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Beef Producer Preferences and Purchase Decisions for Livestock Price Insurance

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Personal interviews were conducted with beef cattle producers in Louisiana to determine their preferences and purchase decisions for livestock price insurance. Conjoint analysis was utilized to determine the importance of selected attributes of insurance policies for these producers. The characteristics of producers who prefer given attributes were also identified. Producers rated products given four economic situations to evaluate. A two-limit tobit model was used to estimate the part worth utility values for each attribute. Univariate probit models were estimated to evaluate the influence of producer characteristics on purchase decisions.

Key Words: conjoint, livestock price insurance, ordered probit, two-limit tobit

JEL Classifications: C25, D81, Q12, Q13, Q16

Beef producers are exposed to substantial price risk resulting from changes in factors including but not limited to beef imports, food safety issues, domestic meat supplies, and domestic demand. Cash-forward pricing and futures and options contracts are the primary tools available for managing price risk associated with livestock production. These tools are not, however, widely used by beef cattle producers. A 1998 study by USDA-APHIS found that forward pricing strategies were used by only about 1.5% of U.S. beef cattle producers. Cash-forward pricing, such as video auctions, is used by a limited number of producers, but requires uniformity among calves, extensive records, and substantial coordination to be conducted successfully. Use of futures and options requires extensive knowledge of commodity markets, and many producers are not comfortable with this strategy.

The U.S. Congress appropriated funds to develop Livestock Price Insurance (LPI) as part of the Agricultural Risk Protection Act of 2000, with the goal of reducing livestock producers' exposure to price risk. In December 2002, a pilot program for feeder cattle was approved for states primarily in the Midwest. In 2005, approximately 3,300 livestock policies were sold, covering nearly 780,000 head of cattle. By July 2007, the program had been expanded by 17 states located in the Pacific, Southwestern, and Southeastern United States to include a total of 37 states (including the state in which the present study was conducted, Louisiana) (USDA-Risk Management Agency). Existing LPI products represent combinations of distinct attributes. The premium price, coverage level, and policy length are attributes that are commonly offered at different levels for most insurance policies. Attributes used to make up LPI products will ultimately determine the level of producer participation and the overall success of the program.

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The primary goals of this study are to: (1) determine the importance of LPI product attributes among cow–calf producers and (2) determine the types of producers who will purchase and the economic situations under which they are most likely to purchase LPI. Determining the relative importance of LPI attributes and identifying the characteristics of producers who prefer certain attributes provides insight to policy makers and private insurers for the development of new LPI products.

The hypothetical LPI product evaluated in this study sets a price guarantee based upon the beef cattle futures price. Producers can guarantee a price at or below the futures price at a given point in time. To purchase LPI, producers pay a premium that is calculated based upon the deductible or coverage level the producer prefers (the higher the deductible, the lower the premium). The deductible is subtracted from the quoted futures price to establish the guaranteed price for the producer. For example, if a futures price of \$90/cwt were quoted and a producer selected a \$5/cwt deductible, he or she would have an \$85/cwt price guarantee. The producer would pay the premium associated with a \$5/cwt deductible. The associated indemnity payment would be based on the USDA Market News average price for that class of livestock at the end of the policy term. Producers would retain the right to sell the livestock at any time during the coverage period, and indemnity payments would be made independent of the price at which the livestock were sold (Bossman). This would allow them to capitalize on favorable prices. To attempt to eliminate hobby farmers, only producers who have a minimum herd size of 50 cows are likely to be eligible to purchase LPI.

The actual product that has been offered to producers since the present data were collected may be purchased for up to 1,000 head of feeder cattle via a one-time application, with producers able to purchase it throughout the year. A number of coverage levels and periods are offered. Online postings of premium rates, coverage prices, and ending values are available daily. Ten coverage lengths are available, ranging from 13 to 52 weeks. Coverage prices range from 70% to 100% of the expected ending value. Insurance is purchased via a livestock insurance agent.

The authors are unaware of previous studies that have addressed producer preferences for LPI products, as these products have been only recently introduced. Thus, there is limited history of participation that can be examined to determine preferences or purchase patterns.

Conceptual Model

The Lancasterian conceptual framework is the basis for modeling producer preferences for LPI in this study. This framework suggests that goods are not the direct object of utility; rather, it is the characteristics of the goods from which utility is derived (Lancaster). Let X represent a composite good (LPI product) with n attributes, where $X = (x_{1j}, \ldots, x_{nj})$ and x_{ij} represents the ith attribute level of the jth product profile. The utility function for the jth multiattribute product follows:

$$(1) \qquad U_j = U\left[X\left(x_{1j}, \ldots, x_{nj}\right)\right]$$

U_j represents the utility an individual receives from product j, and the utility function is analyzed over the n attributes, where there are a total of j alternative products. The consumer assigns a measure of utility for each of the j alternative products (Greene).

An additive utility function requires the assumption of additive independence of the attributes. Keeney and Raiffa state, "An attribute, x_i, is additive independent of attribute x_j when conditional preferences for attribute x_i given x_j do not depend on the particular level of x_j." The additive utility function follows:

$$(2) \qquad U_j = b_1 x_{1j} + b_2 x_{2j} + \ldots + b_n x_{nj}.$$

In (2), b_i represents the weight or part worth utility for each attribute of a given product.

