A Behavioral Approach towards Futures Contract Usage

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We propose a behavioral decision-making model to investigate what factors, observable as well as unobservable, owner-managers consider regarding futures contract usage. The conceptual model consists of two phases, reflecting the two-stage decision structure of manager's use of futures. In the first phase owner-managers consider whether futures are within the market choice set for the enterprise. In the second phase the owner-manager decides whether or not to initiate a futures position when confronted with a concrete choice situation. In both phases owner-manager's beliefs and perceptions play an important role. The proposed model is tested on a data set of Dutch farmers, based on computer-assisted personal interviews. Because we incorporate latent variables (e.g., perceptions and beliefs) in both phases, we propose an estimation procedure that takes the measurement error of these latent variables explicitly into account. The implications of the behavioral decision-making model for futures contract design are derived.

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Introduction

Futures exchanges face the challenge of introducing successful futures contracts and maintaining viable trading of existing contracts. To facilitate this product development approach, previous research has focussed on factors that influence the viability of futures contracts. Two approaches can be distinguished: the commodity characteristics approach and the contract design approach (Black 1986). The commodity characteristics approach defines feasible commodities for futures trading based on an extensive list of required commodity attributes, and, in so doing, focuses on the technical aspects of the underlying commodity. The contract design approach views the contract specification as the critical factor determining the viability of a futures market, and hence focuses on the technical aspects of the contract. Although both approaches provide insight in the conditions that might make a futures contract successful, they do not focus on a critical aspect: the decision-making process that leads to the customers' ultimate choice for using futures contracts or not. That is, both approaches provide necessary conditions for having futures trade, but these conditions are not necessarily sufficient. Ultimately, the success of a futures market is determined by the number of customers who decide to trade futures and the number of customers' trades.

In order to maximize success (trading volume) and to ensure successful product introductions, futures exchanges face the challenge to develop products that will be chosen by potential participants. Hence, the exchange needs insight into how participants choose to use futures contracts. Information about customers' choice behavior will reveal information necessary for the futures exchange to improve the design of its contracts.

Models have been developed that derive the optimal hedging behavior for futures market participants. The actions of (potential) customers are in these models guided by the criterion of maximizing expected utility; non-economic factors do not enter the utility function. These models provide a sound and rigorous theoretical framework. However several researchers have shown that hey have little predictive validity. Hartzmark (1987) and Peck and Nahmias (1989) found that actual positions in futures markets were unrelated to portfolio-recommended strategies. Nor are these models necessarily useful when optimizing futures contract design, since these models do not take all contract

characteristics explicitly into account and assume that the only reason for futures trade is risk reduction. They do, however, implicitly take some elements of the contract specification into account by means of basis risk. Since the commodity characteristic and contract specification approaches do not focus on the decision-making process of managers, and the fact that the expected utility based models that focus on the decision-making process of managers but do not have strong predictive validity, we introduce a behavioral modeling approach that shows direct relationships with revealed behavior. This approach can in turn provide insight for futures exchange management to improve the futures contract development process. This behavioral approach is descriptive in nature and hence does not have the strong theoretical properties of the normative models in the expected utilities framework.

In this behavioral framework managers' beliefs and perceptions play a crucial role. Beliefs pertain to the degree to which an object (e.g., futures contracts) may have particular consequences, and perceptions reflect the interpretation of these consequences. Managers' perceptions and attitudes regarding futures contracts are driving their choices.

In the next section we propose our conceptual decision-making model. We pay particular attention to the fact that the decision to use futures contracts has two phases. In the first phase potential customers decide (or not) to add futures contracts to their toolbox, and hence consider futures contracts as instruments when marketing products or dealing with contractual relationships. In the second phase, when confronted with a concrete choice situation, (potential) customers decide to initiate a position (or not) in the futures market. In both phases perceptions and beliefs are the drivers of the decision process. To deal with perceptions and beliefs, which are latent variables, we propose a modeling procedure that is able to deal with measurement error. Subsequently, our empirical study, conducted with 200 Dutch hog farmers using personal computer guided interviews/experiments, is described and the results are presented. Finally, we discuss the implications for futures exchange policy.

Conceptual Model

This study focuses on owner-managers and managers of small enterprises. For these managers futures contracts are not always seen as relevant for their operation. That is, futures contracts are not always considered as being part of the business of conduct (McQuistion 1989; Posavac, et al. 1997). Before a manager will enter the futures market, the futures contract must be part of the managers' toolbox, and hence be considered as a relevant marketing tool for an owner-manager. Therefore, we pay attention to the managers' adoption process of futures. After futures contracts are considered as being part of the manager's toolbox, futures might be used in a concrete choice situation. In such a situation the price level in the futures markets will, among other factors, play an important role.

Phase I: Adoption of Futures to the Toolbox

In the adoption phase managers decide whether or not futures contracts can contribute to their enterprise. McFadden (1999) provides a framework in which behavior can be characterized by a decision process, which is formed by perceptions and beliefs based on the available information. In this paper we use this framework and the multi-attribute attitude theory (e.g. Ajzen and Fishbein 1980; Bagozzi 1981; Fishbein and Ajzen 1975). In the multi-attribute attitude framework, attitude is assumed to be decomposable as a sum of the products of beliefs and evaluations. The beliefs pertain to the degree to which a futures contract may have particular consequences, for example, risk reduction, and the evaluations reflect the importance of these consequences. Similar beliefs might be grouped into components and the evaluations of these components may influence the managers' attitude differently. These belief groups and the evaluations of these components are referred to as the subjective criteria components (SCC). Managers use these SCCs when deciding whether or not futures are part of the toolbox.

The adoption model postulates a sequential process. Owner-managers are assumed to group beliefs first according to dimensions and to form SCC.[1] In this paper

[1] For example, an owner-manager might evaluate the performance of futures. This evaluation may be based on attributes such as the risk reduction capacity of the hedging service provided by futures exchanges. Components such as "performance" may result. It is assumed that along each of these more abstract components futures contracts are evaluated.

we recognize that SCC may have different weights attached, and, consequently, may have separate influences on attitude. Let us define this matter more formally.

Let SCC_j be the subjective criteria component j for futures. Let b_k be the strength of the belief that futures leads to consequence k, let e_k be the evaluation of this consequence and let K_j denote all consequences that belong to SCC_j. The SSC for futures along component j is now defined as:

$$SCC_j = \sum_{k \in K_j} b_{ik} e_k , \tag{1}$$

where the summation is across all consequences that belong to this component.

