Hedging Efficiency: A Futures Exchange Management Approach

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INTRODUCTION

In studies of futures markets much attention has been paid to the hedging effectiveness of futures contracts because it is an important determinant in explaining the success of futures contracts [Johnston, Tashjian, and McConnell (1989)]. The authors who have proposed measures of this effectiveness include Chang and Fang (1990), Ederington (1979), Gjerde (1987), Hsin, Kuo, and Lee (1994), Lasser (1987), and Nelson and Collins (1985). These measures all try to determine to what extent hedgers are able to reduce cash price risk by using futures contracts. In these studies hedging effectiveness refers to returns on portfolios. A particular futures contract can have different values with respect to hedging effectiveness, depending on which measure is used and on the hedger utility function. Futures contracts, themselves, introduce risks for hedgers. Therefore, the extent to which a futures contract offers a reduction in overall risk is an important criterion for the management of the futures

We are indebted to the Amsterdam Agricultural Futures Exchange (ATA) and the Clearing Corporation (NLKKAS), especially to Rolf Wevers, for invaluable data, and to J. A. Bijkerk from the Department of Marketing and Market Research for computational assistance. Furthermore, we would like to thank Rob Murphy, Senior Economist at the Chicago Mercantile Exchange, Robert A. Collins, Naumes Family Professor at the Institute of Agribusiness, Santa Clara University, The Board of Directors of the ATA, and two anonymous reviewers for helpful comments on an earlier draft. The authors are responsible for remaining errors.

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The Journal of Futures Markets, Vol. 17, No. 5, 599–615 (1997)

CCC 0270-7314/97/050599-17

exchange to evaluate the hedging performance. Actually, the smaller the basis and market depth risks of a futures contract, the greater the risk reduction. The preference for one hedging vehicle over another is made after considering both the risk and the cost of the alternative hedges [Castelino, Francis, and Wolf (1991)].

This article introduces a new concept of hedging efficiency and a measure of this efficiency, indicating the quality of the hedging service provided by a futures contract (including both the risks and the costs of the hedge). The proposed measure is an extension and a supplement to extent measures, and has a different purpose, a different interpretation, and a different target group. It assesses futures contracts from the perspective of the management of the futures exchange. The futures market is assumed to be predisposed toward creating a superior value for customers [Narver and Slater (1990)], thereby generating a high trading volume [Black (1986)]. The article's goal is to provide the management of the futures exchange with a measure that is able to give insight into the performance of the exchange. The proposed hedging efficiency measure appraises the distance between the actual hedge and the perfect hedge. This distance can be divided into a systematic part, which can be managed by the futures exchange, and a random part, which is beyond its control. Hence, the measure is a useful tool for the management of the futures exchange, because it enables the quality of the actual hedge to be evaluated.

The article is organized as follows. After reviewing frequently used measures of hedging performance, that is, hedging effectiveness, the risks in futures trading are examined. Then the conceptual aspects of hedging efficiency are discussed, and a new measure is presented. An empirical application of the proposed hedging efficiency measure reveals its usefulness for the management of the futures exchange. The final section summarizes the findings.

MEASURES OF HEDGING EFFECTIVENESS: A BRIEF REVIEW

In the theory on futures markets three hedging theories can be distinguished. Traditional hedging emphasizes the potential of futures markets to avoid risk. Cash positions are hedged by taking an equal but opposite position in the futures market. A second theory suggests that hedgers operate like speculators, being primarily interested in relative prices rather than absolute prices. According to Working (1962), holders of a long position in the cash market will hedge if they expect the basis to fall,

TABLE I

Mathematical Formulas of Measures of Hedging Effectiveness Currently in Use[a]

	Measures
Ederington (1979)	$e = \sigma_{SH}^2/\sigma_s^2\sigma_f^2 = \rho^2$, where σ_s^2, σ_f^2 and σ_{sf} represent the subjective variances and covariance of the possible price change from time 1 to time 2. ρ^2 is the population coefficient of determination between the change in the cash price and the change in the futures price.
Howard and D'Antonio (1984)	$HE = \theta/(\overline{r}_s - i)/\sigma_s$, where θ is the excess return per unit of risk $\overline{r}_s$ the expected one-period return for the spot position, i the risk-free return, and σ_s the standard deviation of one-period return for the spot position.
Hsin, Kuo, and Lee (1994)	$HE = r_H^{ce} - r_S^{ce}$ where r_H^{ce} and r_S^{ce} denote the certainty equivalent returns of the hedged position H and the spot position S, respectively.

