

A Behavioral Decision-Making Modeling Approach Toward Hedging Services

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This paper takes a behavioral approach toward the market for hedging services. A behavioral decision-making model is developed that provides insight into how and why owner-managers decide the way they do regarding hedging services. Insight into those choice processes reveals information needed by financial institutions to improve the design of their financial products. The key elements of the model are related to the characteristics of the owner-managers, thereby exploring the decision units' evaluations of the hedging services provided by futures exchanges. Using structural equation models and data from 467 owner-managers, obtained by means of computer-assisted personal interviews, we find that the elements "exercising entrepreneurial freedom," "perceived performance," and the "owner-manager's reference price" determine their attitude toward using futures. These elements are related to innovativeness, risk attitude, and level of understanding of futures markets.

There are a variety of financial instruments available to manage price risk, such as the cash market, futures, options on futures, individually negotiated forward contracts, and various OTC instruments. The functioning of such price risk management instruments has been the subject of extensive academic research, but *how* and *why* participants use these instruments has received little attention. Yet financial institutions need such information to develop and market new financial products and to improve existing ones. In this context, a better understanding of the choice process of customers is crucial.

Carter and Sinkey [1998], Géczy, Minton, and Schrand [1997], Howton and Perfect [1998], Koski and Pontiff [1999], Lee and Hoyt [1997], Mian [1996], Nance, Smith, and Smithson [1993], Pennings and Garcia [2003], Schrand and Unal [1998], Tufano [1996], and Visvanathan [1998] provide valuable insights into the corporate characteristics associated with the decision to use derivatives. However, these studies focus primarily on large corporations, and none has investigated *how* managers make decisions. Questions involving the *how* among choices include 1) the type of information managers use when evaluating price risk management instruments, 2) the influence of the manager's decision-making unit on the hedging decision,

3) the level at which (attitudinal) information about alternative price risk management instruments is compared (the level of comparison), and 4) the way this information is compared across alternative price risk management instruments in reaching a decision (the comparison mechanism).

This study differs from previous research into derivative usage in two important ways. First, we focus on owner-managers of small and medium-sized enterprises (SMEs), because, unlike in a large corporation, they tend to embody many of the important functions of the enterprise, such as research and development, manufacturing quality control, sales, and accounting. Large corporations tend to have different departments for each function. Moreover, the wealth of an owner-manager of a SME is directly affected by the variance of expected profit, which constitutes an (extra) incentive to consider and control risk by means of hedging (Sarasvathy, Simon, and Lave [1998]; Smith and Stulz [1985]).

Second, we develop a behavioral decision-making model that reveals why and how these SMEs hedge. While managers usually have a choice of several price risk management instruments, we consider the example of the Dutch hog market, where only two alternatives exist, the use of the cash market or the hog futures contract. We selected this market 1) to keep the illustration of our approach simple, and 2) to apply the results readily, by providing futures exchanges with valuable information about how to improve their contract design and marketing. The latter is particularly important, as successful product innovation is a great challenge for futures exchanges, and the risk of failure of newly developed contracts is considerable (Carlton [1984]; Miller [1990]; Thompson, Garcia, and Dalla-

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fior [1996]). In general however, the proposed behavioral approach is designed for application to any financial market with at least two available alternative price risk management instruments.

The subjects in this study are owner-managers of Dutch hog farms, and hence highly experienced participants in market activities, which makes them excellent subjects for studying decision-making behavior. The Dutch hog industry is a large slaughter hog cash market, with many participants, a homogeneous commodity, no government intervention, and high and unpredictable price fluctuations (according to the participants in the cash market). The only relevant price risk management instrument for Dutch hog farmers is the hog futures contract traded at Euronext. This contract closely reflects the commercial movement of the commodity, so that price distortions are not due to specifications in the contract.

According to the financial literature, all these characteristics make the Dutch hog industry very favorable for viable futures trade (e.g., Black [1986]; Carlton [1984]; Ederington [1979]; Sandor [1973]; Silber [1981]), but only 13% of Dutch hog farmers actually use futures contracts to cover their price risk (Pennings and Smidts [2000]). Therefore, this market is ideal for illustrating the contribution of the behavioral approach to futures contract viability research and to research into the psychology of financial markets in general. Our results are also applicable to any common financial market, such as the markets for interest or exchange rates.

We introduce a widely applicable behavioral model for several available price risk management instruments, and refine it for the case of only two available alternatives. We thereby relate farmer perceptions and evaluations of the hog futures and cash markets to actual choices among those markets. Next, we specify the relationships between the key components of the model and owner-manager characteristics to deepen our insight into their choice behavior. Then, we formulate and test several hypotheses concerning the characteristics that may be related to the evaluation of futures as price risk management instruments, and use the behavioral relationships revealed by the proposed choice model to derive implications for exchanges in designing and marketing futures contracts.

Behavioral Model for Choice Process

Fern and Brown [1984] and Bunn [1993] argue that the choice behavior of owner-managers of SMEs cannot be classified exclusively as either consumer or industrial choice behavior. Therefore, we model this choice behavior by using consumer research, and by incorporating typical elements of industrial choice behavior, such as the effect of the decision units of

owner-managers of SMEs. The proposed choice model is based on the *multi-attribute attitude theory* (Ajzen and Fishbein [1980]; Bagozzi [1981]; Fishbein and Ajzen [1975]) and the *information = processing* paradigm. The multi-attribute attitude theory, in its classical version, assumes that attitude is the sum of the products of beliefs and evaluations, with the products being weighted equally. The beliefs pertain to the degree to which an object may have particular consequences, such as risk reduction, and the evaluations reflect the importance of these consequences.