A central assumption of the model is that SCCs form the attitude towards futures. Let AT be the owner-manager's attitude towards adding futures to the toolbox. If the number of SCC is J, we assume that:

$$AT = \sum_{j=1}^{J} \beta_j SCC_j , \tag{2}$$

where β_j is the weight reflecting the importance of SCC_j in determining the owner-manager's attitude to add futures to the toolbox. Based on the attitude, the owner-manager forms an intention (e.g. probability) to add futures to the toolbox. The model also includes the owner-manager's perception of the extent to which significant others (such as advisors surrounding the owner-manager) think that one should include futures in the toolbox, thereby taking the owner-manager's decision unit into account. This is the decision-making unit (DMU). In this study DMU reflects the degree to which the owner-manager thinks that relevant others expect him/her to add futures to his/her toolbox. The influence of DMU together with the attitude is assumed to determine the intention to add futures to the toolbox according to the following formula:

$$IN = \gamma_1 AT + \gamma_2 DMU , \tag{3}$$

where g_1 and g_2 are the weights reflecting the importance of the attitude and the DMU in determining the intention to add futures to the toolbox.

Consider Figure 1 as a graphical representation of the proposed model. Figure 1 shows that the key elements in the model are the SSCs (subjective criteria components), as they drive the intention to add futures to the toolbox. Therefore, we discuss types of SCCs that might be relevant in this context.

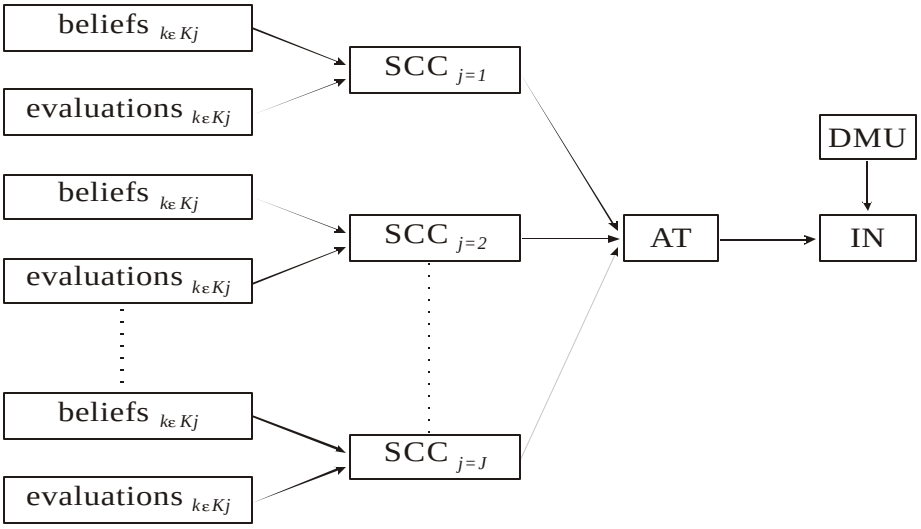

Figure 1. Phase I: The Adoption Model.

In this figure k denotes consequence k $(k = 1 \ldots k)$, K_j denotes all consequences that belong to subjective criteria component (SCC) j, SCC_j the subjective criteria component for component j $(j = 1 \ldots J)$, AT the attitude towards adding futures to the toolbox, and DMU the intention to add futures to the toolbox.

Subjective criteria components: some hypotheses

We hypothesize that in the first stage the *perceived performance criteria component* of futures exchanges (risk reduction, speculation or other functions) will play a role. Tashjian and McConnell (1989) have shown that hedging effectiveness is a determinant in explaining the success of futures contracts and, as a result, considerable attention has been paid to the hedging effectiveness of futures contracts (Ederington 1979; Howard and D'Antonio 1984). However, for owner-managers the perceived performance may differ from the performance as reflected by hedging effectiveness measures. Important in this respect is the perception managers have toward the function of futures exchanges. In the traditional view futures exchange have two main functions: risk reduction and price discovery. Working (1953a, 1953b) challenged the idea of risk insurance by arguing that it is the pursuit of profit through the exploitation of (expected) changes in the basis. In this view, the use of futures markets is primarily a type of arbitrage, to be engaged in only when the hedger perceived a promising opportunity for profit from changing cash-futures price relationships. Recently, several researchers have argued that futures markets provide other services as well. Pennings and Leuthold (2000a), for example, defined the services provided by a futures exchange as: a service through which a firm is offered the opportunity to buy or sell products forward at a fixed price, thereby not restricting the firm to engage in a cash contract relationship. In this paper we do not constrain ourselves by only focussing on the risk reduction and speculation service of futures exchanges, but view the perception of the customers regarding the function of futures exchanges as driving their behavior.

Working (1953b) provided an alternative explanation for the motivation to hedge that has not yet been addressed empirically: using futures gives the manager greater freedom for business action. Working argued that the freedom gained could be used to make a sale or purchase that would otherwise not be possible. This is in line with the recent findings in management studies showing that managers value instruments that increase their "degrees of freedom of action" in the market place (e.g., Brandstätter 1997). We may expect that the factor, *entrepreneurship criteria component*, plays a role in whether or not futures becomes part of the business of conduct.

Several researchers, among others, Ennew, et al. (1992) have shown that owner-managers perceive futures trade as complex and difficult. The perceived complexity will

introduce a cost for managers, such as information gathering, thereby inhibiting the adoption of futures. Therefore, we expect that the *ease of use criteria component* is an important factor for owner-managers when evaluating futures as an option to add to their toolbox.

The present study focuses on owner-managers of small and medium-sized enterprises (SMEs). An important difference between the owner-manager of an SME and the manager of a large enterprise lies in the fact that SMEs do not have different functional departments such as research and development, manufacturing-quality control, sales and accounting. All these departments are combined within the owner-manager. The management functions of SMEs are commonly performed by the owner-manager. While the owner-manager is the primary decision maker, the decision to use futures is often influenced by advisors, employees and other important people. These people form the SME's *decision-making unit (DMU).* Recent findings suggest that the DMU has a significant effect on firms making major decisions (Dholakia, et al. 1993). Various members of the SME may be involved in the SMEs decisions. The SMEs' employees, particularly those responsible for financial decisions, and who may experience directly or indirectly the consequences of using futures, may be motivated to get involved in the decision about the extent of derivative usage.[2] Individuals external to the SME also may have influence on the decision to see futures as a relevant tool. SMEs use advisors, such as consultants or bank account managers, in order to optimize their decision-making process regarding the use of derivatives. We expect that the opinion of these individuals, who are important to the manager when derivatives are of concern, will influence the SME's intention to add futures to the toolbox.