Conjoint analysis is a survey-based approach that decomposes actual or hypothetical products with multiple attributes, all of which have associated utility, into individual

attributes and asks respondents for an overall evaluation of the products. Respondents are required to evaluate only a subset of the entire set of possible products to obtain preference information about each attribute and its levels. Conjoint analysis allows the researcher to determine a part-worth utility for each product attribute, the sum of which allows for determination of total utility for any combination of attributes.

Conjoint analysis is based on the Lancasterian concept that a consumer aggregates the individual values provided by each feature of a product to determine total product value (Hair et al.). It allows respondents to evaluate complex products in a realistic decision context, and provides a quantitative measure of the relative importance of compared attributes. Conjoint analysis is commonly used to evaluate new product acceptance among consumers (e.g., Gillespie et al.; Halbrendt, Wirth, and Vaughn; Harrison, Ozyan, and Myers; Prentice and Benell). In these studies, conjoint analysis is used to analyze consumer preference for a product often before the product is developed or offered to consumers. Sherrick et al. utilized conjoint analysis to examine preferences for crop insurance products.

Assuming additive independence among the product attributes, the econometric specification of the additive conjoint model is:

$$(3) \qquad U_{ij} = X'_{ij}\beta^* + e_{ij}$$

U_{ij} represents the utility the ith individual derives from the jth alternative, X_{ij} is a vector of variables representing values for each of the attributes of the jth product for the ith individual, β^* is a vector of unknown parameters (part worth estimates), and e_{ij} is the random disturbance. The random disturbance may reflect unobserved attributes of the alternative, random choice behavior, or measurement error.

Evaluating preference ratings for products provides limited information about the products individuals would actually purchase. Though a respondent may assign a relatively high rating for a product, other factors may influence his or her decision to actually purchase it. Studies that have examined factors influencing insurance demand include Black and Dorfman, Pennings and Leuthold, and Smith and Baquet. In the case of LPI, unobserved utility from LPI is likely to be the primary determinant of the producer's decision to purchase. In this case, the utility associated with LPI is a function of the attributes of the LPI product, the risk environment faced by the producer, the economic situation characterized by current and expected future prices faced by the producer, demographics, and availability of information in purchase decisions. A budget constraint would also influence the purchase decision.

Given the unique 8- to 10-year cattle cycle, it was of interest to determine whether LPI purchase decisions would differ depending upon the position of the cycle. The authors are unaware of studies that have examined the effects of cycles on insurance purchase decisions, likely because cycles of nonlivestock agricultural industries have generally been shorter and less pronounced than those in livestock. The decreasingly absolute risk-averse individual would be expected to more likely insure during periods of relatively lower prices, and against potential losses rather than for potential gains, consistent with prospect theory (Khaneman and Tversky). This argument, however, does not fully consider the cattle producer's goal structure with respect to the cattle enterprise, nor does it consider differences in subjective probabilities associated with occurrences of outcomes under alternative economic scenarios. For instance, does the producer perceive price variability to be greater and, hence, the situation to be "riskier" when the futures price is \$10 greater or less than the current price than when the current and futures prices are equal? Pennings found that whether or not a producer initiated a position in the futures market could be explained not only by the producer's risk preference, but also by the value of the futures price relative to a reference price. In the case of the present study, Pennings' results would suggest a greater propensity to purchase

insurance when the futures price is higher. While this study does not fully analyze the reasons why LPI purchasing may differ by economic scenario, it determines whether purchases should be expected to differ by scenario—and the above discussion suggests there may be reasons why they would.

Data and Methods

The ability of a multiattribute utility study to provide useful results depends on the selection of appropriate attributes and their levels. To identify the most relevant LPI product attributes, agricultural insurance experts were consulted, producer opinions were solicited, and trial interviews with producers were conducted. Industry expert opinions were used to develop a comprehensive list of attributes. The list was further discussed with cattle producers to determine relevance for the conjoint experiment. Through this process, a comprehensive list of 10 attributes was reduced to four, with three levels each: (1) Premium|Deductible ($/cwt): $2.24|$0.00, $1.25|$5.00, or $0.50|$10.00; (2) Policy Length: 90 days, 180 days, or 360 days; (3) Price Series: State, Regional, or National; and (4) Mode of Communication: In Person, Telephone, or Internet. Attribute levels were selected so that the full range of possibilities would be considered for each.

Premium refers to the amount an individual pays in $/cwt to purchase an LPI policy. Values used for this study are based on those calculated for a proposed LPI product for beef cattle. The *deductible*, also expressed in $/cwt, is defined as the difference between the futures price and the price the producer guarantees when the policy expires. Each deductible corresponds to a given premium price, so these two attributes were combined into one. The premium and deductible combinations are calculated by actuaries and represent a realistic range of possibilities for a given week. *Policy length* refers to the number of days the producer plans to insure the price of cattle. For this study, producers were provided with the scenario of marketing a 500-pound calf, so the 360-day policy allowed producers to lock in a calf price for cows that were at least 3 months' bred. The *price series* specifies the price to be averaged when the contract expires to determine whether an indemnity payment will be made. For example, if the state price series were used, the insurance company would take the average price in the particular state over a specified number of days and compare it with the futures price to determine whether the producer would receive an indemnity payment. *Mode of communication* refers to how the insurance company would interact with producers to set up LPI contracts after the first contract is established.

