.032	-0.142 **	-0.294 *	-0.136 **	-0.176 **
Innovativeness	-0.140	0.062	0.327 *	0.193	-0.007	-0.050	1.527 **	-0.002	0.147
Risk Aversion	-0.213 **	0.102	-0.236 **	-0.087	-0.050	0.007	0.080	0.084	0.068
Risk Perception	-0.067	0.001	-0.115 **	-0.050	-0.035	-0.005	-0.074	-0.029	-0.043
Market Orientation	0.150 *	-0.085	0.187 **	0.173	0.096	0.064	-0.270	0.037	0.057
Involvement	-0.586 **	0.075	-0.931 **	-0.275	0.062	-0.359 *	0.134	-0.346 **	-0.016
Extension	-0.110 **	-0.034	-0.044	-0.019	-0.026	-0.030	0.039	0.016	0.044
MAS	0.240 **	0.116 **	0.298 **	0.149 **	0.053 *	0.142 **	0.140	0.141 **	0.150 **
Satellite	-0.044	0.057	0.032	0.067	0.058	0.029	-0.226 *	0.023	0.035
USDA	0.070	0.054	0.074 *	-0.005	0.057	0.103 **	-0.075	0.019	0.086
Elevator	-0.088 **	-0.037	-0.164 **	0.028	-0.005	-0.007	0.594 **	-0.045	0.016
Internet	0.065 *	0.036	0.039	0.054	0.056 *	0.019	0.180 **	0.008	0.002
GPLAINS	-0.164	-0.104	-0.345 *	-0.954 **	-0.349 **	-0.777 **	-0.168	-0.998 **	-1.125 **
SEAST	-0.564	-0.077	-0.628 *	-0.379	1.057 **	0.605 *	-29.350	-0.466	-0.622

Notes: Strategies correspond to narrow level bracketing strategies described in Figure 2.

Table 8. Estimated Coefficients of the Multinomial Logit Estimation of Narrow Level Bracketing.

Panel B: Crop Insurance Products.

	Choice Set G. CAT	Choice Set H. Yield Insurance			Choice Set I. Revenue Insurance						
Strategy	2	2	3	4	2	3	4	5	6	7	8
Constant	-1.662 **	-2.033	-3.437	-1.034	-0.362	-1.560	-7.305 **	-3.779	106.134	-6.988 **	-10.632 **
Farm Size	-0.021	-0.057	-0.869 **	-0.031	-0.041	-0.079	0.235	-0.357	-30.445	0.096	0.237
Diversification	-0.069	-0.056	-0.288	-0.369 **	0.138	-0.697 *	-0.210	-0.617	-100.994	0.268	-0.837
Decision Makers	0.036	-0.142	-0.023	-0.102 *	0.030	0.240 **	0.220	0.091	8.584	0.110	0.158
External Dec. Makers	-0.018	-0.379	0.469	0.217	0.242	-0.649	0.390	0.079	-104.711	-1.440	-34.475
Age	0.025	-0.128 *	0.029	-0.129 **	-0.097 **	0.000	0.008	-0.193	-28.580	0.157	0.104
Innovativeness	0.074	-0.317	1.126 *	-0.027	-0.023	-0.137	-0.229	-1.130 **	-265.161	0.214	-0.536
Risk Aversion	0.032	-0.147 *	-0.096	0.089	0.089 *	0.231 *	-0.069	-0.131	-55.851	0.119	-0.117
Risk Perception	-0.006	0.024	-0.119	-0.031	0.007	-0.008	0.194 *	-0.082	5.283	-0.183 *	0.163
Orientation	0.054	0.212 **	0.135	0.046	-0.003	-0.133	0.517 **	0.306	23.049	0.191	0.312
Involvement	-0.077	0.037	-0.395	-0.120	-0.070	-0.228	0.340	-0.034	-15.396	0.212	0.917
Extension	0.036	0.068	-0.094	0.013	-0.030	-0.138 *	-0.051	-0.034	23.321	-0.159	-0.190
MAS	-0.038	-0.070	-0.104	-0.012	0.071 **	0.064	0.023	-0.012	-7.091	0.062	0.019
Satellite	0.075 *	0.075	0.162	0.068	-0.056	-0.170 *	-0.232 **	0.046	-11.654	0.177	-0.030
USDA	-0.013	-0.077	-0.008	-0.060	0.030	0.000	-0.073	-0.071	4.744	-0.130	0.176
Elevator	-0.006	-0.040	0.137	0.018	0.049 *	0.021	0.072	0.164	1.119	0.044	-0.133
Internet	0.024	0.074	0.050	0.007	-0.001	-0.048	0.066	0.155 *	-1.377	0.176 **	0.169
GPLAINS	0.254 *	0.391	-0.075	-0.063	0.276 *	0.774 **	0.030	0.837	102.254	-0.677	0.850
SEAST	1.332 **	-0.050	-1.027	-0.271	-0.859 **	-37.528	-1.238	0.737	-47.402	-1.181	2.784 *

Notes: Strategies correspond to narrow level bracketing strategies described in Figure 2.