Shimp and Kavas [1984], however, have challenged the equal weighting of belief evaluation products. They argue that cognitive elements regarding the consequences of behavior may be qualitatively different and are likely to be organized into different schemata or categories. The different categories may have different weights attached, and, consequently, may have separate influences on attitude. A way of integrating both in a multi-attribute approach is the formulation of *expectancy-value components*: Similar beliefs are grouped into components and the evaluations of these components are allowed to influence the attitude differently. The expectancy-value components may be thought of as "valenced belief clusters that hang together in the owner-manager's mind in schematic or categorical representations" (Dabholkar [1994]). The information processing assumes that choice alternatives can be described by cognitive representations of object attributes. These representations are thought to underlie owner-manager choices (Bettman and Sujon [1987]; Corfman [1991]; Johnson [1984]). When this rationale is extended to the attitudinal framework, it is likely that decision-makers use cognitive representations about behavioral consequences as the basis for their choices. In this context, the expectancy-value components, as part of the multi-attribute approach, correspond to these cognitive representations.

Previous empirical research by Corfman [1991] supports the formulation of expectancy-value components. He argues that when subjects compare choice alternatives to reach a decision, value and utility of subgroups of characteristics (i.e., components) appear more important than the overall number of individual objective features. Therefore, for our choice model, we also assume the comparison takes place on the expectancy-value component level, where similar beliefs are assigned to subgroups and the evaluations of these subgroups influence the attitude differently. After having formed expectancy-value components for each alternative under consideration, the manager compares these across alternatives (Dabholkar [1994]).

The model for owner-manager choices hence postulates a sequential process. When owner-managers evaluate price risk management instruments, they are assumed first to map concrete features of the instru-

ment into subgroups, such as "price risk reduction capacity," or "ease of use," and then to compare the instrument to other available price risk management alternatives in these subgroups. This is the formation of expectancy-value components. The resulting comparative judgments determine the relative attitude of the owner-managers toward the instrument, which in turn influences whether they will use it.

There are different ways of comparing the expectancy-value components across alternatives. But because only two choice alternatives are available here, the choice process is based on the value differences between the two alternatives along a number of evaluative dimensions (Albert, Aschenbrenner, and Schmalhofer [1989]; Böckenholt and Kroeger [1993]; Busemeyer and Townsend [1993]). Expressed more formally, let EVC_{ij} be the expectancy-value component for choice alternative i and component j . Let b_{ik} be the strength of the belief that alternative i leads to consequence k , let K_j denote all consequences that belong to expectancy-value component j , and let e_k be the evaluation of this consequence. The expectancy-value component for alternative i along component j is defined as:

$$EVC_{ij} = \sum_{k \in K_j} b_{ik} e_k, \quad (1)$$

where the summation is across all consequences that belong to this component. For the case of only two choice alternatives f (utures) and c (ash), consider the following comparison across alternatives along a particular expectancy-value component j , with $REVC_{jf}$ being the *relative* expectancy-value component for alternative f and component j :

$$REVC_{jf} = EVC_{jf} - EVC_{jc}. \quad (2)$$

Let J be the total number of expectancy-value components. The owner-manager then combines all relative expectancy-value components j to form a relative attitude toward alternative f (RAT_f) by:

$$RAT_f = \sum_{j=1}^J \beta_j REVC_{jf}, \quad (3)$$

where β_j is the weight reflecting the importance of the relative expectancy-value component j in determining the relative attitude toward alternative f . Based on the relative attitude, the owner-manager forms an intention to choose one of the two alternatives. Relative measurements of constructs such as attitude are superior when they are obtained by direct comparison of one alternative with the other (van den Putte, Hoogstraten, and Meertens [1996]). Therefore, we also use direct comparative measurements for assessing attitude.

Research into organizational behavior and in the decision sciences has shown that the people surrounding the decision-maker can have a significant impact on the decisions made in SMEs (Moriarty and Bateson [1982]; Dholakia et al. [1993]). The decision to use a particular instrument is often influenced by advisors, employees, and other important people, particularly those responsible for financial decisions and those who experience, directly or indirectly, the consequences of using that alternative. Those people form the company's decision-making unit (DMU). Our model accounts for the owner-manager's perception of the DMU's influence. Combining the relative attitude toward using the hog futures contract (RAT_f) and the extent to which the owner-manager thinks that relevant others expect her/him to use the futures contract (DMU_f) yields:

$$INTENTION_f = \gamma_1 RAT_f + \gamma_2 DMU_f, \quad (4)$$

where γ_1 and γ_2 are the weights reflecting the importance of the relative attitude and the opinions of others in determining the intention toward alternative f ($INTENTION_f$).

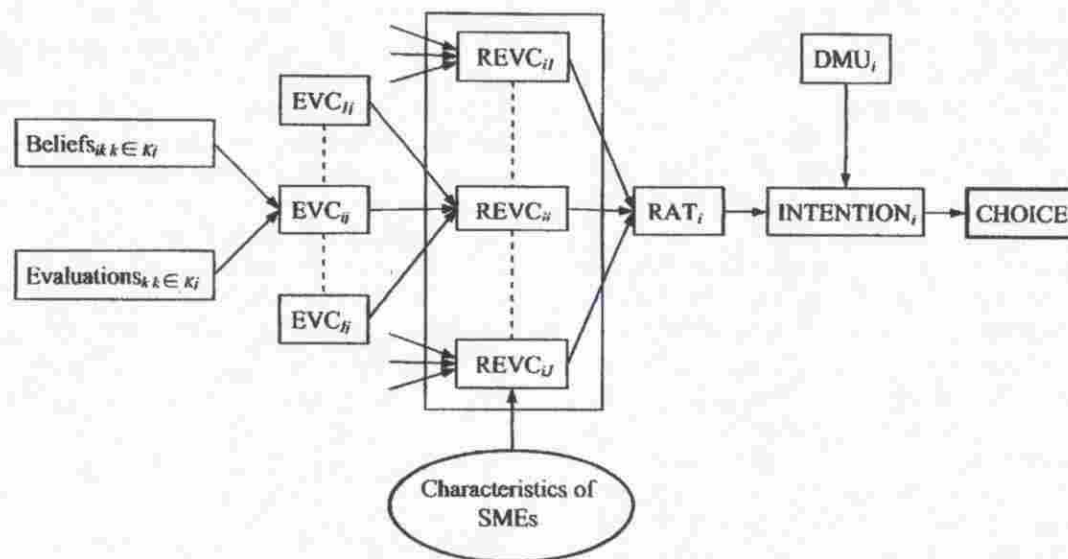
The intention toward the alternative influences the choice for this particular alternative. We assume a linear dependency between the intention and the choice variable, which in this study is binary: Did the owner-manager choose a futures contract, or did the owner-manager choose not to sell his output forward using futures contracts? Figure 1 summarizes graphically the proposed choice model for the general case of several available choice alternatives. Figure 1 also shows that the key elements in the choice model are related to the characteristics of the decision-maker, which allows insight into *why* a certain alternative is chosen, i.e., why owner-managers (don't) use the hog futures contract.