A full factorial design resulted in 81 ($3 \times 3 \times 3 \times 3 = 81$) hypothetical products, but a fractional factorial design reduced the number of products to be evaluated by each respondent to nine (Table 1). Two additional products were included, one to increase degrees of freedom for individual models and the second to test for internal validity. A fractional factorial design is a sample of products selected from a full factorial design that can be analyzed to effectively test the effects of the attributes on producer's preferences (Hair et al.). The fractional factorial design retains the orthogonality of the full factorial design in estimating all single-factor main effects. Conjoint Analyzer (Bretton-Clark) was used to determine the fractional factorial design.

Additive independence among the attributes is assumed for three reasons: (1) previous studies have found little evidence that the assumption is overly constraining for most studies (Hair et al.); (2) given the four economic scenarios analyzed, a large number of profiles were to be considered, making the further task of respondents explicitly considering interactions among the attributes overly difficult; and (3) economic theory does not provide obvious rationale for assuming otherwise with these attributes.

A survey was developed to collect data concerning the producer's farm characteristics, risk attitude, risk management and record keeping practices, demographics, and preference for LPI products. Fifty-two beef cattle producers in 15 major beef-producing parishes

Table 1. Hypothetical Livestock Price Insurance Products for Conjoint Analysis

	Product Attributes			
Products	Premium/Deductible ($/cwt)	Policy Length	Price Series	Mode of Communication
Product 1	$2.24/$0.00	90 days	State	In person
Product 2	$1.25/$5.00	360 days	State	Telephone
Product 3	$0.50/$10.00	180 days	State	Internet
Product 4	$1.25/$5.00	180 days	Regional	In person
Product 5	$0.50/$10.00	90 days	Regional	Telephone
Product 6	$2.24/$0.00	360 days	Regional	Internet
Product 7	$0.50/$10.00	360 days	National	In person
Product 8	$2.24/$0.00	180 days	National	Telephone
Product 9	$1.25/$5.00	90 days	National	Internet
Product 10	$2.24/$0.00	180 days	State	Telephone
Product 11	$1.25/$5.00	90 days	Regional	Internet

in Louisiana[1,2] were surveyed via personal interview. The interviews were conducted over a 6-week period during January and February 2002. Personal interviews were selected over mail surveys as a result of preliminary survey administration with producers. While selecting the personal interview method increased data reliability, there was a tradeoff, given the number of producers surveyed was lower than would be obtained via mail survey, an issue also faced by Vandeveer and Loehman. Louisiana Cooperative Extension Service agents were used to select producers for interviews. Agents were asked to identify specified numbers of producers in the following herd size categories: 50 to 99, 100 to 199, 200 to 499, and 500 or more cows.

Respondents were asked to rate (not rank) eleven products from 0 (least preferred) to 10 (most preferred). To determine the impact of economic conditions on a producer's product ratings, producers were asked to evaluate each of the products under four different economic scenarios: Scenario 1—Current Price: $90/cwt, Futures Price: $100/cwt; Scenario 2—Current Price: $70/cwt, Futures Price: $80/cwt; Scenario 3—Current Price: $80/cwt, Futures Price: $80/cwt; and Scenario 4—Current Price: $100/cwt, Futures Price: $90/cwt. Prices used in the scenarios were selected based on observed annual cattle price variations. This allowed for determination of whether preferences or purchase volume depended upon economic scenario.

Aggregate model ratings data were analyzed using both ordered probit and two-limit tobit models. Though an ordered probit model would, from an economic theoretical standpoint, be the favored model, no significant differences in part-worth utilities estimated from ordered probit versus two-limit tobit analyses were found in our analysis. (Both results are presented in the Results section of the present paper.) These results are similar to those of Harrison, Gillespie, and Fields, with three separate datasets. Harrison, Gillespie, and Fields provide extensive discussion regarding the preference of the ordered probit from an economic theoretical standpoint based upon arguments regarding ordinality versus cardinality of the conjoint dependent variable, as well as the constraints associated with using that framework for individual-level conjoint models. Thus, we refer the reader to that paper for greater details on this issue. Since individual models would also be run for the analysis, the two-limit tobit model was ultimately chosen over the ordered probit, as

[1] Utility of income includes risk preference, assuming the Arrow-Pratt coefficient of absolute risk aversion, $r(I) = -[-U''(I)/U'(I)]$.

[2] Louisiana beef cattle producers are fairly representative of cattle producers throughout the Southeastern United States, which are typically primarily smaller, cow–calf-based operations using a full range of different crossbred mixes, and whose comparative advantage is based upon availability of relatively high-quality year-round forage.

there would not be sufficient degrees of freedom to run ordered probit analyses for the individual models.

Using two-limit tobit analysis, actual ratings provided by respondents served as the dependent variable and the part-worth utility values for each attribute level were estimated. Values of the part-worth estimates were used to determine the relative importance and desired levels of each product attribute. The two-limit tobit model treats the ratings as a censored cardinal measure of utility, with censoring at both 0 and 10. With this approach, there is an assumed transformation from ratings space to utility space, and an implicit assumption that the utility distance between each unit change in rating is constant. The two-limit tobit model follows:

$$
\begin{aligned}
y_i^* &= \beta' x_i + u_i \\
y_i &= L_{1i} \quad \text{if } y_i \le L_{1i} \\
&= y_i^* \quad \text{if } L_{1i} < y_i^* < L_2 \\
&= L_{2i} \quad \text{if } y_i^* \ge L_{2i}\,,
\end{aligned} \tag{5}
$$

where y_i^* is the latent variable and y_i is the observed dependent variable (product rating). In this model, L_{1i} and L_{2i} represent the lower and upper limits of the dependent variable, respectively.