Furthermore we expect *risk attitude* to play a role (Carter 1999). Tufano (1996) found that managerial risk aversion affects corporate risk management policy in the North American gold mining industry. We expect the owner-manager's risk attitude to influence their decision to add futures to their toolbox.

[2] We do not study the decision-making process within a DMU, rather we are interested in the effect that members of the DMU have on the owner-manager's decision to add futures to their toolbox.

Phase II: Initiating a Futures Position

The first phase is designed to explain why managers may consider futures contracts. It does not explain the manager's decision whether or not to enter the futures market in a concrete choice situation. In the second phase futures contracts are already in the manager's toolbox. Hence, the second phase focuses on a concrete choice situation regarding the initiation of a futures market position. In such a concrete choice situation, the manager has two options: to initiate a futures position or not (the latter could mean delaying the initiation of the futures position). A manager who is deciding whether or not to initiate a futures position takes the consequences of such action into account. Initiating a futures position has two important consequences. First, by fixing the price in advance (s)he has reduced his or her spot market risk. Secondly, fixing the price in advance at a certain price level is inherent to taking a futures position.

From the decision literature it is well known that decision makers use anchor points to evaluate a stimulus, in our case, futures prices (Payne, Laughhunn and Grum 1980; Fershtman 1996). The anchor points chosen differ across domains and decision frames. Tversky and Kahneman (1981) showed that decision makers perceive outcomes (such as futures prices) as gains or losses. Gains and losses are defined relative to the manager's reference point. So, managers compare the futures price level to their reference price (where the reference price is defined as the manager's internal price that (s)he uses as an anchor to judge other prices). The further the futures price exceeds the manager's reference price, the more attractive it becomes for him/her to take a futures position.[3] And, conversely, the further the reference price exceeds the futures price, the less attractive it will become to take a futures position. Puto (1987) found that the reference price varies widely for each individual, depending on such factors as judgement capacity and aspiration level. In the context of a producer deciding whether or not to initiate a futures position, the reference price may be closely related to the production costs of the underlying commodity. We assume that owner-managers use the futures price level and the reference price when deciding whether or not to initiate a futures position. Monroe and Chapman (1987) found that decision makers derive perceived value from

[3] Note that throughout the paper we focus on a manager who is deciding whether or not to initiate a sell (short) position in the futures market. The analysis is analogous for a manager deciding whether or not to initiate a buy (long) position

perceived benefits and perceived sacrifice. They suggested that perceived value = perceived benefits/perceived sacrifice, which is similar to comparison by ratio. Moreover, in a study involving judgements of similarity and dissimilarity, Ramsay (1980) found that comparison by ratio described the data well. Therefore, in this study the manager is assumed to compare the futures price and the reference price by ratio. Thus, two important factors play a role in a manager's behavior in initiating a futures position: *risk attitude* and the *ratio of the futures price level to the reference price (FPRP).* We hypothesize that the extent of risk aversion is positively related to the incidence of initiating a futures position in a hedging context. Furthermore, we expect the ratio of the futures price level to the reference price to be positively related to the incidence of initiating a futures position.

Empirical Model

Covariance Structure Model Framework

Both phases will be estimated within one empirical model. In both phases latent variables (not directly observable variables) play an important role. In phase I the SCCs play an important role in the manager's decision behavior. The SCCs are latent variables that cannot be measured directly. They are measured by a set of observable indicators, which in our case are the belief and evaluation products (e.g. Equation (1)). Furthermore, the latent constructs such as attitude and intention play an important role. In phase II the latent constructs risk attitude (which also plays a role in phase I) and the owner-manager's reference price play a role. These latent variables entail measurement error. An empirical problem may arise when taking latent variables into account. The relationships between and among latent theoretical concepts (constructs) that are not directly observable may result in biased coefficients when estimated in a linear regression framework because of measurement error. To account for measurement error, we use a covariance structure model framework (often referred to as structural equation modeling), as it permits the explicit modeling and estimation of errors in measurement (Bollen 1989,

1996). Covariance structure models provide us with a method for estimating structural relationships among unobservable constructs and for assessing the adequacy with which those constructs have been measured. Following Pennings and Leuthold (2000b) the covariance structure model can be expressed as:

$$\boldsymbol{h} = B\boldsymbol{h} + \Gamma\boldsymbol{x} + V \tag{4}$$

$$y = \Lambda^{y}\boldsymbol{h} + \boldsymbol{e} \tag{5}$$

$$x = \Lambda^{x}\boldsymbol{x} + \boldsymbol{d} \tag{6}$$

Equation (4) is called the latent variable or structural model and expresses the hypothetical relationships among the constructs. The m*1 vector η contains the latent endogenous constructs. In our framework the endogenous constructs are the attitude to add futures to the toolbox, the intention to add futures to the toolbox (phase I) and finally whether or not the owner-manager initiates a futures position (phase II). The n*1 vector ξ consists of the latent exogenous constructs, which in our framework consist of SSC entrepreneurship, SSC performance, SSC ease of use, the influence of the decision unit, risk attitude and the ratio of the futures price level to the reference price. The coefficient matrix B shows the effects of endogenous constructs on each other, and the coefficient matrix G denotes the effects of exogenous on endogenous constructs. The vector of disturbances V represents errors in equations. Equations (5) and (6) are factor-analytic measurement models which tie the constructs to observable indicators. The p*1 vector $\boldsymbol{y}$ contains the measures of the endogenous constructs, and the q*1 vector $\boldsymbol{x}$ consists of the measures of the exogenous indicators. The coefficient matrices Λ^{y} and Λ^{x} show how $\boldsymbol{y}$ relates to η and x relates to ξ, respectively. The vectors of disturbances, ε and δ, represent measurement errors. Figure 2, shown later with results, depicts the structural model.

Research Method

Context

The Dutch hog industry, which is examined empirically, is among the largest exporters of slaughter hogs in the European Union and accounts for an important part of Dutch exports. Contrary to practices associated with other agricultural products, the market for slaughter hogs in the European Union knows no government intervention. This study uses Dutch owner-managers of hog farms who are making decisions with their own real business context in mind. These subjects are highly experienced participants in market activities, which makes this sector an excellent domain to address the two research questions: what is the decision process of owner-managers regarding futures usage and what factors drive this process.