Formulation of Hypotheses

An owner-manager deciding whether to use the hog futures contract takes two important consequences into account. First, by using futures contracts, a manager will reduce his spot market risk and will no longer be exposed to *cash price volatility*. Second, the *price level* will become fixed, and so will an important part of the enterprise's revenues. The price level as a stimulus is often evaluated by decision-makers according to anchor points (Fershtman [1996]; Payne, Laughhunn, and Grum [1980]), which differ across domains and decision frames, as well as across owner-managers.

We expect that owner-managers compare the hog futures price level to an internal reference price (Penning [2002]), a price (s)he would use as an anchor to judge other prices. Hence, this psychological reference price serves as a basis for judging or comparing

FIGURE 1
Behavioral Choice Model



Note: k denotes consequence k ($k = 1 \dots K$), K_j all consequences that belong to expectancy-value component j , EVC_{ij} the expectancy-value component for alternative i and component j ($i = \text{futures}$ and $c(\text{ash})$ and $j = 1 \dots J$), $REVC_{ij}$ the relative expectancy-value component for alternative i and component j , RAT_i the relative attitude toward alternative i , $INTENTION_i$ the relative intention to choose alternative i , and DMU_i the decision-making unit for alternative i .

prices (Grewal, Monroe, and Krishnan [1998]). The psychological reference price does not refer to the manager's expected spot price in the Anderson and Danthine [1981] framework of hedging decisions, however.

Following Kahneman and Tversky [1979] and Tversky and Kahneman [1981], who have shown that people perceive outcomes (e.g., futures prices) as gains or losses relative to a psychological reference point, we assume that owner-managers also evaluate the futures price as a gain or loss relative to their internal reference price. The further the hog futures price exceeds the manager's reference price, the more attractive it becomes to choose futures. And, conversely, the further the hog futures price is below the internal reference price, the less attractive it becomes to choose futures.

Puto [1987] found that the reference price varies widely for each individual, depending on such factors as judgment capacity and aspiration level. In the context of a producer, the reference price may be closely related to production costs. Therefore, we include the difference between the hog futures price and the owner-manager's reference price in our model when implementing the model for the hedging services provided by futures exchanges. In order to gain insight into why owner-managers behave the way they do, we investigate which variables are related to the relative expectancy-value components. This insight provides futures exchange management with a framework for

improving their products, as well as valuable information for designing new contracts.

Prior to the actual quantitative study, we conducted four group discussions about price risk management, with ten hog farmers per group. The group discussions took place in an informal atmosphere, and each session lasted about two and one-half hours. The goal was to gain insight into the decision-making process involved in selling output using price risk management instruments. More specifically, we wanted to explore the criteria that owner-managers use when choosing between alternative price risk management instruments, and what their evoked set consists of, i.e., which price risk management instruments are perceived as alternatives in the Dutch hog industry.

The group discussions revealed that the owner-managers have only two alternatives to sell their hogs. The first is to buy piglets, raise them to hogs, and sell them on the cash market for a price unknown at the time the piglets are bought. The second is to price the hogs forward by selling futures contracts when the piglets are bought, and hence eliminate the price risk in the hog cash market. The most prominent criteria used to decide whether to use the futures contract were: the possibility of exercising entrepreneurial freedom, the (perceived) risk reduction performance, and the ease of using futures.

These criteria served as the basis for the formulation of beliefs for the later interviews. Based on the qualitative pre-study, we expect to find at least three relative

expectancy-value components: 1) "entrepreneurship" (REVCE), the extent to which an owner-manager values using futures as a way to exploit his/her entrepreneurship, compared to selling on the cash market (Kent, Sexton, and Vesper [1982]); 2) "performance" (REVCPC), the extent to which an owner-manager values the performance of futures in managing price risk, compared to selling on the cash market; and 3) "ease of use" (REVCU), the extent to which the owner-manager values the ease of use of futures, compared to selling on the cash market. We expect these relative expectancy-value components to be the key components in the choice process. Hence, the model assumes that an owner-manager maps beliefs into dimensions and transforms those dimensions into expectancy-value components for each alternative.

After having formed expectancy-value components for each alternative on the dimensions entrepreneurship, performance, and ease of use, the owner-manager compares them across the alternatives that determine his or her relative attitude toward futures contracts (thus forming *relative* expectancy-value components). We can now formulate several hypotheses as to *how* owner-managers make choices about the use of the hog futures and cash market.

- H1: *The relative expectancy-value components entrepreneurship, performance, and ease of use influence the relative attitude of an owner-manager toward futures contracts.*
- H2: *The owner-manager's perception of the extent to which others (such as advisors surrounding her/him) think that (s)he should use futures contracts, as opposed to other alternatives, is positively related to the relative intention to use futures contracts.*
- H3: *The more the futures price exceeds the owner-manager's internal reference price, the higher the relative attitude toward using futures.*

Although the subjects in our study have some experience with risk reduction strategies, most of them are unfamiliar with futures contracts. Innovative owner-managers like to use new instruments or methods with which they can exploit their entrepreneurial freedom of action. Following Goldsmith [1984] and Leavitt and Walton [1975, 1988], we define innovators as individuals open to new experiences and novel stimuli, possessing the ability to transform information about new concepts, ideas, products, or services for their own use, and having a high ability to recognize the potential application of new ideas. Futures contracts increase the "degrees of freedom of action" in the marketplace because they provide an additional instrument to fine-tune market actions. Therefore, innovative owner-managers should value using hog futures as a way to exploit their entrepreneurship more strongly (Brandstätter [1997]).