Mean deviation coding, explained by Hair et al. and Gillespie et al., was used for all explanatory variables in the model. The base level of each attribute is coded as -1, rather than 0, and constraints the levels of each attribute to sum to 0. As such, the coefficients have different interpretations than dummy variables: the base level coefficient is the negative sum of the $(k - 1)$ attribute coefficients.

Purchase Decision Analysis

Once each product was rated, respondents were asked to indicate whether or not they would purchase each product. For each respondent, the product with the median rating was selected and the respondent was then asked, "Would you purchase this product if it were the only product available if the current price were $\$X$ and the futures price were $\$Y$?" If the producer responded "yes", then a product with a lower rating was selected and the same question asked. If the respondent responded "no", then a product with a higher rating was selected and the question repeated. This process continued until the product with the lowest rating that would be purchased by the respondent was identified. Once this product was identified, it was assumed that all products with the same or a higher preference rating would also be purchased, and those with lower preference ratings would not be purchased.[3] Since individual conjoint analyses were conducted for each respondent, using the estimated part-worth utilities resulting from the two-limit tobit models, purchase decisions could therefore be determined for the full set of 81 potential products by ranking the predicted for each product. The respondent's purchase decision was evaluated similarly for each of the four economic scenarios to determine whether purchase decisions changed under different market conditions. This procedure allowed for determination of the subset of the full set of 81 potential products that would be chosen under a particular economic scenario if it were the only product offered.

The purchase decision is analyzed using a univariate probit model. The dependent variable is a binomial choice of either purchasing "1" or not purchasing "0" each LPI product. Therefore, each observation is treated as a single draw from a Bernoulli distribution. The distribution for the probit model follows (Greene):

$$
Prob(Y = 1) = \int_{-\infty}^{\beta} \phi(t)dt = \Phi(\beta' x). \tag{6}
$$

$\Phi(.)$ represents the standard normal cumula-

[3] This assumption is likely to hold as long as the budget does not constrain the producer from reaching the higher utility levels. Given that these insurance products were relatively inexpensive, with the highest price of $2.24/cwt ($11.20/calf), it was assumed that the budget constraint would not be binding for these products and, thus, a higher rated product would have a greater probability of being purchased.

tive density function, Y is the observed dependent variable, β represents the estimated parameters that reflect the impact of changes in x (independent variables in the model) on the probability. Marginal effects for probit continuous variables are

$$(7) \qquad \frac{\partial p_i}{\partial x_{ik}} = \phi(x'_i\beta)\beta_k,$$

where ϕ represents the probability density function of a standard normal random variable. For dummy variables, d, the marginal effects are calculated as

$$(8) \qquad \Delta = \Phi(\overline{X}\beta, d = 1) - \Phi(\overline{X}\beta, d = 0).$$

One univariate probit model was estimated nine products, four economic scenarios, and all 52 producers, for a total of 1,872 observations. The model is set to determine the effects of product attributes, risk preference, risk environment, demographic, and economic situational variables on purchase. The nine products selected were not the same as were used in the conjoint estimation. The products used in the purchase analysis were selected by varying one attribute while holding all other attributes constant at their median levels; thus, each product differed from the ''median'' product by the variation of only one attribute. By varying the level of one attribute while holding others constant, one could avoid offering products that were likely to be considered unrealistic. This allowed the authors to identify the differences in purchase decision that resulted from changing the level of the specified attribute.

The Role of Product Attributes and Risk Preference on the Insurance Purchase Decision

Levels of attributes premium|deductible, policy length, price series, and mode of communication affect utility, and thus whether a product will be purchased. It is expected that the benefits of government subsidized insurance will be recognized and higher premium, lower deductible products will be preferred. Likewise, it is expected that Louisiana producers will be more willing to purchase products using a state price series, given the generally lower level of Louisiana compared to U.S. beef prices. It must be pointed out that, as explained earlier, the purchase decision as used in this analysis was determined from the elicitation of purchase decisions among products used in the fractional factorial design along with the part-worth estimates of the conjoint two-limit tobit models. Thus, significance of an attribute in the two-limit tobit models would suggest likely significance in the probit purchase analysis. Therefore, post-conjoint, the primary contributions of these variables in the purchase decision analysis are their marginal effects on the probability of purchase, rather than their significance.

RISKAVERSE provides a measure of the producer's risk preference regarding investments and, thus, a proxy for preference over income variability. The question asks, ''Relative to other investors, how would you characterize yourself?'' Possible answers were, ''I tend to take on substantial levels of risk in my investment decisions,'' ''I neither seek nor avoid risk in my investment decisions,'' and ''I tend to avoid risk when possible in my investment decisions.'' Fausti and Gillespie utilized this question in a comparative analysis of risk preference elicitation procedures in a mail survey context. It is expected that those answering, ''I tend to avoid risk when possible in my investment decisions'' will more likely purchase LPI.