[a]This list does not pretend to be exhaustive.

but not if a rise is expected. The latest and most commonly used theory today utilizes a portfolio approach, when the risk of price changes is introduced into the hedging model through a variance function. Moreover, a frontier is traced, showing a relationship between variance and expected returns.

Several studies [e.g., Ederington (1979), Franckle (1980), Hill and Schneeweis (1982), Wilson (1984), Howard and D'Antonio (1984), Chang and Shanker (1986), Overdahl and Starleaf (1986), Lindahl (1989), Chang and Fang (1990), Gjerde (1987), Pirrong, Kormendi, and Meguire (1994), Hsin, Kuo, and Lee (1994)] express the usefulness of trading a futures contract after comparing the results of a combined cash-futures portfolio and the cash position only. Table I summarizes the mathematical formulas of the different measures of hedging effectiveness currently in use.

Ederington (1979) defines hedging effectiveness as the reduction in variance. The objective of a hedge is to minimize the risk of a given position. This risk is presented by the variance of returns. Howard and D'Antonio (1984) define hedging effectiveness as the ratio of the excess return per unit of risk of the optimal portfolio of the spot commodity and the futures instrument to the excess return per unit of risk of the portfolio containing the spot position alone [e.g., Chang and Shanker (1986); Lien (1993)]. Hsin et al. (1994) measure hedging effectiveness by the difference of the certainty equivalent returns between the hedged position and

TABLE II

Hedging Effectiveness Measures and Their Characteristics[a]

Measure	*Based on Minimum Variance Hedge*	*Based on Risk Return*	*Including Cost Involved in Futures Trading*[b]	*Including Basis Risk and Liquidity Risk*
Ederington	Yes	No	No	No
Howard and D'Antonio	No	Yes	No	No
Hsin, Kuo, and Lee	No	Yes	No	No
Proposed measure	Yes	No	Yes	Yes

[a]This list does not pretend to be exhaustive.
[b]Brokerage costs and margin requirements.

spot position. This approach considers both risk and returns in hedging. They argue that the advantages of their measure are that it considers both risk and expected returns and that it is a consistent measure regardless of the empirically expected changes in spot prices.

The measures reviewed are concerned with optimizing the payoff of the portfolio, under the condition that the variance in returns is minimized or that some optimal balance is found between risk and return. All these measures implicitly assume that the futures contract is perfect, that is, introduces no risks. However, futures contracts do introduce risks, which will have an impact on the variance of the hedger's returns. These risks have an impact on the success of a futures contract and are, therefore, of great interest to the management of the futures exchange [Black (1986)]. Table II summarizes and classifies the hedging performance of the measures described above, including the proposed measure.

In the next section the risks involved in futures trading, basis risk, and market depth risk are examined in detail before a concept and a measure of hedging efficiency are proposed.