Also, an owner-manager who perceives a substantial price risk and who is price risk-averse may like the hog futures contract because it reduces price risk. However, subjective assessment of the hedging services provided by futures exchanges is strongly influenced by the information managers have been exposed to. Hence, subjects may differ in their understanding of these services. Futures contracts are often perceived by owner-managers as a complex financial service, which inhibits their participation (Glaum and Belk [1992]). Understanding futures reduces the psychological distance between the owner-manager and the hedging service provided by the futures exchange. The level of understanding influences the ease with which futures are considered as a method of selling output. Hence, based on previous research and the group discussions, we propose three additional hypotheses as to *why* owner-managers evaluate entrepreneurship, performance, and ease of use the way they do.

- H4: *Innovativeness is positively related to the relative expectancy-value component entrepreneurship.*
- H5: *The owner-manager's risk aversion is positively related to the relative expectancy-value component performance.*
- H6: *The level of understanding of futures contracts is positively related to the relative expectancy-value component ease of use.*

Research Method

Procedure

In 1996, 467 Dutch owner-managers of hog farms were studied in computer-assisted interviews, making decisions in the context of their own real-life businesses. The sample of managers was stratified along the variables "region" and "size of the enterprise." Each interview lasted about forty-five minutes. All interviewers had prior interviewing experience and had undergone extensive training for the assessment procedures to ensure they understood the questions being posed to the owner-managers.

The owner-managers were contacted by the interviewer prior to the interview to encourage participation and to ensure that the right person would be interviewed. The interview was computerized, with care taken to build a user-friendly interface. The software written for this interview was extensively tested, and fifteen test interviews were conducted to ensure that the owner-managers understood the interface and perceived it as "very user-friendly." The interview consisted of several parts. After asking several background questions (pertaining to the size of the enterprise and previous behavior regarding price risk management, etc.), the owner-managers were confronted with state-

ments about selling hogs by means of futures contracts and in the cash market. The statements were randomized to avoid response bias.

We measured the variables in the model for a concrete choice situation where a price level was given and the owner-manager had to make a choice. Five different price levels were randomly assigned to the owner-managers. The price levels were based on previous year information, and reflected the price distribution function. Owner-managers were asked to indicate their relative attitude, the extent to which the opinion of their decision-making unit (DMU) mattered, and the intention toward the two alternatives. Finally, the participants had to make their choice.

We measured the managers' hedging behavior using a scenario framework that closely matched the real economic situation of our respondents. The validity of scenarios as a research tool has been well-documented (Bem [1967]). The method is advocated by many researchers and has been applied in several research domains (e.g., Surprenant and Solomon [1987]), where it has been particularly successful when subjects are required to "play themselves" rather than unfamiliar roles. Therefore, this study also asked the managers to "play themselves" by instructing them to "read the following situation carefully" and that "it is important to imagine yourself in the situation described." The interview continued, measuring the owner-manager's risk attitude, innovativeness, level of understanding, and their reference price.

Measures

Previous research by Fishbein and Middlestadt [1995], Ryan and Bonfield [1975], and Wochnowski [1995] indicates that bipolar scoring leads to the strongest relationships between attitude as a sum of beliefs-evaluation products and direct measurement of attitude. In addition, only the use of bipolar scales results in a logical pattern of attitudes. Therefore, we also measured the beliefs and evaluations regarding the use of futures contracts and trading in the cash market on bipolar nine-point scales.

The belief endpoles were labeled "strongly disagree" and "strongly agree"; the evaluation endpoles were labeled "very negative" and "very positive." The relative attitude and the intention were measured by asking the respondent to distribute 100 points across the two alternatives to indicate the extent of liking and the probability of using the alternative, respectively. Similarly, we measured the degree to which the DMU's opinions matter by asking the owner-manager to distribute 100 points across the two alternatives to indicate the extent to which significant persons thought he should use one or the other instrument (van den Putte, Hoogstraten, and Meertens [1996]). Finally, the owner-manager had to choose

between using futures contracts or selling the output in the cash market.

The measures of the constructs characterizing the owner-managers were developed from scales following the iterative procedure recommended by Churchill [1979]. First, we generated a large pool of potential items to tap the domain of the construct as closely as possible. Next, we tested the items for clarity and appropriateness in personally administered pre-tests with forty owner-managers. The respondents were asked to complete a questionnaire, indicating any ambiguity or difficulty they experienced in responding to the items, and to make any suggestions they deemed appropriate. Based on their feedback, some items were eliminated, others were modified, and additional items were developed. The resulting set of items was administered to the 467 owner-managers in the large-scale personal interview.

Innovativeness. We used the Open Processing Scale (OPS) developed by Leavitt and Walton [1975, 1988] to measure innovativeness (a list of items included in the measure is provided in Appendix A). The OPS measure provides a "respondent-friendly" instrument, useful for studies on the use of new products of all kinds (Goldsmith [1984]; Joseph and Vyas [1984]). Leavitt and Walton [1988] have shown that the OPS is relatively independent of a scale measuring the desire for experience. This supports the psychometric quality of the OPS scale, as innovativeness can be separated from experience.

Level of understanding. We used the items in the multi-item measure developed by Ennew, Morgan, and Rayner [1992] to measure the level of understanding of futures markets. The respondents were asked to indicate their agreement with each statement on a nine-point scale ranging from "strongly disagree" to "strongly agree" (see Appendix A).