The Role of Marketing Strategies and Farm Characteristics on Insurance Purchase Decision

COWS is a continuous variable for the number of cows and bred heifers on the farm, divided by 100 for computational purposes. A positive relationship is expected with LPI purchase. Producers with larger herds are expected to have greater interest in protecting price, as they are more heavily exposed to the effects of price swings due to greater volume. Smith and Baquet did not find farm size to significantly influence insurance purchase decisions, while Goodwin found that larger Iowa crop producers were likely to insure a higher proportion of planted crop acres.

VIDEO is a dummy variable indicating whether producers utilize video auctions as a marketing strategy. The hypothesized sign for this parameter is inconclusive. Producers market cattle through video auction to obtain a premium or be compensated for maintaining accurate production, health, and herd genetics records. Individuals who utilize this marketing strategy are usually among the better managers in the industry as a result of the level of coordination and record keeping required. These producers are likely to be more knowledgeable in risk mitigating strategies, and therefore, they may be interested in LPI as a method of diversifying their risk management strategies (Lesser). On the other hand, producers using these strategies face less price risk and, thus, may not be as likely to purchase LPI.

PRIVATE refers to the use of private treaty as a means of marketing cattle. Producers marketing cattle via private treaty generally have higher quality animals, and are usually able to sell them at a price higher than via conventional auction. Most purebred producers use this marketing strategy. Producers marketing the majority of their animals through private treaty are expected to be less interested in purchasing LPI. Private sales allow them to mitigate price risk without directly paying a premium or commission. Therefore, PRIVATE is expected to have a negative relationship with LPI purchasing. Video auctions and private treaty sales are marketing strategies commonly utilized by superior managers in the industry. It is not expected that the availability of LPI or their decision to purchase it would have any impact on their choice of marketing strategy.

FARMINC$<$50% is a dummy variable indicating that less than 50% of the farmer's household net income is from farming. It is expected that producers with a greater percentage of off-farm income have less interest in insurance, as their income is less exposed to variation associated with routine price swings in agriculture.

DEBT$>$20% is a dummy variable that represents producers with debt-to-asset ratios greater than 20%. As debt increases, the producer is expected to be more willing to purchase insurance in order to guarantee that financial obligations are met. The expected sign of this variable is positive, consistent with Smith and Baquet.

DIVERSIFIED is a dummy variable denoting whether a producer has multiple farm enterprises. As enterprise diversification increases, the expected total farm revenue becomes less variable. More diversified producers are expected to be less likely to purchase LPI. Black and Dorfman found a negative relationship between enterprise diversification and demand for crop insurance.

Effect of Demographic and Informational Variables on Insurance Purchase Decisions

COLLEGE is a dummy variable representing producers with a 4-year college degree. The effect of education on LPI purchase is explored in this study. On the one hand, producers with higher education may have better management skills and a better understanding of the benefits of LPI, thus increasing purchase. On the other hand, higher educated individuals are likely to be more knowledgeable about other already-available risk management strategies, such as utilizing futures and options. Smith and Baquet found education to positively influence insurance purchase, while Richards and Mischen found a negative relationship.

FUTURES, a dummy variable indicating that the producer checks beef cattle futures prices on at least a weekly basis, is expected to have a positive relationship with LPI purchasing. Producers with greater knowledge of futures markets are expected to be better able to make informed decisions about purchasing LPI. Producers who frequently monitor prices use their market knowledge as part of their risk management strategy.

AGE is a continuous variable representing producer's age (divided by 10 for computational purposes). Theory provides little guidance as to the expected sign for producer's age (Smith and Baquet), though Richards and Mischen found that older producers were more likely to purchase yield and cost of

production insurance for specialty crops. Older persons are commonly more risk averse in investments due to their dependence on investment returns for their livelihoods. On the other hand, they may be less likely to experiment with alternative management strategies, as found in technology adoption studies (Feder, Just, and Zilberman). A squared term (AGES) is included to account for a nonlinear relationship between age and purchase.

Effect of Economic Situation on Insurance Purchase Decision

ECON1, ECON2, and ECON4 are dummy variables representing economic scenarios 1, 2, and 4, which are presented to producers before they rate each product. Economic scenario 3 is the base scenario, which presents producers with a market condition where both the current cash price and the projected futures price are \$80 per hundredweight.

Results

Survey results indicate that respondents were diverse in terms of herd size, age, education, debt-to-asset ratio, income from farming, farming experience, and marketing practices. Nearly 90% used the auction barn to market cattle, and 54% and 33% used private buyers and video auctions, respectively. Almost 60% monitored beef cattle futures prices on at least a weekly basis. Eleven indicated they would not purchase LPI under any economic scenario. However, 89% felt that LPI would be beneficial to beef cattle producers. Only 5.5% felt that LPI would not be beneficial and 5.5% were indifferent or undecided about its benefits.

Table 2 presents the results of the aggregate conjoint analyses, which included 520 observations (52 producers evaluated 10 products each). For the aggregate model, both two-limit tobit and ordered probit results are provided. Models were run using two of the three levels for each product attribute to prevent a circular reference. Then the excluded level was added and another level dropped and the model was run to determine the coefficients for all attribute levels. The predicted total utility for one holdout card was calculated and compared to the actual rating for each producer. The internal validity was tested for each of the four economic scenarios. Pearson correlation coefficients for economic scenarios 1, 2, 3, and 4 were 0.67, 0.65, 0.65, and 0.74, respectively, suggesting relatively strong correlation between actual and predicted utility values for the holdout card.