RISKS IN FUTURES TRADING

The motivation for hedging cash prices with offsetting futures contracts is to reduce, if not eliminate, cash price risk. It is generally recognized that futures markets can be used by traders to hedge the risks associated with the price fluctuations in the underlying spot market [Grossman (1986)]. Any deviation in the cash–futures price relationship at the settlement date will be arbitraged away. However, if the arbitrage transaction costs are high, the necessary convergence of cash–futures price will not occur. This will introduce a risk for the hedger, which will negatively affect participation in futures markets. Bailey and Chang (1993) find evidence that the spread between commodity spot and futures prices, the basis, reflects the macroeconomic risks common to all asset markets. The basis between a futures contract and its underlying commodity is an important measure of the cost of using the futures contract to hedge. In a cross hedge, the relative size of the basis of alternative hedging vehicles often plays a decisive role in the selection of the optimal hedging vehicle [Castelino (1992), Anderson and Danthine (1981)]. Basis risk is attributed to location, quality, and timing discrepancies between commodities traded in the cash market and those deliverable on futures [Paroush and Wolf (1989)]. In the case of futures indexes, unanticipated variation in dividends may involve basis risk [Figlewski (1984), Brennan and Schwartz (1990)]. The variability in the basis contributes to basis risk, as is outlined by Figlewski (1984) and Brennan and Schwartz (1990). Explanations for the variability in the basis include the mark-to-market requirement for futures contracts, the differential tax treatment of spot and futures, and the difficulties in arbitrage between large cash positions and futures. Chen, Cuny, and Haugen (1995) provide empirical evidence that the basis, defined by them as the futures price minus the fair futures price (implied by stock prices), decreases as the volatility of the S&P 500 cash index increases. Kumar and Seppi (1994) find that arbitrage reduces basis volatility.

The existence of basis risk, which is specific to futures markets and does not exist in cash forward markets, introduces an element of speculation in the sense that hedgers are still exposed to this risk while hedging their physical commodity. In a recent article Netz (1996) showed that basis risk will not only affect the futures position, but also the cash market position in all hedging situations by risk-averse agents. Numerous articles have provided statistical models to predict the basis [Naik and Leuthold (1988), Trapp and Eilrich (1991), Liu, Brorsen, Oellerman, and Farris (1994)]. Researchers have found it difficult to forecast the basis. This unpredictability presents hedgers with a risk that cannot be hedged.

The lack of liquidity also introduces risks for hedgers. Hedgers in liquid markets trade with little price effect on their transactions. However, in thin markets, the transactions of individual hedgers may have a significant effect on the price and may therefore result in substantial transaction costs [Thompson, Waller, and Seibold (1993)]. A futures market is considered to be liquid if traders and participants can quickly buy or sell futures contracts at low transaction costs [Thompson and Waller (1987), Berkman (1992), Bessembinder and Seguin (1993), Affleck-Graves, Hegde, and Miller (1994)].

This article defines liquidity as market depth. Kyle (1985) defines depth as the volume of unanticipated order flows required to shift prices by one unit. Market depth risk is the risk hedgers face when there is a sudden price fall or rise due to order imbalances. This risk seems important to systematic hedgers. Such price changes may occur in the case of a long hedge as well as a short hedge. When a market selling (buying) order arrives, the transaction price will be the bid (ask) price. For a relatively large market selling (buying) order, several transaction prices are possible, at lower and lower (higher and higher) values, depending on the size of the order and the number of traders available. If the selling order is large, the price should keep falling to attract additional traders to take the other side of the order. Given a constant equilibrium price, a deeper market will be one in which relatively large market orders produce a smaller divergence of transaction prices from the underlying equilibrium price. Note that hedgers can eliminate this risk when they give their orders to the brokers in limit prices. However, using limit prices means that they may run the risk that their trade cannot be executed. According to Lippman and McCall (1986) the thickness of the market for a commodity increases with the frequency of offers. Hasbrouck and Schwartz (1988) report the relationship between market depth and the trading strategies that market participants apply. Passive participants may avoid depth costs or may even profit from the execution costs that others have to pay, whereas active participants generally incur depth costs.

Note that the market depth costs are dependent on the basis of time of lifting. An example will make this clear. Suppose a cattle producer goes short for the December 1995 contract at 62 U.S. dollars. Now suppose that in December 1995 when (s)he enters the market to lift the hedge, the current basis is 0.5 U.S. dollar. The producer will buy to cover the short position. The market depth effect will push the price upward, so that the actual, realized basis is 0.1 U.S. dollar. Thus, the market depth risk has actually improved the hedging efficiency.

A hedger who wants to manage price risk will weigh the futures trading risk against the need to eliminate the cash price risk. In the next section these two components will be integrated into a concept of hedging efficiency.