Risk attitude. Recently, Pennings and Smidts [2000] and Pennings and Wansink [2003] have shown the high predictive validity of risk attitude measurements based on the expected utility paradigm. Following their recommendations, we set up lottery-based measurements that closely reflect the respondent's actual decision-making behavior. The expected utility model (von Neumann and Morgenstern [1947]) presents decision-making under risk as a choice between alternatives, in which each alternative is represented by a probability distribution. Decision-makers are assumed to have a preference ordering defined over the probability distributions.

A number of axioms hold for this preference ordering (Fishburn [1983, 1988]). Risky alternatives can be ordered under these assumptions by using the utility function $u(x)$, in which the curvature of $u(x)$ reflects

risk attitude (Keeney and Raiffa [1976]; Smidts [1997]). The well-known Pratt–Arrow coefficients of risk aversion are defined on $u(x)$ and provide a quantitative measure of risk attitude. Fundamental to this approach is that the utility function, and hence the risk attitude measure, is assessed by means of the certainty equivalence method (Keeney and Raiffa [1976]). In this method, the respondent compares the lottery $(x_l, p; x_h)$ with a certain outcome, where $(x_l, p; x_h)$ is the two-outcome lottery that assigns probability p to outcome x_l and probability $1 - p$ to outcome x_h , with $x_l < x_h$. The certain outcome [denoted by $CE(p)$] is varied until the respondent reveals indifference.

By applying the von Neumann–Morgenstern utility u , we obtain: $u[CE(p)] = pu(x_l) + (1-p)u(x_h)$. When eliciting utilities, two outcomes are fixed first, so that the range of outcomes between them includes all outcomes of interest. Second, we can set $u(x_L) = 0$ and $u(x_H) = 1$, where x_L and x_H denote the upper and lower bounds, respectively, of the selected outcome range. By using only probability 0.5, the certainty equivalence method used here consists of a bisection framework. First, the certainty equivalent $CE(0.5)$ with utility 0.5 is found, as above. Then the outcome $CE(0.25)$ is obtained with utility 0.25 through an indifference $CE(0.25) \sim [x_L, 0.5; CE(0.5)]$. The indifference $CE(0.75) \sim (CE(0.5), 0.5; x_H)$ yields certainty equivalence $CE(0.75)$, with utility 0.75, etc.

A manager's former responses to lotteries are used in the assessment of subsequent responses. A large number of CEs can be found after a sufficient number of questions, when each question involves a bisection of a particular interval. Nine points of the utility curve were assessed by means of an iterative process, which included two consistency checks. Based on the assessed utility curve, the Pratt–Arrow coefficient of absolute risk aversion was derived as a measure of risk attitude (Smidts [1997]). The widely used exponential function was fit to each subject's outcomes; after scaling the boundaries of the functions, the estimation of just one parameter suffices to characterize a decision-maker's risk attitude. Since the certainty equivalents, not the utility levels, are measured with error, the inverse function is estimated (see Appendix B for the estimation procedure).

The measurement procedure was computerized and took about twenty minutes. The lottery was formulated in terms of selling hogs at either a relatively high/low price, with a probability of 0.5 for both prices (alternative A), or at a fixed price (alternative B). The assessment of the certainty equivalent was an iterative process. If the respondent chose alternative A, the computer would generate a higher fixed price (alternative B) than the previous one, thus making alternative B more attractive. If the respondent chose alternative B, the computer would generate a lower fixed price (alternative B) the next time, thus making alternative A

more attractive. The next measurement (lottery) would start after the respondent had indicated that it did not matter whether (s)he received A or B.

Difference between futures price and owner-manager's reference price (DRP). Following Puto [1987], the reference price was identified by asking the owner-manager to respond to this question: "If you sell your hogs, you will receive different prices for your hogs depending on the market situation. Some prices will make you feel that you have suffered a loss, and others will make you feel you have made a gain. Suppose you sold your hogs today, from which price level onward would you perceive the price as a gain?" Immediately after declaring the initial reference price, the respondent was confronted with this sentence "So, if I understand you correctly, then a price below ___ Dutch guilders is perceived as a loss." The respondent could answer this question with "yes" or "no." If the respondent answered "no," the first question was repeated to give the respondent the opportunity to change the initial reference price. If the respondent answered "yes," the assessment of the reference price had been accomplished. The DRP variable was calculated as the difference between the price level of the futures contract and the owner-manager's reference price.

Statistical Analysis and Measure Validation

We tested the relationships between the relative expectancy-value components, the relative attitudes, the degree to which the DMU's opinions matter, intentions, and choice behavior, as well as the respective relationships with the owner-manager's characteristics as specified in the previous section. Some of the variables were measured via self-reports. Each of these variables is treated as a latent variable measured by a set of observable indicators (items). Observable variables may be assumed to be measured with error.

Structural equation modeling was conducted to test the hypotheses because it permits the explicit modeling and estimation of errors in measurement (Bagozzi [1994]; Baumgartner and Homburg [1996]; Bollen [1989, 1996]; Lee and Wang [1996]; Steenkamp and van Trijp [1991]). The coefficients in the structural equation model represent theoretical cause-and-effect relationships among the latent variables, which underlie the observed variables. As such, they are the parameters of interest (see Appendix C for a description of the structural equation model).

Baumgartner and Homburg [1996] and Cudeck [1989] found that the use of covariances or correlations has no effect on overall goodness-of-fit indices, but that standard errors may be inaccurate when using correlations. Therefore, the covariance matrix was used as

input for the structural equation model (Jöreskog and Sörbom [1993]). Prior to the model estimation, the data were screened for coding errors and the presence of outliers, and the univariate and multivariate normality of the observed variables was tested using PRELIS. The coefficient of relative multivariate kurtosis was 1.11, indicating that the assumption of multivariate normality is tenable (Steenkamp and van Trijp [1991]). Finally, the model was estimated with LISREL 8 using maximum likelihood.