Computer Guided Survey and Experiments

Personal computer guided interviews were administered to 200 owner-managers. Each interview lasted for about 45 minutes. All the interviewers had prior interviewing experience, and received an extensive training program in the assessment procedures. Moreover, the training program ensured that the interviewers understood the questions posed to the owner-managers.

The owner-managers were contacted by the interviewer prior to the personal interview to encourage participation and to ensure that the interview was to be conducted with the right person. The interview was computerized and care was taken to build a user-friendly interface. The software written for this interview was extensively tested and 15 test-interviews were conducted to ensure that the interface was understood by the owner-managers and perceived as "very user-friendly". Owner-managers were confronted with statements that measured beliefs and evaluations. The beliefs and evaluations were measured on bipolar nine-point scales. For the beliefs the end-poles were labeled as "strongly disagree" and "strongly agree", whereas the end-poles for the evaluations were labeled as "very negative" and "very positive" (see appendix for a

description of the beliefs). Several studies, amongst others, Fishbein and Middlestadt (1995), Ryan and Bonfield (1975), and Wochnowski (1995) indicate that bipolar scoring leads to the strongest relations between attitude as a sum of belief-evaluation products and direct measurements of attitude. Moreover, only the use of bipolar scales results in a logical pattern of attitudes.

In this study, attitude was measured by asking the respondent to distribute 100 points across 'adding futures to the toolbox or not'. Intention was measured in a similar way. The influence of the decision-making unit (DMU) was measured by asking the owner-manager to indicate the extent to which significant persons surrounding him/her thought that he/she should add futures to his/her toolbox by distributing 100 points across 'adding futures to the toolbox or not' (Putte, van den Hoogstraten and Meertens 1996).

Finally, the owner-manager was exposed to an experiment in which (s)he had to decide whether or not to initiate a futures position. In line with DeBondt and Thaler (1995) and Daniel, Hirshleifer and Subrahmanyam (1998), we believe that a good finance theory is grounded on evidence about how people actually behave. The main sources of bias are due to the fact that the experiment does not match the real decision situation of the subjects under consideration. For these reasons we measured the manager's behavior in initiating a futures position using a scenario framework which closely matched the real economic business situation of our respondents. The validity of scenarios has been well documented (Bem 1967). The scenario method is advocated by many researchers and has been applied in several research domains (see e.g. Surprenant and Solomon 1987). It is particularly successful as a research tool when subjects are required to "play themselves" rather than unfamiliar roles. In this study, the managers "played" themselves. During the measurement the managers were instructed to "read the following situation carefully" and that "it is important to imagine yourself in the situation described". They were given a choice between selling their hogs forward through initiating a futures position or selling their hogs on the spot market, i.e. without taking a futures position. Five different futures price levels were randomly assigned to the managers. The price levels chosen were based on price levels from previous years on the futures market and reflected the price distribution function. The managers perceived the scenario as very realistic, as it is quite similar to the

kind of choices they make in daily life. The manager had to choose between actually taking or not taking a futures market position.

The reference price was identified by asking the manager to respond to the open-ended question: "If you sell your hogs you will receive different prices for them, depending on the market situation. Some prices will make you feel that you have made a loss and some prices will make you feel that you have made a gain. Supposing you sold your hogs today, from which price level onwards would you perceive the sale as a gain?" Immediately after declaring the initial reference price, the manager was confronted with the following sentence "so, if I understand you correctly, then a price below ------- Dutch guilders is perceived as a loss" the manager could answer this question with "yes" or "no". When the manager answers the last question with "no", the first question was repeated, in order to give the manager the opportunity to change the initial reference price. Whenever the manager answered the latter question with a "yes", the assessment of the reference price had been accomplished (Puto 1987). The ratio of the futures price level to the reference price was calculated by dividing the price level of the futures contract by the manager's reference price. The nomological validity of the elicited reference price may be tested by investigating how that reference price relates to the variables to which it is theoretically associated, such as production costs (Campbell and Fiske 1959; Churchill 1979; Cook and Campbell 1979). Therefore, we correlated the manager's reference price to the manager's cost of raising hogs, and as expected, the correlation was significantly positive ($\rho = 0.86$, $p = 0.00$), indicating the nomological validity of the measurement procedure to obtain the manager's reference price.

We used the expected utility model in order to derive the owner-manager's risk attitude (von Neumann and Morgenstern 1947). Decision making under risk is modeled 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 distribution. A number of axioms hold for this preference ordering (Fishburn 1988). Risky alternatives can be ordered under these assumptions using the utility function, $u(x)$. In this model, the curvature of the utility function $u(x)$ 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. In the certainty equivalence method (cf. Keeney and Raiffa 1976), 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 is varied until the respondent reveals indifference (this certain outcome is denoted by CE(p)). By application of the von Neumann-Morgenstern utility u we obtain: $u(\text{CE}(p)) = pu(x_l) + (1-p)u(x_h)$. When eliciting utilities, two outcomes are fixed first such that the range of outcomes between them includes all outcomes of interest. Second, one may set $u(x_L) = 0$ and $u(x_H) = 1$ where x_L and x_H denote the upper and lower bound respectively of the selected outcome range. The certainty equivalence method used in this study concerns a bisection framework by only using probability 0.5. 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) ~ (x_L, 0.5; CE(0.5)). The indifference CE(0.75) ~ (CE(0.5), 0.5; x_H) yields certainty equivalence CE(0.75), with utility 0.75, etc. 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 in which each question involves a bisection of a particular interval. Following Pennings and Smidts (2000) we designed the lottery task in a way such that it matched the daily decision-making process of our respondents. The measurement procedure was computerized and took about 20 minutes. The lottery was formulated in terms of selling hogs for either a relatively high or a relatively low price (with both prices having a probability of 0.5) (this was alternative A) or receiving a fixed price (alternative B). The assessment of the certainty equivalent was an iterative process. If the respondent chose alternative A, the computer generated a higher fixed price (alternative B) than the previous fixed price, hence making alternative B more attractive. If the respondent chose alternative B, the computer generated a lower fixed price (alternative B) than the previous fixed price, hence making alternative A more attractive. The next measurement (the next lottery) started after the respondent had indicated that it did not matter to receive alternative A or B. Nine points of the utility curve were assessed by means of this iterative process. Based on the assessed utility curve, the Pratt-Arrow coefficient of

absolute risk aversion was derived as a measure of risk attitude (cf. Smidts 1997). The widely used exponential function was fit to each subject's outcomes; after having scaled the boundaries of the functions, the estimation of just one parameter suffices to characterize a decision-maker's risk attitude.