CONCEPTUAL ASPECTS OF MEASURING HEDGING EFFICIENCY

The proposed measure informs the management of the futures exchange about the efficiency of a specific futures contract by comparing the ideal

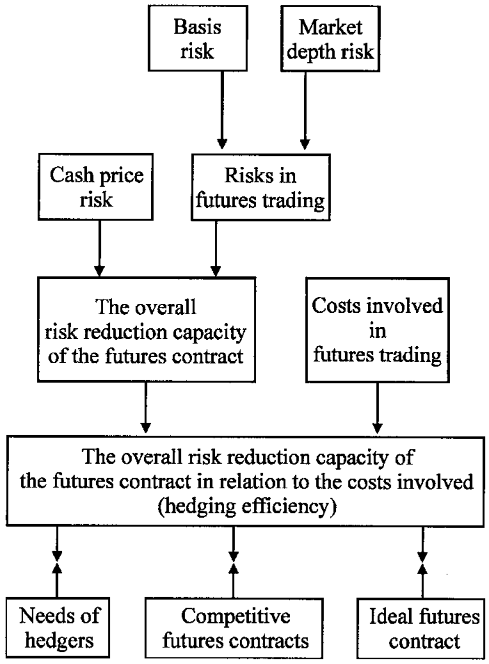

FIGURE 1
Concept of hedging efficiency.

hedge [where all cash price risk and futures trading risk is eliminated] with the actual hedge (see Figure 1). The proposed measure assesses the distance between the actual hedge and the perfect hedge. Furthermore, the proposed measure is able to divide the variance of a hedge into a systematic part, which can be controlled by the management of the exchange, and a random part, which is beyond its control.

Hence, the proposed measure is a complement rather than an alternative to the existing measures. A futures contract that is able to set a certain price without introducing other risks will best fulfill the hedger's need for hedging. In this case the hedger will not always use that particular futures contract, because the decision will also be influenced by the cost involved in futures trading, that is, commission costs and margin requirements. The hedger will weigh the cost involved in futures trading against the benefits derived from the futures contract. Therefore, the concept of hedging efficiency is defined as the capacity of the futures contract to reduce the overall risk (basis risk, cash price risk, and market depth risk) in relation to the cost involved in futures trading. For the futures exchange it is important to know how well the services provided by the futures contract meet the needs of the hedgers. The proposed

TABLE III

Conceptual Differences between the Measures of Hedging Effectiveness Reviewed and the Proposed Measure

	Measures of Hedging Effectiveness Reviewed	*Proposed Measure of Hedging Efficiency*
Related to:	Hedgers	Futures contract
Focus on:	Cash market risk	Cash market risk and futures trading risk
Concerned with:	Performance of portfolio	Hedging service of futures contract
Way of measurement:	Measuring reduction in variance in portfolios	Measuring distance between actual and perfect hedging services
Instrumental variables:	Means and variances Sharpe index	Variances divided into a systematic part and random part
Information for:	Hedgers	Management of futures exchange

concept of hedging efficiency assesses how well the futures exchange is able to achieve this goal. Figure 1 illustrates this concept of hedging efficiency.

This overall risk-reduction capability of the futures contract in relation to the trading costs involved is the hedging service the futures exchange provides. Two factors are important for the futures exchange: whether it meets the need of the hedgers with respect to overall risk reduction, and whether it can compete on that point with competitive futures exchanges.

Table III shows the conceptual difference between the measures of hedging effectiveness reviewed and the proposed one.

MEASURE OF HEDGING EFFICIENCY

In this section a measure of hedging efficiency is derived that is in accordance with the proposed concept of hedging efficiency. Each step is described, in order to understand the components combined in the measure (see Figure 1).