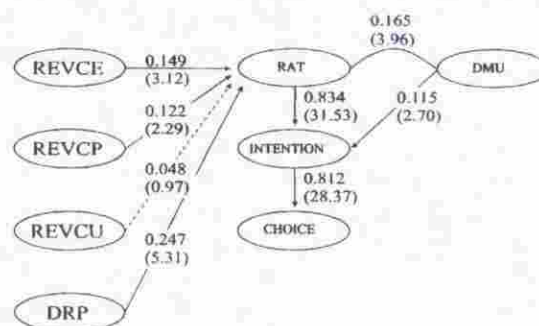
The (psychometric) measurement quality of our constructs was assessed by confirmatory factor analysis, as it permits a rigorous assessment of the stability of latent variables and their psychometric properties (Hair et al. [1995]; Reise, Widaman, and Pugh [1993]; Yung [1997]). All factor loadings were significant (the minimum *t*-value was 4.60, $p < 0.001$), and greater than 0.4. These findings support the convergent validity of the items (Anderson and Gerbing [1988]). The composite reliabilities for the constructs ranged from 0.65 to 0.78, indicating good reliabilities for the construct measurements (Finn and Kayande [1997]). Details regarding the psychometric properties are given in Appendix A.

Results

The results of the exploratory factor analysis indicate that beliefs are naturally grouped into three factors (components) that can be labeled as “entrepreneurship,” “performance,” and “ease of use.” This confirms the findings from the group discussions. Hence, the owner-manager may be expected to use these more abstract cognitive representations of futures contracts. Based on these results, we conducted a confirmatory factor analysis (CFA) to test for the identified belief components (the details and results of the three CFA models are given in Appendix D).

The CFA model for entrepreneurship had a good fit, with a χ^2 of 14.55 ($df = 8, p = 0.07$), a root mean square error of approximation (RMSEA) of 0.04, a goodness-of-fit index (GFI) of 0.99, an adjusted goodness-of-fit index (AGFI) of 0.97, and a Tucker Lewis Index (TLI) of 0.98. The CFA model for performance also had a good fit, with a χ^2 of 14.55 ($df = 8, p = 0.02$), a RMSEA of 0.05, a GFI of 0.99, an AGFI of 0.97, and a TLI of 0.95. The fit for the CFA model for ease of use was not as good, though still acceptable, with a χ^2 of 36.47 ($df = 9, p = 0.00$), a RMSEA of 0.08, a GFI of 0.97, an AGFI of 0.94, and a TLI of 0.82. Thus, three meaningful expectancy-value components—performance, entrepreneurship, and ease of use—were identified, and their relative values REVCP, REVCE, and REVCU were calculated. These three components were used in the proposed choice model, which included the difference between the futures price and the owner-man-

FIGURE 2
Structural Parameter Estimates and Fit Statistics of the Behavioral Choice Model



χ^2	df	p	RMSEA	AGFI	TLI
29.55	10	0.00	0.06	0.94	0.98

Note: DRP denotes the difference between the hog futures price and the owner-manager’s reference price. The relative expected-value components are denoted as follows: REVCU “ease of use,” REVCP “performance,” REVCE “entrepreneurship.” RAT is the relative attitude toward futures contracts, INTENTION the intention toward using futures contracts, and DMU the decision-making unit. The *t*-values of the standardized loadings are given in parentheses.

ager’s reference price. The choice model (depicted in Figure 2) had a good fit with a χ^2 of 29.55 ($df = 10, p = 0.00$), a RMSEA of 0.06, a GFI of 0.98, an AGFI of 0.94, and a TLI of 0.98.

These test results confirm that the model provides an adequate description of the choice process of the owner-managers in our study. We can now test the six hypotheses about owner-manager decision behavior.

- H1: *The relative attitude of an owner-manager toward futures is significantly influenced by the REVCE ($\beta = 0.149, p < 0.00$) and REVCP ($\beta = 0.112, p = 0.01$), but the hypothesis regarding the effect of the REVCU on the relative attitude toward futures is not supported ($\beta = 0.048, p = 0.16$).*
- H2: *The owner-manager’s perception of whether members of her/his DMU think he should use futures, as compared to the cash market, significantly influences her/his relative intention to use futures ($\beta = 0.115, p = 0.00$). Hence, the manager’s DMU does affect the choice to use futures contracts.*
- H3: *The DRP has a significant influence on relative attitude ($\beta = 0.247, p = 0.00$), meaning the more the futures price exceeds the owner-manager’s reference price, the higher her/his relative attitude toward using futures.*

- H4: *Innovativeness has a significantly positive effect on the REVCE ($\beta = 0.130, p = 0.01$). The model fit was good, with a χ^2 of 12.64 ($df = 5, p = 0.03$), a RMSEA of 0.05, a GFI of 0.99, an AGFI of 0.97, and a TLI of 0.98. Thus, innovative owner-managers value the entrepreneurial opportunities that futures provide.*
- H5: *The owner-manager's risk aversion has a significant positive effect on the REVCP ($\beta = 0.276, p = 0.00$). The model was saturated, resulting in a perfect fit.*
- H6: *Level of understanding of the futures market has a significant, positive effect on the REVCU ($\beta = 0.139, p = 0.00$). The model fit was good, with a χ^2 of 11.41 ($df = 5, p = 0.04$), a RMSEA of 0.05, a GFI of 0.99, an AGFI of 0.97, and a TLI of 0.97.*

The results show that H1 is partially supported, and H2 through H6 are fully supported. This indicates that the proposed behavior of managers regarding the use of futures, as derived from psychological theory, accurately describes how and why they decide between the two alternatives. This study evaluates six behavioral hypotheses. However, if needed, more hypotheses could be formulated and tested to gain deeper insight into managers' decision-making processes.