Results

Exploratory factor analysis was conducted on the beliefs. The results of the exploratory factor analysis showed that beliefs are grouped naturally into SCCs. We found that the beliefs could be grouped into three factors (components), which can be labeled as "entrepreneurship", "performance" and "ease of use". These three SCCs were used in our choice model. In addition, risk attitude, the ratio of the futures price level to the reference price, attitude, intention, the influence of the DMU and the owner-manager's choice whether or not to initiate a futures position were included.

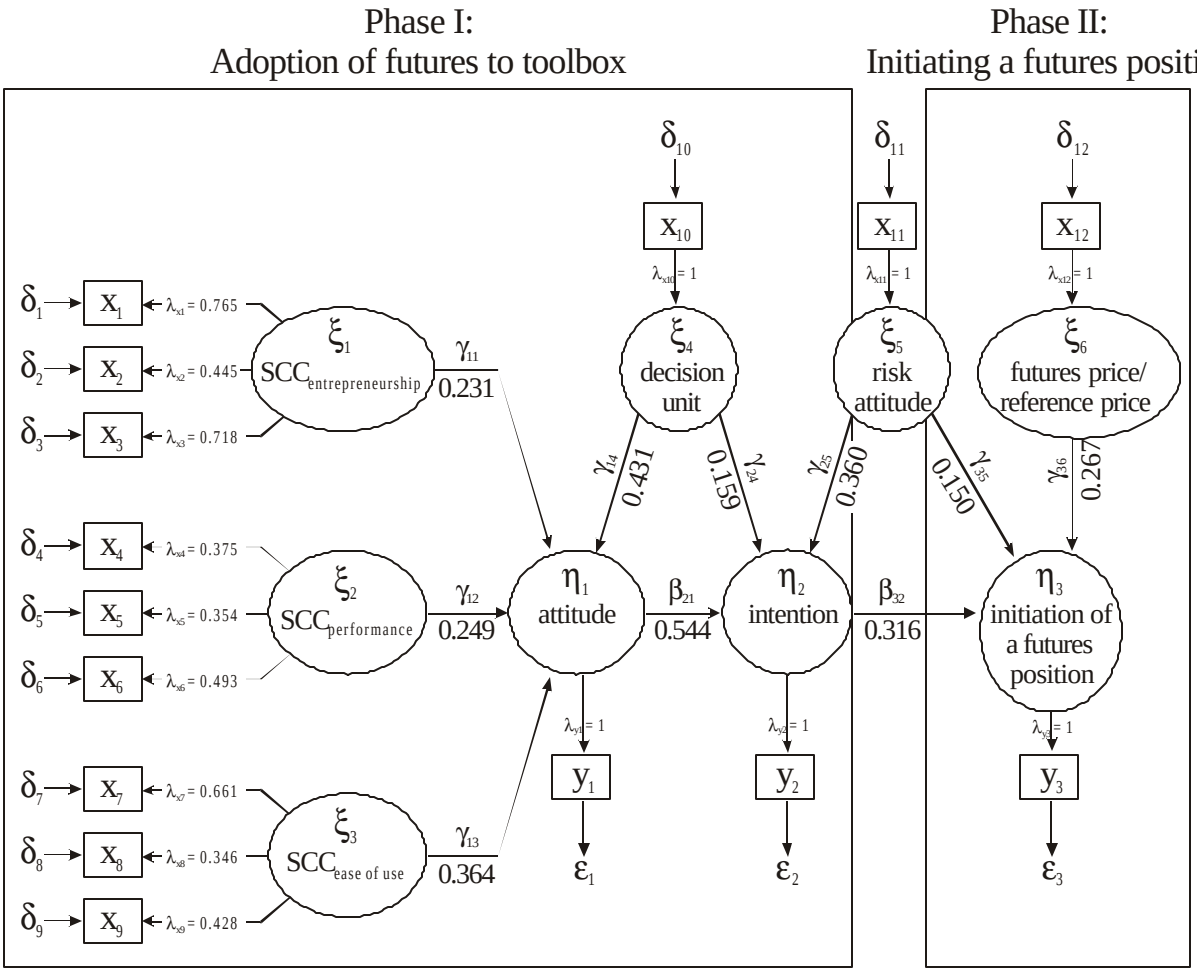

Figure 2. Owner-manager's Two-Phase Decision Process: Parameter Estimates.

The covariance structure in Equations (4)-(6) can be estimated by one of the full information methods: unweighted least squares, generalized least squares, and maximum likelihood. The fitting function measures show how close the estimated covariance matrix of the observed variables is to the sample covariance matrix. Because of its attractive statistical properties, we use maximum likelihood procedures (Bollen 1989). The model can be estimated in the maximum likelihood LISREL framework developed by Jöreskog and Sörbom (1993). The estimation results of the covariance structure model are shown in Figure 2 and Table 1. The model (depicted in Figure 2) had a good fit with a χ^2 of 80.22 (*df* = 70, *p* = 0.189), a RMSEA of 0.02, a GFI of 0.95, an AGFI of 0.91, and a TLI

of 0.96.[4] The test results show that the model provides an adequate description of the futures adoption and choice process of the owner-managers in our study. All relationships in our model were significant, thereby confirming our hypotheses that the SSCs and the DMU are the drivers in the adoption stage, whereas the owner-manager's reference price in relation to the futures price drives the futures initiation behavior. Our estimates, as displayed in Figure 2 and Table 1 can directly be translated to the covariance structure model as given in Equations (4)-(6).

Table 1

Estimation Results of Behavioral two Phase Futures Decision Model using Covariance Structure Modeling*

Paths between (Latent) variable	Estimated standardized Coefficient	*p*-value
SCC entrepreneurship → AT	$\gamma_{11} = 0.231$	0.04
SSC performance → AT	$\gamma_{12} = 0.249$	0.04
SCC ease of use → AT	$\gamma_{13} = 0.364$	0.05
DMU → AT	$\gamma_{14} = 0.431$	0.02
AT→ IN	$\beta_{21} = 0.544$	0.00
DMU→ IN	$\gamma_{24} = 0.159$	0.05
RA→ IN	$\gamma_{25} = 0.360$	0.05
IN→ IFP	$\beta_{32} = 0.316$	0.00
RA→ IFP	$\gamma_{35} = 0.150$	0.05
FPRP → IFP	$\gamma_{36} = 0.267$	0.00

Fit statistics: χ^2 of 80.22 (df = 70, p = 0.189), a RMSEA of 0.02, a GFI of 0.95, an AGFI of 0.91, and a TLI of 0.96.