Because the futures market offers a risk management service, this service preferably should not introduce additional risk. For an ideal futures contract, two conditions have to be satisfied. The first is that when the futures contract matures, there is no basis.[1] The second is that there is no market depth risk. The basis can be measured by the difference between the cash price and the futures price; whereas the market depth

[1]The hedging efficiency measure is also applicable to the situation where the futures position is offset before maturity.

can be measured by the price difference between the prices for which hedgers enter the market, PF^1, and the prices of successive contracts traded, PF^k, as is shown in eq. (1).

$$DC_j = \sum_{k=1}^{K} \frac{V_k^*(PF^1 - PF^k)}{V} \tag{1}$$

where DC_j is the market depth costs of futures contract; j, PF^k, the price of the kth futures contract; with k the number of changes in transaction prices; with $k = 1 \ldots K$, K, the total number of transaction prices; v_k, the volume of futures contracts sold at PF^k; and v, the total volume.

The proposed depth measure assesses the average depth costs per futures contract. If the futures market introduces no additional risk, the futures contract is a perfect or ideal one. Let IPR_{t+1} be the price the hedger would realize for time $t + 1$ if an ideal futures contract is used; $P_{(t+1)}$, the commodity price in the cash market at maturity; and $PF_{(t+1)}$, the futures price at maturity. If the futures contract is a perfect one, a short hedger will realize a price of[2]

$$IPR_{t+1} = PF_t \tag{2}$$

which implies that $PF_{t+1} = P_{t+1}$.

The price actually realized will differ from eq. (2) because of the basis, market depth cost, and trading costs (i.e., commission) and can be expressed as[3]

$$ARP_{t+1} = PF_t^1 - B_{t+1} - DC_{t+1} - C \tag{3}$$

where PF_t^1 is the futures price at the moment of entrance; ARP_{t+1} is the actual price realized; B_{t+1}, the basis of the futures contract; and DC_{t+1}, the market depth cost when initiating the futures position and offsetting the futures position. The service of risk reduction by futures contracts is not free; the hedger has to pay for it. Therefore, C is the cost involved in futures trading per futures contract, represented by the commission.

ARP_{t+1} is a stochastic variable because of the stochastic nature of the basis and the market depth costs. The expected value and the variance of ARP_{t+1} can be expressed as $\mu_A = E(ARP_{t+1}) = PF_t^1 - C - E(B_{t+1} + DC_{t+1})$ and $\sigma_A^2 = E\,(ARP_{t+1} - \mu_A)^2$, respectively. Defining $FTR =$

[2]Because it is not essential for the derivation of the measure of hedging efficiency, a long hedger could be used equally well in this example.

[3]Note that the basis and liquidity cost should not be a problem for the price the hedger wants to realize, if the hedger is able to internalize this basis and liquidity cost.

$B_{t+1} + DC_{t+1}$ and $\mu = E(B_{t+1} + DC_{t+1})$, the variance of ARP_{t+1} can now be written as

$$\sigma_A^2 = E(FTR - \mu)^2 = E(FTR^2 - \mu^2) \tag{4}$$

subsequently, $E(FTR^2) = \sigma_A^2 + \mu^2$.

To interpret the measure of futures trading risk, μ^2 can be looked upon as the *systematic deviation* of a futures contract at time period, $t + 1$, from the ideal futures contract and σ_A^2, the *random deviation*. Knowledge of the systematic part is very important to the futures exchange because this part of the total deviation is caused by contract specification and futures exchange structure (trading system, kinds of traders allowed, etc.) and, therefore, can be managed by the futures exchange. For example, a hedger in Jacksonville will know that (s)he has to discount the transportation costs if the futures contract specifies delivery in Chicago and that because of those costs the price set by a hedge will deviate from the price locked into with the help of a Chicago exchange, that is, the systematic deviation. The exchange in Chicago could reduce this systematic deviation by allowing delivery in Jacksonville [see Pirrong et al. (1994)]. The random deviation is dependent on factors that are beyond the control of the futures exchange.

Similar to the coefficient of variation,[4] the futures trading risk measure ($FTRM$) is measured as the square root of the futures trading risk, $E(FTR_{t+1}^2)$, relative to the net price for the hedger if an ideal futures contract is used:

$$FTRM = \frac{\sqrt{E(FTR_{t+1})^2}}{PF_t^1 - C} \tag{5}$$

where the net price is the futures contract price minus the cost of commission, $PF_t^1 - C$.