Discussion and Conclusion

This paper investigates *how* potential hedgers act, and what psychological constructs explain their choice behavior. In particular, we analyze the characteristics that determine the owner-manager's choice for a particular alternative and the way in which information about these characteristics is integrated in reaching a decision. The key elements of the model—entrepreneurship, performance, and ease of use—are linked to the characteristics of the manager, thus providing insight into *why* certain choices are made.

The empirical results suggest that owner-managers first group beliefs according to dimensions, and then form expectancy-value components for each alternative. For example, the owner-manager might evaluate the hog futures contract and judge its risk reduction performance. After having formed expectancy-value components for all available alternatives on all dimensions, the manager compares the dimensions across the alternatives. Next, the owner-manager evaluates which alternative scores highest on performance, etc., and then weighs these dimensions according to the loadings in Figure 2 to reach a final choice. To gain insight into *why* owner-managers behave the way they do, we relate the relative expectancy-value components to the owner-manager's

characteristics. We find that these key elements are related to the owner-manager's innovativeness, risk attitude, and level of understanding.

The key elements in our model can be used by futures exchanges and financial institutions when designing and marketing financial products for small and medium-sized enterprises. For example, "entrepreneurship" is positively related to the relative attitude toward futures, meaning that futures are an attractive instrument whenever their use increases the level of freedom in the marketplace. When designing futures contracts, the futures exchange could increase the compatibility of futures with other instruments available to the owner-manager, thereby increasing the expectancy-value component entrepreneurship of futures over other alternatives. The perceived performance of futures is a critical attribute that influences the relative attitude toward futures. The owner-manager's risk attitude is related to the expectancy-value component "performance." Using a more appealing standardization procedure for the underlying commodity may increase its performance (Tashjian [1995]).

The level of understanding of futures also had a significant impact on their use. This has two important marketing implications. First, an exchange could increase its efforts to educate (potential) participants. Second, an exchange could expand marketing efforts to members of the manager's DMU, as we found a significant relationship between the impact of those members and the likelihood of using futures.

Interestingly, we find a contradiction between owner-managers' stated attitudes toward risk and their actual attitudes. On the one hand, innovative managers value the entrepreneurial opportunities that futures provide and tend to answer "yes" when asked things like "Do I take more chances than others do?" or "Do I like to experiment with new ways of doing things?" On the other hand, the owner-managers' risk aversion was positively related to the use of futures, i.e., the more risk-averse managers considered themselves, the more likely they were to use futures. This result again carries important marketing implications for a futures exchange. The focus of a marketing campaign should be on both the risk reduction potential of the hog futures contract, and on advertising hog futures as a new, innovative form of marketing hogs. One reviewer suggested following the example of Philip Morris (who made a fortune transforming "couch potatoes" into Marlboro Men), by advertising hog futures with slogans like "I like taking risks, but not with the price of my hogs!"

The difference between the futures price and the reference price of the owner-manager has a significant, positive effect on the relative attitude toward futures. Both are beyond the control of the exchange. The futures price is determined by fundamental economic factors (supply and demand factors of the fu-

tures contract's underlying commodity), and the reference price is determined by the owner-manager's aspiration level with regard to making a profit. Although the exchange cannot influence these prices, and hence use this information when designing a futures contract, it *can* use the relationship between futures price and reference price when introducing a new contract. During the initial listing period of a new contract, the price level in the underlying market of the commodity is an important determinant in creating sufficient trading volume, and, hence, liquidity. For example, if previous market research indicated that the psychological barriers to using futures would make it relatively difficult to attract the short side (i.e., farmers) of the market, as compared to the long side (i.e., processors), a new contract might be best introduced when the futures price is above the farmers' reference price, as an extra incentive for farmers to enter the futures market.

With the proposed choice model, we gain deeper insight into managers' decision-making processes and provide valuable information for the providers of the alternatives in the decision-maker's choice set. We provide a simple choice situation with only two alternatives—cash or futures—and then focus on how futures exchanges could improve their products. The implications include such things as contract design and marketing of the hog futures contract. However, more research is needed on the motivation to hedge. Future applications of the choice model, for example, should be extended to other commodities, such as interest or exchange rates, different financial products, and financial markets in general. Future research might also incorporate elements like the possibility of subgroups within the subject pool, thereby accounting for possible differences in owner-manager characteristics and how these differences relate to their choice behavior.

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Appendix A: Confirmatory Factor Analysis for the Measures

In what follows, RMSEA is the root mean square error of approximation, GFI the goodness-of-fit index, AGFI the adjusted goodness-of-fit index, and TLI the Tucker Lewis Index (Jöreskog and Sörbom [1993]).¹

Managers of SMEs were asked to indicate on a nine-point scale how well the statements, as contained in each of the scales, fit their own views.

Innovativeness

- 1) I buy new products before my colleagues (competitors) buy them.
- 2) I like experimenting with new ways of doing things.
- 3) I take more chances than others do.
- 4) I generally like trying new ideas in my enterprise.

Owner-managers were asked to indicate how well the statements fit their own views on a nine-point scale ranging from "strongly disagree" to "strongly agree." Construct reliability = 0.78; $\chi^2 = 9.3$ ($df = 2$, $p = 0.01$); RMSEA = 0.09; GFI = 0.99; AGFI = 0.95; TLI = 0.98.

Level of understanding

- 1) I know how the futures market functions.
- 2) There is sufficient information on the functioning of futures markets.
- 3) I understand the way I can hedge my risk on the futures market.
- 4) I keep up with futures prices.

Owner-managers were asked to indicate their agreement with each item on a nine-point scale ranging from "strongly disagree" to "strongly agree." Construct reliability = 0.65; $\chi^2 = 6.36$ ($df = 2$, $p = 0.04$); RMSEA = 0.06; GFI = 0.99; AGFI = 0.97; TLI = 0.98.