Table 2 shows that the estimated coefficients were similar across the four economic scenarios. The signs were the same for the part-worth utilities and estimate values varied only slightly among the four models. The combined model found no significant differences in preference by economic scenario. The part-worth utilities estimated for eight attribute levels were statistically significant at the 1% level in each economic scenario. Estimates for premium|deductible = \$1.25|\$5.00 were statistically significant at the 5% level in Economic Scenarios 1, 2, and 3, and at the 10% level in Economic Scenario 4. The coefficients for regional price series were not statistically significant in any of the models.

Results showed that the presence of a premium|deductible of \$0.50|\$10.00/cwt, 90- and 360-day policy lengths, a national price series, or the Internet mode of communication would decrease producers' preference for a product. Table 3 shows the relative importance and confidence intervals of attributes for the conjoint analysis.[4] Price series was identified as the most important attribute with a contribution of approximately 50% to the overall product rating in each economic scenario. Producers indicated a strong preference for products with a state price series and a much lower preference for products with a national price series. It was expected that the state price series would be preferred by

[4] Percentage importance of attributes is determined by: (1) for each attribute, summing the absolute values of the part worths with the largest positive and largest negative values; (2) summing the results of (1) for all attributes and dividing the result of (1) by the result of (2) for each attribute. Confidence intervals were determined by using a bootstrapping technique where coefficients were estimated from 1,000 random draws.

Table 2. Estimates for the Combined Model and Individual Economic Scenarios

Variable	Ordered Probit Aggregate Model	Two-Limit Tobit Aggregate Model	Two-Limit Tobit Economic Scenario 1	Two-Limit Tobit Economic Scenario 2	Two-Limit Tobit Economic Scenario 3	Two-Limit Tobit Economic Scenario 4
Constant	2.318***	5.084***	5.168***	5.107***	4.968***	5.092***
Prem|Deduct \$2.24|\$0.00	0.295***	0.652***	0.696***	0.641***	0.579***	0.691***
Prem|Deduct \$1.25|\$5.00	0.141***	0.302***	0.286**	0.303**	0.352**	0.266**
Prem|Deduct \$0.50|\$10.00	−0.436***	−0.953***	−0.982***	−0.943***	−0.931***	−0.956***
90-day policy	−0.088***	−0.184**	−0.182	−0.193	−0.216	−0.144
180-day policy	0.269***	0.565***	0.567***	0.576***	0.593***	0.524***
360-day policy	−0.180***	−0.382***	−0.386***	−0.383***	−0.377***	−0.380***
State price series	0.818***	1.787***	1.802***	1.811***	1.802***	1.733***
Regional price series	0.031	0.051	0.264	0.036	0.079	0.063
National price series	−0.849***	−1.839***	−1.828***	−1.848***	−1.881***	−1.797***
In-person purchasing	0.181***	0.397***	0.414***	0.401***	0.373**	0.400**
Telephone purchasing	0.078**	0.172**	0.165	0.189	0.179	0.153
Internet purchasing	−0.259***	−0.568***	−0.579***	−0.599***	−0.552***	−0.552***
Economic scenario 1	0.043	0.091	n/a	n/a	n/a	n/a
Economic scenario 2	0.013	0.027	n/a	n/a	n/a	n/a
Economic scenario 4	−0.054	−0.118	n/a	n/a	n/a	n/a
σ	n/a	2.209***	2.158***	2.194***	2.229***	2.250***

***, **, and * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively.

Louisiana producers since the average state price is consistently lower than the average national price. The premium|deductible was the second most important attribute with a contribution of about 22% to the preference rating of products. The policy length and mode of communication made contributions of about 13% each to preference ratings. The 180-day policy length and the in-person mode of communication were the preferred levels for their respective attributes.

The aggregate model results indicated that the most preferred product would have a \$2.24|\$0.00/cwt premium|deductible, a 180-day policy length, a state price series, and an in-person method of purchase. Results suggest producers prefer paying a higher premium for a full price guarantee to paying a lower premium for a partial guarantee. Relatively small differences are seen in the relative importance of attributes between the aggregate two-limit tobit and the ordered probit models, with differences occurring at the first decimal place.

Purchase Decision

Willingness to purchase LPI varied greatly depending upon product offered and economic scenario (Table 4). The top-rated product, with \$2.24/\$0.00 premium/deductible, 180-day policy length, state price series, and in-person marketing, was purchased by 69.2% of producers under Economic Scenario 1, but by only 32.7% of producers under Economic Scenario 3. On the other hand, the bottom-rated product, with \$0.00/\$10.00 premium/deductible, 90-day policy length, national price series, and Internet marketing, was purchased by 0.2% of producers under Economic Scenario 1 and by no producers under Economic Scenario 3. These numbers represent the end-

Table 3. Relative Importance and 95% Confidence Intervals[a] for Product Attributes, %