*Where, SCC is subjective criteria component, AT, attitude towards adding futures to the toolbox, IN the intention to add futures to the toolbox, RA the owner-manager's risk attitude,

[4] For a description and interpretation of these measures, see footnote 11 in Pennings and Leuthold (2000b).

FPRP, the ratio between the futures price and the reference price and IFP whether or not the owner-manager initiates a futures position.

The estimation results and the fit show that the model is able to explain and describe owner-manager's futures usage. In order to test the predictive validity of phase II, the phase in which the owner-manager decides to initiate a futures position, we modeled this phase in a logistic regression framework. This framework provides us with the possibility to investigate how well the model is able to predict the owner-managers futures initiation behavior. Because our dependent variable (whether or not to initiate a futures position) is a binary response variable, we adopted maximum likelihood logistic regression, utilizing the logistic cumulative distribution. The risk attitude measure, ratio of the futures price level to the reference price and the intention to adopt futures to the toolbox (the dependent variable in phase I) were used as the predictors of the managers' choice behavior in the logistic regression. The probability of initiating a futures position *p*, is modeled as:

$$p = \frac{1}{1 + e^{-[g_1 IN + g_2 RA + g_3 FPRP]}} \qquad (7)$$

The logistic regression estimates the parameters l_1, l_2, and l_3 in the model, such that the likelihood of the choice data given the model is maximized. The model produces the likelihood ratio statistics and Wald statistics (the square of the parameter estimate divided by the standard error), both of which closely follow a chi-square distribution under the null hypothesis that the parameter being tested is zero. As a measure of model fit, we provide the improvement of the –2 log likelihood as compared to the –2 log likelihood of the null model (consisting of only an intercept). The higher the chi-square value of the model, the better it describes the binary model. For the optimal model we also consider two goodness-of-fit statistics to examine the substantive significance of the variables in the model. We will consider Nagelkerke's R^2, which is similar to the R^2 in linear regression (Hair, et al. 1995), and the proportional reduction of prediction error (PRPE) (cf. Sharma 1996). The latter statistic indicates the improvement in predictive

power compared to a null model that does not include the predictor variables. The PRPE statistic is closer to one, the more the model improves the null model in terms of predictive power (Hosmer and Lemeshow 1989). Table 2 provides the estimation results.

Table 2

Results of the Logistic Regression in which Risk Attitude (RA) and the Ratio of the Futures Price to the Owner-manager's Reference Price (FPRP), and the Intention to Add Futures to the Toolbox (IN) Predict the Probability of Initiating a Futures Position

	RA	FPRP	IN
Initiating a futures position: Yes (=1) or No (=0)			
B	0.131	3.688	0.085
Wald Statistic	3.933	114.94	103.61
Significance	0.051	0.000	0.000
χ^2-improvement	374.96		
Significance	0.000		
Nagelkerke R^2 =	0.79		
Correctly classified:	90%		
(Huberty's test: $p < 0.1$).			

The model's chi-square values resulting from logistic regression are displayed in Table 2. The model significantly improves the fit when compared to the null model, which includes only an intercept ($p < 0.001$). Furthermore (not shown in the table), none of the models can be rejected when compared to a saturated model that perfectly describes the data ($p \approx 1.0$). This indicates that the model describes the data sufficiently well. Moreover, the proportion of correctly classified choices supports the validity of the models: 90 percent. This proportion significantly exceeds the proportion of choices correctly classified by chance (Huberty's test: $p < 0.1$). These results confirm that our model has high predictive validity.

Relating Empirical Findings to Futures Exchange Policy: A Preliminary Study

Our research confirms that owner-manager's decision process regarding futures contracts is a two-phase process. That is, before the owner-manager will actually initiate a futures position, futures must be considered as a relevant tool for the toolbox. For a futures exchange, it thereby seems valuable to understand the underlying factors that drive phase I. Our empirical results show that these factors are psychological constructs, the subjective criteria components (SCCs). An owner-manager evaluates futures along these SCCs. Hence, a futures exchange faces the challenge to design contracts that have a high score on these SCCs. Furthermore, the exchange faces the challenge to communicate these benefits to potential customers.

SCC 'entrepreneurship' appears to play a key role in forming an attitude towards futures trading. Working (1953b) suggested that one of the reasons to use futures contracts might be "to have greater freedom of business action". Surprisingly, no article ever explored this suggestion. In this study we have been able to confirm this statement empirically. So, whenever owner-managers feel that futures might increase their entrepreneurial freedom, they developed a positive attitude towards futures. Futures are an attractive instrument whenever their use increases the degrees of freedom in the market place. When designing futures contracts, the futures exchange may increase the compatibility of futures with other instruments available to the owner-manager, thereby increasing the SCC 'entrepreneurship' of futures.

The SSC 'performance of futures' is a critical attribute that influences the owner-manager attitude to add futures to his/her toolbox. Interestingly, 'performance' is not only related to the risk reduction feature of futures, but is also related to other aspects of the owner-manager's marketing plan, such as facilitating contractual relationships. The role of futures in facilitating contractual relationships has recently been investigated by Pennings and Leuthold (2000a). Using a contract specification that is flexible enough to

contribute to contractual relationships is a challenge. In the literature, considerable attention has been paid to the design process of futures contracts.

The SCC 'ease of use' played an important role in Phase I. In order to reduce the psychological distance to futures contracts, the futures exchange might develop training programs for owner-managers and thus increase their understanding of futures trade and improve the accessibility of the exchange. Not only do the owner-managers' SCCs play a role, but also advisors surrounding the owner-manager. The DMU had a great influence in Phase I, indicating that the exchange should not only target their marketing effort on the potential participants but also on the advisors surrounding the owner-manager.

In Phase II, when a owner-manager has to decide whether or not to initiate a futures position, the ratio between the futures price and the reference price of the owner-manager plays an important role. Both the futures price and the owner-manager's reference price are beyond the scope of the exchange. The futures price is determined by fundamental economic factors. The reference price is determined by the owner-manager's aspiration level with regard to making a profit. Although the futures exchange cannot influence these two prices, it can profit from them when introducing new futures contracts. Our model makes clear that, when introducing a new futures contract, the relative price level in the underlying market of the commodity is an important determinant in creating sufficient trading volume and hence liquidity.