Table 9. Combinations of Risk Management Tools Used by Narrow Bracketing Crop Producers in 1999-2000.

Panel A: Forward Pricing Instruments

Combination strategy	Cash Forward Contract	Hedge using futures	Buy put option	Hedge-to-arrive contract	Minimum price contract	Basis contract	Percentage	
							%	Σ %
1	0	0	0	0	0	0	32.8	32.8
2	1	0	0	0	0	1	9.9	42.7
3	1	0	0	0	0	0	9.2	51.9
4	1	1	0	0	0	0	5.3	57.3
5	1	0	0	0	1	1	4.6	61.8
6	1	0	0	1	0	1	3.8	65.6
7	0	0	0	0	0	1	3.1	68.7
8	1	0	1	0	0	0	3.1	71.8
9	0	1	0	0	0	0	2.3	74.0
10	1	1	1	0	0	0	2.3	76.3
11	1	1	1	0	0	1	2.3	78.6
12	0	0	0	1	0	0	1.5	80.2
13	0	0	0	1	0	1	1.5	81.7
14	0	1	1	0	0	0	1.5	83.2
15	1	0	1	0	0	1	1.5	84.7
16	1	1	0	0	0	1	1.5	86.3
17	1	1	0	1	1	1	1.5	87.8
18	10	1	1	0	1	0	1.5	89.3

Panel B: Crop Insurance Products

Combination strategy	Catastrophic coverage	Crop Revenue Coverage (CRC)	Income protection (IP)	Revenue assurance (RA)	GRP area yield insurance	Only hail insurance purchased	Percentage	
							%	Σ %
1	0	0	0	0	0	0	74.0	74.0
2	1	0	0	0	0	0	6.1	80.2
3	0	0	0	0	1	0	3.8	84.0
4	1	0	0	0	0	1	3.8	87.8
5	1	1	0	0	0	0	3.1	90.8
6	0	1	0	0	0	0	2.3	93.1

Note: N=1109: 1=use, 0=do not use.

Table 9 (Continued). Combinations of Risk Management Tools Used by Narrow Bracketing Crop Producers in 1999-2000.

Panel C: Risk Management Tools

Combination strategy	Cash forward contract	Hedge using futures	Buy put option	Hedge-to-arrive contract	Minimum price contract	Basis contract	Catastrophic coverage	CRC	IP	RA	GRP	Only hail insurance	Percentage	
													%	Σ %
1	1	0	0	0	0	1	0	0	0	0	0	0	9.9	9.9
2	1	0	0	0	0	0	0	0	0	0	0	0	8.4	18.3
3	0	0	0	0	0	0	0	0	0	0	0	0	7.6	26.0
4	0	0	0	0	0	0	1	0	0	0	0	0	6.1	32.1
5	1	1	0	0	0	0	0	0	0	0	0	0	5.3	37.4
6	1	0	0	0	1	1	0	0	0	0	0	0	4.6	42.0
7	0	0	0	0	0	0	1	0	0	0	0	1	3.8	45.8
8	1	0	0	1	0	1	0	0	0	0	0	0	3.8	49.6
9	0	0	0	0	0	0	0	0	0	0	1	0	3.1	52.7
10	0	0	0	0	0	0	1	1	0	0	0	0	3.1	55.7
11	0	0	0	0	0	1	0	0	0	0	0	0	3.1	58.8
12	1	0	1	0	0	0	0	0	0	0	0	0	3.1	61.8
13	0	0	0	0	0	0	0	1	0	0	0	0	2.3	64.1
14	0	1	0	0	0	0	0	0	0	0	0	0	2.3	66.4
15	1	1	1	0	0	0	0	0	0	0	0	0	2.3	68.7
16	1	1	1	0	0	1	0	0	0	0	0	0	2.3	71.0
17	0	0	0	1	0	0	0	0	0	0	0	0	1.5	72.5
18	0	0	0	1	0	1	0	0	0	0	0	0	1.5	74.0
19	0	1	1	0	0	0	0	0	0	0	0	0	1.5	75.6
20	1	0	1	0	0	1	0	0	0	0	0	0	1.5	77.1
21	1	1	0	0	0	1	0	0	0	0	0	0	1.5	78.6
22	1	1	0	1	1	1	0	0	0	0	0	0	1.5	80.2
23	1	1	1	0	1	0	0	0	0	0	0	0	1.5	81.7

Note: N=1109: 1=use, 0=do not use.