Attribute	Ordered Probit Aggregate Model	Two-Limit Tobit Aggregate Model	Two-Limit Tobit Economic Scenario 1	Two-Limit Tobit Economic Scenario 2	Two-Limit Tobit Economic Scenario 3	Two-Limit Tobit Economic Scenario 4
Premium|deductible	22.24 (19.33, 25.19)	22.47 (19.56, 25.46)	23.13 (17.62, 29.04)	22.02 (16.28, 27.80)	21.30 (15.39, 27.29)	23.42 (17.39, 29.50)
Policy length	13.66 (10.56, 16.53)	13.26 (10.13, 16.17)	13.13 (7.25, 18.64)	13.34 (7.31, 18.98)	13.69 (7.46, 19.53)	12.86 (6.50, 18.77)
Price series	50.71 (47.65, 54.00)	50.76 (47.65, 54.03)	50.06 (44.34, 56.38)	50.87 (44.89, 57.42)	51.96 (45.76, 58.82)	50.19 (44.00, 57.02)
Mode of communication	13.39 (10.33, 16.42)	13.51 (10.46, 16.56)	13.68 (7.75, 19.63)	13.77 (7.57, 19.82)	13.05 (6.57, 19.25)	13.54 (6.98, 19.86)

[a] 95% Confidence interval values are listed in parentheses beside each relative importance estimate for given product attributes.

points in percentages of our sample of producers' willingness to purchase LPI.

The probit model was tested for multicollinearity using Pearson correlation coefficients and condition indexes and heteroskedasticity using the LM statistic. Analyses provided no evidence of multicollinearity or heteroskedasticity.

The purchase decision analysis showed that product attributes greatly affected the willingness of producers to purchase LPI (Table 5). Compared with a base product with a \$0.50 premium and \$10.00 deductible, the probability of purchase increased by 0.0744 for a \$1.25|\$5.00 product, and by 0.1576 for a \$2.24|\$0.00 product, showing a clear preference for higher premium, lower deductible products and likely reflecting producers' understanding of the government-subsidized nature of LPI products. Producers were more likely to purchase the 180-day policy than either the 90-day policy, associated with a reduced purchase probability of 0.0949; or the 360-day policy, associated with a reduced purchase probability of 0.0690. Producers clearly favored the state price series, which would increase the probability of purchase by 0.2755 over a regional price series. The national price series reduced the probability of purchase by 0.1652 relative to the regional price series. Relatively large differences in purchase probabilities across price series are consistent with the magnitude of the importance of this attribute in the part-worth analysis. The in-person method of marketing was preferred to Internet marketing, which reduced the probability of purchase by 0.0886 relative to in-person marketing.

Persons considering themselves as risk averse in investment decisions had an increased probability of 0.0899 of purchasing LPI relative to those who tended to neither seek nor avoid risk, or those who tended to take on substantial levels of risk in their investment decisions.

As expected, producers who sold via private treaty or received less than half of their income from the farm had lower probabilities, 0.0499 and 0.0780, respectively, associated with purchasing insurance. This

Table 4. Percentage of Producers Indicating They Would Purchase under Alternative Economic Scenarios

Product Number (Premium/Deductible, Policy Length, Price Series, and Mode of Communication)		Economic Scenario 1	Economic Scenario 2	Economic Scenario 3	Economic Scenario 4
1	\$2.24/\$0.00, 180 days, regional, telephone	48.1	42.3	15.4	32.7
2	\$1.25/\$5.00, 180 days, regional, telephone	36.5	34.6	13.5	26.9
3	\$0.50/\$10.00, 180 days, regional, telephone	25	25	11.5	21.2
4	\$1.25/\$5.00, 90 days, regional, telephone	19.2	19.2	7.7	9.2
5	\$1.25/\$5.00, 360 days, regional, telephone	28.9	25	7.7	23.1
6	\$1.25/\$5.00, 180 days, state, telephone	71.2	65.4	32.7	50
7	\$1.25/\$5.00, 180 days, national, telephone	13.5	13.5	5.8	13.5
8	\$1.25/\$5.00, 180 days, regional, in person	44.2	40.4	11.5	30.8
9	\$1.25/\$5.00, 180 days, regional, internet	30.8	26.9	9.6	21.2
Top-rated	\$2.24/\$0.00, 180 days, state, in person	69.2	65.4	32.7	50
Bottom-rated	\$0.50/\$10.00, 90 days, national, internet	0.02	0	0	0.02

can be explained by the lesser risk encountered by these producers as a result of currently utilized risk management strategies. On the other hand, those who used video auctions or forward contracting were more likely to purchase LPI, suggesting that producers utilizing these strategies would view LPI as being a complementary risk management strategy. Forward contracting generally requires knowledge of futures markets and, thus, those strategies may be perceived as complementary. While farm diversification was not significant at the cutoff 10% level, it was significant at the 11% level, suggesting that a weak negative relationship might exist between diversification and LPI.

Age had a highly significant influence on the purchase of LPI, suggesting that older producers would be the greater purchasers of LPI, a result that is not surprising given increased risk aversion with age. The relationship was nonlinear, however, with the marginal increase in probability decreasing with age and eventually declining. As expected, producers with futures market knowledge were more likely to purchase LPI.

Results revealed that economic scenarios had significant impacts on insurance purchase decisions for all types of products. Producers were expected, *a priori*, to be willing to purchase LPI more frequently when cattle prices were forecasted to decline. However, producers were almost equally willing to purchase LPI when prices were expected to either increase or decrease. There was significantly less interest in purchasing LPI when prices were expected to remain constant over the term of the contract. A possible explanation is that expected increases or decreases in price cause producers to perceive prices to be more volatile, encouraging them to purchase LPI.