Finally, risk attitude played a role in both phases. Since our empirical domain was in a hedging context, risk aversion was positively related to the intention to add futures to the toolbox as well as to the concrete decision to enter the futures market. Hence, hedging effectiveness seems still to be a topical subject. Exchanges need to continually monitor this, including for existing contracts.

Conclusions and Further Research

This paper is a first attempt to benefit from behavioral models such that insight can be gained in futures contract usage. A major disadvantage from the behavioral approach is the fact that it does not provide a rigorous theoretical framework. The model is descriptive in nature and provides information on the decision process and the criteria

that owner-managers use in this decision process. It does not come up with guidelines for the owner-manager to optimize their behavior. Although this disadvantage is a serious one, the behavioral model is able to predict owner-managers actual behavior. Our model had a very good fit, moreover it was able to predict owner-managers choices with 90 percent accuracy.

Several routes can be taken to improve our model and thereby our understanding of futures contract usage, and hence, the different possibilities to improve the services offered by futures exchanges.

First, our model could be expanded by taking owner-manager's heterogeneity into account. Pennings and Leuthold (2000b) showed that heterogeneity can mask several critical factors. In order to model heterogeneity in our two-phase behavioral model that includes latent variables, research is needed on how mixture models can be expanded to structure covariance models. Although some attempts have been made in this area, more methodological research is required to effectively apply it to the proposed model. Recent findings by Jedidi, Jagpal, and DeSarbo (1997) and Pennings and Garcia (2000) on general finite mixture structural equation modeling are encouraging.

Second, our model does not take other competitive instruments into account, such as forward contracts or competitive marketing strategies (for example, the frequency of entering the spot market). That is, an owner-manager not only makes the decision whether or not to add futures to the toolbox, or whether or not to initiate a futures position, but also makes the decision whether to use futures or forward contracts. Including these competitive instruments in our model would increase its validity. The main conclusion of our paper is that latent constructs play an important role in the owner-manager's decision to use futures. Not taking these latent constructs into account would mask critical information for the futures exchange about how to improve their services. Since these latent variables are unobservable, indicators need to be designed that are able to measure the latent variables. Methods that gain insight into the reliability and validity of these measures (e.g., confirmatory factor analysis) should be further developed as well as methods that take measurement error explicitly into account when relating latent variables to behavior (e.g., structural equation models).

The challenge now is to map these latent variables, the SCCs, back into concrete characteristics of the services that futures exchanges provide. Methodological research in this area is underway. Further research that integrates the normative expected utility models with behavioral models, and hence leverage the interesting properties of both approaches in the domain of futures research seems an interesting and promising route to take.

Appendix Subjective Criteria Components

Beliefs related to SSC Entrepreneurship

1) I think that adding futures to my toolbox I can fully exploit my spirit of free enterprise.

2) I think that adding futures to my toolbox gives me the opportunity to receive an extra high price.

3) I think that adding futures gives me a large freedom regarding actions in the market place.

Beliefs related to SSC Performance

1) I think that adding futures to my toolbox I am able to reduce the fluctuations in my revenues.

2) I think that adding futures to my toolbox ensures my sales.

3) I think that adding futures using futures will improve my relations with traders.

Beliefs related to SSC Ease of use

1) I think that futures are an easy marketing instrument.

2) I think that futures are a difficult matter.

3) I think that futures will are an easy tool when making contract relationships.

References

Ajzen, I. and Fishbein, M., *Understanding Attitudes and Predicting Social Behavior,* (Englewood Cliffs, NJ: Prentice-Hall, 1980).

Bagozzi, R. P., 'Attitudes, intentions, and behavior: a test of some key hypothesis', *Journal of Personality and Social Psychology,* Vol. 41, 1981, pp. 607-27.

Bem, D. J., 'Self perception: an alternative interpretation of cognitive phenomena', *Psychological Review*, Vol. 74, 1967, pp. 183-200.

Black, D. G., *Success and Failure of Futures Contracts: Theory and Empirical Evidence*, Monograph 1986-1 Salomon Brothers Center for the Study of Financial Institutions, New York, 1986.

Bollen, K. A., *Structural Equations with Latent Variables,* (New York: John Wiley, 1989).

Bollen, K. A., 'An alternative two stage least squares estimator for latent variables equations', *Psychometrika,* Vol. 61, 1996, pp. 109-21.

Brandstätter, H., 'Becoming an entrepreneur: a question of personality structure', *Journal of Economic Psychology,* Vol. 18, 1997, pp. 157-177.

Campbell, D. T. and Fiske, D. W., 'Convergent and discriminant validation by the multitrait-multimethod matrix', *Psychological Bulletin*, Vol. 56, 1959, pp. 81-105.

Carter, C. A., 'Commodity futures markets: a survey', *The Australian Journal of Agricultural and Resource Economics*, Vol. 43, 1999, pp. 209-47.

Churchill, G. A., 'A paradigm for developing better measures of marketing constructs', *Journal of Marketing Research*, Vol. 16, 1979, pp. 64-73.

Cook, T. D. and Campbell, D. T., *Quasi-experimentation, Design and Analysis Issues for the Field Settings*, (Chicago: Rand McNally, 1979).

Daniel, K., Hirshleifer, D. and Subrahmanyam, A., 'Investor psychology and security market under- and overreactions', *Journal of Finance*, Vol. 53, 1998, pp. 1839-85.

DeBondt, W. F. M. and Thaler, R. H., 'Financial decision-making in markets and firms: a behavioral perspective', in: Jarrow, Robert A., Maksimovic, Voijslav and Ziemba, William T. (eds.), *Finance, Handbooks in Operations Research and Management Science* 9, (Amsterdam: North Holland, 1995), pp. 385-410.

Dholakia, R. R., Johnson, J. L., Della Bitta, A. J. and Dholakia, N., 'Decision-making time in organizational buying behavior: an investigation of its antecedents,' *Journal of the Academy of Marketing Science*, Vol. 21, 1993, pp. 281-292.

Ederington, L. H., 'The hedging performance of the new futures markets', *Journal of Finance*, Vol. 34, 1979, pp. 157-70.