Hedging Efficiency

Risk in futures trading does not indicate, per se, how well a futures contract will meet the hedger's need. The hedger's need to reduce, if not to eliminate, cash market risk without introducing futures trading risk im-

[4]The standard deviation is expressed as a fraction of the mean. For data from different sources, the mean and standard deviations often tend to change together, so that the coefficient of variation is relatively stable. Furthermore, being dimensionless, the coefficient of variation is easy to remember [Snedecor and Cochran (1994)].

plies that both the risks of futures contracts and of the cash market have to be included in a measure of hedging efficiency.

Analogous to the measure of futures trading risk, the measure of cash price risk is defined as

$$CPRM = \frac{\sigma_{CP}}{E_t\,(CP)} = \frac{\sqrt{E(CP_t - \overline{CP})^2}}{\overline{CP}}, \tag{6}$$

where $\overline{\text{CP}}$ is the mean of the cash price over the period from initiating the futures position to the time of liquidation of the futures position.

A hedger will tend to use a futures contract if the value of the futures trading risk measure (5) is low compared with that of the measure of cash price risk (6). In that case the hedger is exchanging high risk in the cash market for low risk in the futures market. For this reason the following measure of hedging efficiency is proposed:

$$E = \frac{FTRM}{CPRM} \tag{7}$$

where $E \geq 0$.

The value of the proposed measure ranges from zero to infinity. If the proposed measure is smaller than 1, hedgers will reduce their risks because they exchange a larger cash price risk for a smaller futures trading risk. Note that if the value of the proposed measure increases, the hedging efficiency decreases.

Equation (7) can be rewritten as

$$E = \frac{\sqrt{E(FTR_{t+1})^2}\,\overline{CP}}{(PF_t^1 - C)\,\sqrt{E(CP_t - \overline{CP})^2}} = \frac{(\sqrt{\sigma_A^2 + \mu^2})\overline{CP}}{(PF_t^1 - C)\,\sqrt{E(CP_t - \overline{CP})^2}} \tag{8}$$

where $\sqrt{\sigma_A^2 + \mu^2}$ represents the distance between the actual hedging service and the perfect service, divided into a systematic and a random part.

The operational measure of hedging efficiency can now be expressed as

$$E = \frac{\sigma_{FTR}\overline{CP}}{(PF_t^1 - C)\,\sigma_{CP}} \tag{9}$$

where $\sigma_{FTR} = \sqrt{(B_{t+1} + DC_{t+1})^2}$.

The intuition behind eq. (9) is the following: if the futures trading risk increases compared with the cash price risk, the hedging efficiency decreases. Furthermore, if the commission costs increase, the hedging efficiency decreases.

EMPIRICAL TEST OF THE EDERINGTON MEASURE AND THE PROPOSED MEASURE

Because the Ederington measure is still the most used measure in practice as well as in research, the Ederington measure is compared with the proposed measure of hedging efficiency. However, these measures are in no way substitutes, because they serve different purposes.

Data and Methodology

The Ederington measure and the proposed measure are calculated with the use of data on the potato futures contract traded at the Amsterdam Agricultural Futures Exchange (ATA). The annual volume (200,000 contracts in 1995) is small compared with agricultural futures traded in the United States. The sample covers the period from September, 1995 up to April, 1996. This period equals 1 potato storage year, that is, potatoes harvested in 1995. The data on transaction-specific futures contract are obtained from the Clearing Corporation (NLKKAS) of the ATA. The cash price data are obtained from the Rotterdam potato cash market (the central spot market for potatoes in the Netherlands.)

The transaction-specific data consist of the price quoted of every futures contract traded in a chronological order. With these data the market depth costs can be calculated. The market depth costs in the case of an order selling imbalance are calculated as the area between the downward-sloping price path and the price paid by the hedger when he enters the futures market. The market depth costs in the case of an order buying imbalance were calculated as the area between the upward-sloping price path and the price paid by the hedger when he or she enters the futures market. Having determined the market depth costs, the spot prices and the closing prices of the futures contract, the proposed measure can be calculated according to eq. (9).