Note

1. The likelihood-ratio chi-square statistic (χ^2) tests whether the matrices observed and those estimated differ. Statistical significance levels indicate the probability that these differences are due solely to sampling variations. A low χ^2 per degree of freedom (a value lower than 2.5) indicates that the actual and predicted input matrices are not statistically different. The likelihood-ratio chi-square statistic is heavily (negatively) influenced by sample size ($N > 200$) (Bentler [1990]). Because of this problem, other fit indices have been developed, such as the goodness-of-fit index (GFI), which represents the overall degree of fit, i.e., the squared residuals from prediction compared with the actual data. The adjusted goodness-of-fit index corrects the GFI for the number of parameters in the model, and ranges from 0 (poor fit) to 1.0 (perfect fit). The Tucker Lewis Index (TLI) is an incremental fit measure that combines a measure of parsimony into a comparative index between the proposed and a null model. A recommended value is 0.9 or above. The root mean squared error of approximation (RMSEA) estimates how well the fit model approximates the population covariance matrix per degree of freedom (Steiger [1990]). Browne and Cudeck [1986] suggest that a value below 0.08 indicates a close fit (see

Baumgartner and Homburg [1996], Bentler [1990], and Hair et al. [1995] for a detailed explanation of the fit indices).

**Appendix B:
Estimation of the Pratt–Arrow
Coefficients**

The exponential utility function was fit to each subject's outcomes. The exponential utility function $u(x)$ can be written as:

$$U(x_i) = \frac{1 - e^{-a(x_i - x_L)}}{1 - e^{-a(x_H - x_L)}} \quad (B1)$$

In Equation B1 x_L and x_H represent the upper and lower bounds, respectively, of the selected outcome range. Parameter a is the Pratt–Arrow coefficient of absolute risk aversion (if $a > 0$, the owner-manager is risk-averse, if $a < 0$, the owner-manager is risk-seeking). Since it is the certainty equivalents, and not the utility levels, that are measured with error, the inverse function is estimated. Following Smidts [1997], we derive that the (inverse) estimation function can be written as:

$$x_i = \frac{\ln(0.5(e^{-ax_l} + e^{-ax_h}))}{-a} + e_i \quad (B2)$$

In Equation B2, x_l and x_h represent the low and high outcomes, respectively, of the fifty–fifty lottery, while e_i indicates the response error, and x_i stands for the assessed certainty equivalent. The respondent assesses x_i for nine lotteries, with varying outcomes x_l and x_h . The parameter a in B2 is estimated using routine ZXMIN from the IMSL library of FORTRAN programs. In ZXMIN, Fletcher's Quasi-Newton Method obtains the least squares estimate. We follow Smidts [1997] in our estimation of the parameters.

**Appendix C:
Structural Equation Model**

Structural equation models (SEMs) consist of two parts: the measurement model and the structural model. The measurement model specifies how the psychological constructs are measured in terms of the observable variables, and it describes the psychometric properties (pertaining to reliability and validity) of the construct as measured. The structural model specifies the relationships among the latent variables and describes the effects and the amount of unexplained variance in the latent variables. A full structural equation model can be written as follows

(see Bollen [1989]; Baumgartner and Homburg [1996]; and Lee and Wang [1996]):

$$\eta = B\eta + \Gamma\xi + \zeta \quad (C1)$$

$$y = \Lambda^y\eta + \varepsilon \quad (C2)$$

$$x = \Lambda^x\xi + \delta \quad (C3)$$

Equation C1 is called the latent variable or structural model and expresses the hypothetical relationships among the constructs. The $m \times 1$ vector η contains the latent endogenous constructs and the $n \times 1$ vector ξ consists of the latent exogenous constructs. The coefficient matrix B shows the effects of endogenous constructs on each other, and the coefficient matrix Γ denotes the effects of exogenous on endogenous constructs. The vector of disturbances ζ represents the errors in the equations.

Equations C2 and C3 are factor-analytic measurement models that tie the constructs to observable indicators (i.e., items). The $p \times 1$ vector y contains the measures of the endogenous constructs, and the $q \times 1$ vector x consists of the measures of the exogenous indicators. The coefficient matrices Λ^y and Λ^x show how y relates to η and x relates to ξ , respectively. The vectors of disturbances ε and δ represent measurement errors. Figure 2 depicts the structural model, which is represented by C1 (for a more detailed description of SEM, see Anderson and Gerbing [1988], Bollen [1989], Cudeck [1989], and Bagozzi [1994]).

**Appendix D:
Confirmatory Factor Analysis
on Beliefs About the Use of Futures
Contracts and Cash Markets**

An exploratory factor analysis was conducted in order to find the underlying factor structure of the beliefs. A three-factor model provided the best solution. Items loading relatively high on one of these factors (factor loading > 0.4) are included with the corresponding factors in a confirmatory factor analysis.

Entrepreneurship

- 1) I think that the use of futures contracts/cash markets allows me fully to exploit my spirit of free enterprise.
- 2) I think that the use of futures contracts/cash markets gives me the opportunity to receive an extra high price.
- 3) I think that the use of futures contracts/cash markets allows me great freedom regarding actions in the marketplace.

$\chi^2 = 14.55$ ($df = 8, p = 0.07$); RMSEA = 0.04; GFI = 0.99; AGFI = 0.97; TLI = 0.98.

Performance

- 1) I think that selling my hogs by means of futures contracts/cash markets enables me to reduce the fluctuations in my revenues.
- 2) I think that a futures contract/cash market ensures the sale of my hogs.
- 3) I think that using futures contracts/cash markets improves my relations with traders.

$\chi^2 = 17.27$ ($df = 8, p = 0.02$); RMSEA = 0.05; GFI = 0.99; AGFI = 0.97; TLI = 0.95.

Ease of use

- 1) I think that using futures contracts/cash markets is an easy way of selling hogs.
- 2) I think that using futures/cash markets is a difficult matter.
- 3) I think that by using futures/cash markets I do not have to worry about finding buyers for my hogs.

$\chi^2 = 36.47$ ($df = 9, p = 0.0$); RMSEA = 0.08; GFI = 0.97; AGFI = 0.93; TLI = 0.82.

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