Table 5. Results of the Probit Insurance Purchase Decision Analysis

Variable	Coefficient	SE	Marginal Effect	SE
Constant	−3.8607***	0.7170	−1.1962***	0.2200
Product attribute variables				
PREM224	0.4581***	0.1380	0.1576***	0.0512
PREM125	0.2534*	0.1401	0.0744*	0.0388
PL90	−0.3399**	0.1418	−0.0949***	0.0351
PL360	−0.2392*	0.1399	−0.0690*	0.0373
PSSTATE	0.7672***	0.1321	0.2755***	0.0511
PSNAT	−0.6630***	0.1528	−0.1652***	0.0287
TELEPHONE	−0.1155	0.1339	−0.0366	0.0433
INTERNET	−0.3146**	0.1375	−0.0886**	0.0347
Risk preference variable				
RISKAVERSE	0.2775***	0.0815	0.0899***	0.0274
Variables influencing the risk environment				
COWS	−0.0078	0.0076	−0.0024	0.0024
VIDEO	0.1452*	0.0867	0.0455*	0.0274
PRIVATE	−0.1588*	0.0847	−0.0499*	0.0270
FARMINC<50%	−0.2513***	0.0957	−0.0780***	0.0297
DEBT>20%	−0.0030	0.0853	−0.0009	0.0264
DIVERSIFIED	−0.1420	0.0931	−0.0432	0.0278
Demographic variables				
COLLEGE	−0.0750	0.0771	−0.0233	0.0240
AGE	1.0508***	0.2607	0.3256***	0.0804
AGES	−0.1024***	0.0245	−0.0317***	0.0076
FUTURES	0.3409***	0.0871	0.1024***	0.0252
Economic situational variables				
ECON1	0.8408***	0.1005	0.2895***	0.0360
ECON2	0.7576***	0.1008	0.2593***	0.0360
ECON4	0.5704***	0.1019	0.1918***	0.0360
McFadden R^2				0.1313
% Correctly predicted				74.947

****, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.*

Conclusions and Implications

Most beef cattle producers do not take advantage of the risk management tools currently available. This is likely a result of the level of understanding and expertise required, the volume of cattle needed to participate in many risk-reduction mechanisms, and perhaps the ''hobby farm'' mentality of many part-time beef cattle producers. Results indicate substantial interest in LPI among the surveyed producers. The most important attribute among producers in selecting an LPI product is the price series. Louisiana producers recognize that the average price of cattle in Louisiana is significantly lower than in the region or the nation; thus, use of the state price series would lead to higher indemnity payments than would either a regional or national price series. Producers in areas with relatively higher-priced cattle would also be expected to view the price series as important, but would prefer the national price series. The premium and deductible are also relatively important, accounting for 21% to 23% of the relative factor importance. Of less importance are the policy length and mode of communication. The importance of attributes did not change significantly when economic scenarios were changed. Thus, it does not appear that the cattle cycle will affect relative preference among products.

The most preferred product had a higher premium and no deductible, likely reflecting

producers' realization that government-subsidized LPI is relatively inexpensive, considering the significant benefits. Producers also preferred the 180-day policy length, showing more interest in insuring cattle once they were born, rather than in the womb or 3 months prior to sale. This likely reflects the length of financial planning horizon of many cow-calf producers. Surprisingly, producers preferred to purchase the policy in person, rather than by telephone or Internet. The substantially lower level of utility associated with Internet purchasing is expected to become less pronounced as farmers become more comfortable with Internet use.

Results indicate that willingness to purchase LPI products depends greatly upon risk preference and risk environment. Separating risk preference from risk environment allows the researcher to isolate the effects of preference from factors that influence the level of risk faced by producers. As expected, risk-averse producers were the greater purchasers of LPI, but those who had reduced risk via another mechanism were less likely to purchase unless it was viewed as complementary to the risk strategy. Likewise, older producers familiar with futures markets were more likely to purchase LPI.

Results underscore the importance of economic scenario in LPI purchase decisions. Perhaps surprisingly, LPI was more attractive to producers when prices were expected to change, regardless of whether price was expected to increase or decrease. It must be pointed out that a change in economic scenario did not change the preference ordering of products (from the conjoint analysis); it only changed whether or not any insurance product would be purchased. When relative price stability was expected (the current price and futures price were equal), producers were less interested in purchasing any of the products than when the two prices differed. While these results are not in exactly the same context of Pennings, they do support his findings that the futures price relative to a reference price can influence whether a futures position is taken. This shows the difference between an analysis that relies solely on conjoint analysis to examine preferences of products and one that goes the second step and requests purchase information.

We suggest future research to determine whether economic scenario effects on purchase decisions would hold with a larger sample of producers and, if so, to determine the motivations behind greater purchasing when the futures price exceeds the current market price. We suspect that the greater purchasing in this situation exists due to perceived greater volatility during periods of greater divergence between current market and futures prices. Since pilot insurance programs have a very short history in cyclical industries such as livestock, there is little basis to test this phenomenon with actual purchase data at this time. It will be, however, of interest to see whether this behavior plays out in actual markets after LPI has been on the market for an extended time period that includes a range of economic scenarios.

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