Because the time-series data are limited, this study can only test the hedging performance of hedges held over two short periods: (a) 1-day period and (b) 1-week period. This type of hedging, offsetting the contract within 1 day or 1 week, seems more relevant to a speculative transaction than a systematic hedging transaction, because the period of harvesting and storing the potatoes covers about 1 year. Therefore, this empirical analysis must be viewed as illustrative only.

TABLE IV

Hedging Performance of Potato Futures Contract April 1996 Measured by the Proposed Hedging Efficiency Measure (E) and the Ederington Measure (EM).

Day Hedging		*Week Hedging*	
E = 1.3800	EM = 0.92405	E = 1.28916	EM = 0.94006
μ^2 = 63.303		μ^2 = 63.620	
σ_A^2 = 65.398		σ_A^2 = 59.359	

It is well known that the hedging effectiveness tends to increase as the investment horizon increases [Castelino (1992), Geppert (1995)]. Therefore, it can be expected that both measures indicate that situation (b) is more effective than situation (a). Furthermore, it is expected that the proposed measure shows relatively lower efficiency than the Ederington measure because the latter does not include market depth costs and commission costs. The empirical analysis also reveals the managerial implications of the proposed measure, that is, providing information about what part of the hedging inefficiency can be managed by the exchange.

Results

Table IV tabulates the value of the hedging performance measured by the Ederington measure and the proposed measure for the two different periods of hedges, 1 day and 1 week, respectively. Furthermore, Table IV presents the systematic deviation, μ^2, and the random deviation, σ_A^2. Both measures indicate that the hedging performance increases (the proposed measure decreases and the Ederington measure increases) as the period of hedges held increases.[5] This result confirms the results of previous research [Castelino (1992), Geppert (1995)].

From Table IV it also appears that the hedging effectiveness for both hedge periods is high according to the Ederington measure. This is in contrast to the proposed measure, which indicates that the hedging efficiency is relatively low, that is, the futures trading risk measure exceeds the cash price risk measure. This different result between both measures is due to the fact that the proposed measure takes basis risk, market depth costs, and commission costs into account; whereas the Ederington measure only takes the basis risk into account.

[5]Note that a low value of the Ederington measure indicates a low hedging effectiveness, whereas a low value of the proposed measure indicates a high hedging efficiency.

One can derive from the proposed measure that for both the 1-day hedge and the 1-week hedge the systematic deviation, μ^2, accounts for about 50% of the total distance between the perfect and the actual hedges.

The data indicate that both the basis and the market depth risk contribute to the relatively inefficient hedging possibilities of the potato futures contract. This has already been recognized by the management of the ATA which is redesigning the contract to decrease basis risk and the trading system to lower the market depth risk.

SUMMARY AND CONCLUSIONS

In this study a concept of overall risk reduction and a new measure of hedging efficiency are described. In contrast to existing measures, this one does not focus on the performance of a portfolio but on the hedging service of the futures contract. This measure takes into account that futures contracts not only reduce cash price risk, but also introduce a futures trading risk, consisting of basis risk and market depth risk. Furthermore, the proposed measure takes commission costs into account. The measure expresses the distance between the hedging service provided by the exchange and the perfect hedge. This distance is divided into a systematic part, which can be managed by the futures exchange, and a random part, which is dependent on factors that are beyond the influence of the futures exchange. The hedging efficiency measure provides the hedger with a tool for comparing the competitive strength of alternative futures contracts. Not only are the characteristics of the futures contract incorporated in the measure of hedging efficiency, but also those of the cash market risks, because both the quality of hedging service and the need for this service (i.e., the price risk in the cash market) are relevant to the success of the hedging service rendered by the futures exchange. The futures trading risk component of the measure indicates the hedging quality of the futures contract. The cash price risk component emphasizes the potential need for the futures contract. The empirical results indicate that the measure should be useful to the futures exchange management. Further research, in which the proposed measure is applied to different futures markets, is clearly called for.

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