Ennew, T. C., Morgan, W. and Rayner, T., 'Role of attitudes in the decision to use futures markets: the case of the London potato futures market', *Agribusiness: An International Journal*, Vol. 8, 1992, pp. 561-73.

Fershtman, C., 'On the value of incumbency: managerial reference points and loss aversion', *Journal of Economic Psychology*, Vol. 17, 1996, pp. 245-57.

Fishbein, M. and Ajzen, I., *Belief, Attitude, Intention, Behavior: An Introduction to Theory and Research*, (Reading, MA: Addison-Wesley, 1975).

Fishbein, M. and Middlestadt, D., 'Noncognitive effects on attitude formation and change: fact or artifact?', *Journal of Consumer Psychology*, Vol. 14, 1995, pp. 244-46.

Fishburn, P. C., 'Normative theories of decision making under risk and uncertainty', in: Bell, et al. (eds.), *Decision Making. Descriptive, Normative and Prescriptive Interactions*, (Cambridge: Cambridge University Press, 1988), pp. 78-98.

Hair, J. F., Anderson, R., Tatham, R. L. and Black, W. C., *Multivariate Data Analysis with Reading*, (New Jersey: Prentice-Hall, Inc., 1995).

Hartzmark, M. L., 'Returns to individual traders of futures: aggregate results', *Journal of Political Economy*, Vol. 95, 1987, pp. 1292-1306.

Hosmer, D. W., Jr. and Lemeshow, S., *Applied Logistic Regression*, (New York: John Wiley, 1989).

Howard, C. and D'Antonio, L., 'A risk-return measure of hedging effectiveness', *Journal of Financial and Quantitative Analysis*, Vol. 19, 1984, pp. 101-12.

Jedidi, K., Jagpal, H. S. and DeSarbo, W. S., 'Finite-mixture structural equation models for response-based segmentation and unobserved heterogeneity', *Marketing Science*, Vol. 16,1, 1997, pp. 39-59.

Jöreskog, K. G. and Sörbom, D., *LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language*, (Chicago: Scientific Software International, Inc, 1993).

Keeney, R. L. and Raiffa, H., *Decisions With Multiple Objectives: Preferences and Value Tradeoffs*, (New York: John Wiley, 1976).

McFadden, D., 'Rationality for economists?', *Journal of Risk and Uncertainty*, Vol. 19, 1-3, 1999, pp. 73-105.

McQuiston, D. H., 'Novelty, complexity, and importance as causal determinants of industrial buyer behavior', *Journal of Marketing*, Vol. 67, 1989, pp. 66-79.

Monroe, K. B. and Chapman, J. D., 'Framing effects of buyers' subjective product evaluations', in: Wallendorf, M. and Anderson, P.F. (eds.), *Advances in Consumer Research*, Vol.14, 1987, pp. 193-97.

Neumann, J. von and Morgenstern, O., *Theory of Games and Economic Behavior* (2nd Ed.), (Princeton: Princeton University Press, 1947).

Payne, J. W., Laughhunn, D. J. and Grum, R., 'Translation of gambles and aspiration level effects in risky choices behavior', *Management Science*, Vol. 26, 1980, pp.1039-60.

Peck, A. E. and Nahmias, A. M., 'Hedging your advice: do portfolio models explain hedging?', *Food Research Institute Studies*, Vol. 21, 1989, pp. 193-204.

Pennings, J. M. E. and Garcia, P., 'Unobserved heterogeneity: evidence and implications from SMEs' hedging behavior', Working paper, University of Illinois at Urbana-Champaign, 2000.

Pennings, J. M. E. and Leuthold, R. M., 'The motivation for hedging revisited', *Journal of Futures Markets*, Vol. 20, 2000a, pp. 865-85.

Pennings, J. M. E. and Leuthold, R. M., 'The role of farmers' behavioral attitudes and heterogeneity in futures contracts usage', *American Journal of Agricultural Economics*, Vol. 82, 2000b, pp. 908-919.

Pennings, J.M.E. and Smidts, A., 'Assessing the construct validity of risk attitude,' *Management Scienc*e, 2000, Forthcoming.

Posavac, S. S., Sanbonmatsu, D. M. and Fazio, R. H., 'Considering the best choice: effects of the salience and accessibility of alternatives on attitude-decision consistency', *Journal of Personality and Social Psychology*, Vol. 72, 1997, pp. 253-61.

Puto, C. P., 'The framing of buying decisions', *Journal of Consumer Research*, Vol. 14, 1987, pp. 301-15.

Putte van den, B., Hoogstraten, J. and Meertens, R., 'A comparison of behavioral alternative models in the context of the theory of reasoned action', *British Journal of Social Psychology,* Vol. 35, 1996, pp. 257-66.

Ramsay, J. O., 'The joint analysis of direct rating, pairwise preferences, and dissimilarities', *Psychometrika,* Vol. 45, 1980, pp. 139-44.

Ryan, M. J. and Bonfield, E. H., 'The Fishbein extended model and consumer behavior', *Journal of Consumer Research,* Vol. 2, 1975, pp. 118-36.

Sharma, S., *Applied Multivariate Techniques,* (New York: John Wiley, 1996).

Smidts, A., 'The relationship between risk attitude and strength of preference: a test of intrinsic risk attitude', *Management Science*, Vol. 43, 1997, pp. 357-70.

Suprenant, C. F. and Solomon, M. R., 'Predictability and personalization in the service encounter', *Journal of Marketing*, Vol. 51, 1987, pp. 86-96.

Tashjian, E. and McConnell, J., 'Requiem for a market: an analysis of the rise and fall of a financial futures contract', *Review of Financial Studies*, Vol. 2, 1989, pp. 1-23.

Tufano, P., 'Who manages risk? An empirical examination of risk management practices in the gold mining industry', *Journal of Finance*, Vol. 51, 1996, pp. 1097-1137.

Tversky, A. and Kahneman, D., 'The framing of decisions and the psychology of choice', *Science*, Vol. 211, 1981, pp. 453-58.

Wochnowski, H., 'Die bedeutung der scalierung bei multiattribut-modellen der qualitatsmessung', *Marketing Zeitschrift Forschung und Praxis*, Vol. 3, 1995, pp.195-201.

Working, H., 'Futures trading and hedging', *American Economic Review*, Vol. 43, 1953a, pp. 544-61.

Working, H., 'Hedging reconsidered', *Journal of Farm Economics*, Vol. 35, 1953b, pp. 544-61.