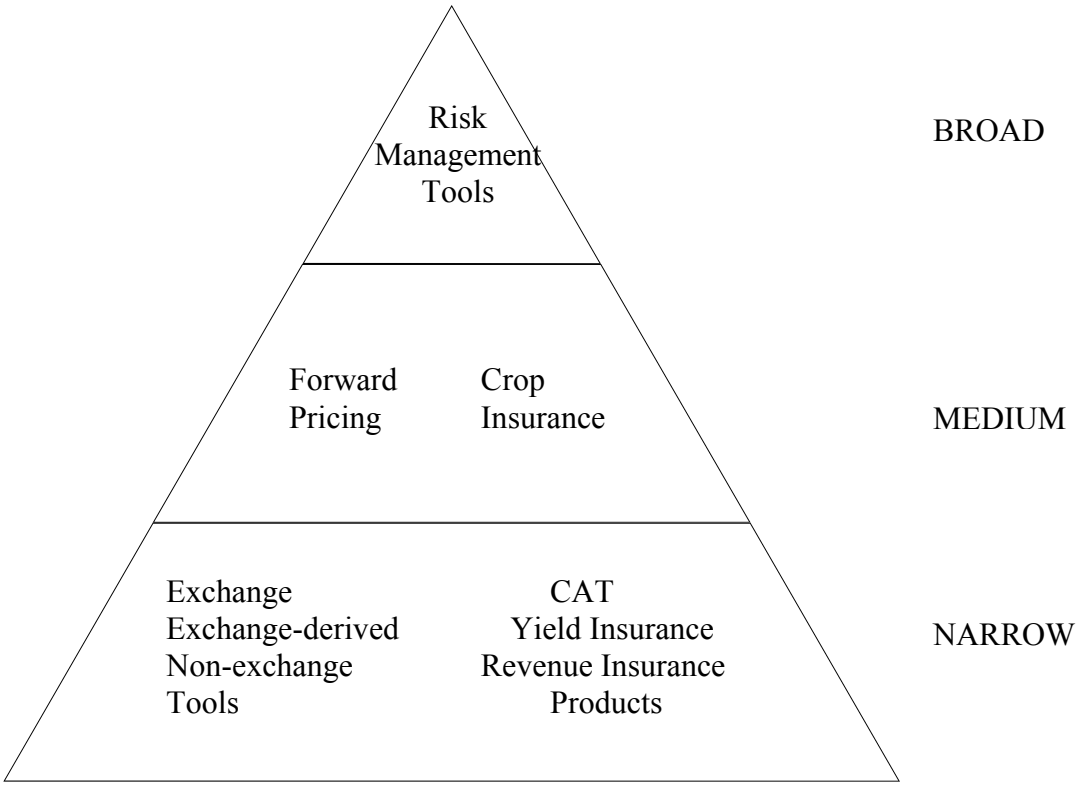

Figure 1. Crop Producer Choice Bracketing Levels

Bracketing Level	Strategies	Choice Set A	
		Forward Pricing Tools	Crop Insurance Products
Broad	1	0	0
	2	1	0
	3	0	1
	4	1	1

		Choice Set B			Choice Set C		
		Exchange Instruments	Exchange-Derived Instruments	Non-Exchange-Derived Instruments	CAT	Yield Insurance Products	Revenue Insurance Products
Medium	1	0	0	0	0	0	0
	2	1	0	0	1	0	0
	3	1	1	0	0	1	0
	4	1	0	1	0	0	1
	5	0	1	1	1	1	0
	6	1	1	1	0	1	1
	7	0	1	0	1	0	1
	8	0	0	1	1	1	1

		Choice Set D		Choice Set E		Choice Set F		Choice Set G	Choice Set H		Choice Set I		
		Futures	Options	Hedge-to-Arrive Contract	Basis Contract	Minimum Price Contract	Cash Forward Contract	CAT	GRP Area Yield Insurance	Hail Insurance	Crop Revenue Coverage	Income Protection	Revenue Assurance
Narrow	1	0	0	0	0	0	0	0	0	0	0	0	0
	2	1	0	1	0	1	0	1	1	0	1	0	0
	3	0	1	0	1	0	1		0	1	0	1	0
	4	1	1	1	1	1	1		1	1	0	0	1
	5										1	1	0
	6										0	1	1
	7										1	0	1
	8										1	1	1

Figure 2. Crop Producer Risk Management Strategies.

Notes: 1=Use, 0=Do not Use

Panel A: Broad Bracketing Level.

Choice Set 1. Risk Management Tools

		Predicted				
	Strategy	1	2	3	4	Total
Actual	1	**1**	0	0	11	12
	2	0	**14**	0	130	144
	3	0	1	**2**	60	63
	4	0	66	2	**822**	890
	Total	1	81	4	1023	1109

Panel B: Medium Braketing Level.

Choice Set 1. Forward Pricing Instruments

		Predicted								
	Strategy	1	2	3	4	5	6	7	8	Total
Actual	1	**11**	0	0	4	2	15	0	43	75
	2	1	**3**	0	11	0	15	0	10	40
	3	0	0	**1**	3	0	14	0	5	23
	4	1	1	1	**44**	3	119	0	48	217
	5	4	0	0	13	**9**	73	0	62	161
	6	2	0	0	40	4	**219**	0	48	313
	7	3	0	0	7	1	12	**0**	16	39
	8	8	2	0	29	8	65	0	**129**	241
	Total	30	6	2	151	27	532	0	361	1109

Choice Set 2. Crop Insurance Products

		Predicted								
	Strategy	1	2	3	4	5	6	7	8	Total
Actual	1	**7**	14	1	130	0	0	4	0	156
	2	5	**20**	0	118	2	0	6	0	151
	3	2	2	**1**	65	0	0	5	0	75
	4	9	6	3	**316**	0	0	7	3	344
	5	2	12	0	88	**0**	0	6	0	108
	6	1	2	1	63	0	**0**	0	1	68
	7	7	12	2	114	2	0	**7**	1	145
	8	1	5	0	52	0	0	2	**3**	63
	Total	34	73	8	946	4	0	37	8	1110

Figure 3. Actual versus Predicted Choices of Risk Management Tools.

Notes: Strategies correspond to broad and medium level bracketing strategies described in Figure 2.

Panel C: Narrow Bracketing Level.

Choice Set 1. Exchange Instuments

Actual \ Predicted	1	2	3	4	Total
1	**440**	5	7	64	516
2	109	**5**	3	66	183
3	104	2	**11**	28	145
4	121	4	5	**136**	266
Total	774	16	26	294	1110

Choice Set 2. Exchange-Derived Instuments

Actual \ Predicted	1	2	3	4	Total
1	**530**	0	36	7	573
2	59	**0**	7	2	68
3	251	0	**50**	7	308
4	126	0	25	**9**	160
Total	966	0	118	25	1109

Choice Set 3. Non-Exchange-Derived Instruments

Actual \ Predicted	1	2	3	4	Total
1	**11**	0	166	0	177
2	0	**1**	19	0	20
3	10	1	**776**	0	787
4	2	0	124	**0**	126
Total	23	2	1085	0	1110

Choice Set 4. CAT Insurance

Actual \ Predicted	1	2	Total
1	**594**	49	643
2	381	**86**	467
Total	975	135	1110

Choice Set 5. Yield Insurance

Actual \ Predicted	1	2	3	4	Total
1	**796**	0	0	0	796
2	76	**0**	0	0	76
3	23	0	**0**	0	23
4	215	0	0	**0**	215
Total	1110	0	0	0	1110

Choice Set 6. Revenue Insurance

Actual \ Predicted	1	2	3	4	5	6	7	8	Total
1	**256**	234	0	0	0	0	0	0	490
2	181	**321**	1	0	0	0	0	0	503
3	13	27	**1**	0	0	0	0	0	41
4	12	14	0	**1**	0	0	0	0	27
5	8	9	0	0	**0**	0	0	0	17
6	0	0	0	0	0	**2**	0	0	2
7	12	14	0	0	0	0	**0**	0	26
8	2	2	0	0	0	0	0	**0**	4
Total	484	621	2	1	0	2	0	0	1110

Figure 3 (Continued). Actual versus Predicted Choices of Risk Management Tools.

Notes: Strategies correspond to narrow level bracketing strategies described in Figure 2.