EFFECTIVENESS OF THE MANAGEMENT OF PRICE RISK METHODOLOGIES FOR THE CORN MARKET BASED ON TRADING SIGNALS

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Abstract

Corn production is scattered geographically over various continents, but most of it is grown in the United States. As such, the world price of corn futures contracts is largely dominated by North American corn prices as traded on the Chicago Board of Trade. In recent years, this market has been characterised by an increase in price volatility and magnitude of price movement as a result of decreasing stock levels. The development and implementation of an effective and successful derivative price risk management strategy based on the Chicago Board of Trade corn futures contract will therefore be of inestimable value to market stakeholders worldwide.

The research focused on the efficient market hypothesis and the possibility of contesting this phenomenon through an application of a derivative price risk management methodology. The methodology is based on a combination of an analysis of market trends and technical oscillators with the objective of generating returns superior to that of a market benchmark.

The study found that market participants are currently unable to exploit price movement in a manner which results in returns that contest the notion of efficient markets. The methodology proposed, however, does allow the user to consistently achieve returns superior to that of a predetermined market benchmark. The benchmark price for the purposes of this study was the average price offered by the market over the contract lifetime, and as such, the efficient market hypothesis was successfully contested.

Keywords: Trading Signals, Price Risk, Effectiveness, Corn Market

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1 Introduction

Worldwide, roughly 829 million tons of corn is produced on an annual basis of which the bulk is grown in the United States (USDA 2012). The world price of corn is consequently determined to a large extent by North American corn prices. Ever since the inception of the Chicago Board of Trade (otherwise known as CBOT) in 1848, participants in the agricultural soft commodities market have had to adapt to a challenging and volatile futures market highlighted by extreme price movements.

According to Irwin and Good (2009), compelling evidence exists that the CBOT corn futures contract is on the brink of a new era of exceptional high volatility with increased uncertainty regarding the future price levels of corn futures contracts. The probable magnitude and volatility of future corn price movements are highlighted by reference to the shift in nominal prices during two previous periods. Irwin and Good identifies the first period as being from 1947 to 1972, a period characterised by the suspension of price controls, while the second period from 1972 to 2006 is known as a period of escalating energy prices and rapid inflation. The average monthly corn price increase between these periods was close to 89%.

Another structural change in corn prices occurred in 2006, resulting in the start of a new period of escalating commodity prices. Whereas the price of corn was previously determined by its feeding value to livestock, ethanol production currently explains 90% of all corn price fluctuations (Good, Hieronymus & Hinton 1980). In addition, Trostle (2008) states that the growth in demand from developing nations coupled with the current US monetary policy will result in a further surge in prices. These structural shifts in nominal prices, coupled with ever-increasing levels of volatility, comprise the least manageable factor threatening the existence of market participants and have stressed producers, processors and speculators literally beyond the breaking point (Nivens, Kastens & Dhuyvetter 2002). Uncertainty regarding the most appropriate and effective hedging and/or speculative methodology to be implemented under ever-changing technical and fundamental market conditions remains the single biggest shortcoming of market participants in their effort to mitigate price risks inherent in the futures market successfully.

In this paper the price-risk management performance from strategies, as implemented by stakeholders in the futures market, was identified and the returns achieved compared against a relevant benchmark. In addition, a structured approach to price-risk management was investigated through the identification of specific market trends. Trading signals were derived from the trends identified, resulting in the development of a trading methodology and the consequent comparison of returns achieved against a predetermined market benchmark.

2 Aim

This paper aims to identify the success by which participants in the soft commodity futures market mitigate the risk of price movement and volatility of corn futures contracts through the use of exchange-traded derivative instruments. As a result of thorough technical- and market price analysis, a derivative trading methodology will be developed. This methodology will be based on trading signals and market trends identified by means of the analysis applied on price data. The subsequent returns achieved by the proposed methodology will be benchmarked against the return offered by the market. Successful price-risk mitigation with returns superior to that offered by the market will contest the efficient market hypothesis and could serve as motivation for the development of similar risk management strategies with the objective of achieving superior returns.

3 Scope

This paper is divided into the following topics:

- Theoretical background on derivative instruments.
- Price-risk management performance of stakeholders in the corn futures market.
- Background and application of proposed risk management methodology.
- Evaluation of proposed price risk management methodology versus benchmark.

4 Theoretical background on derivative instruments

A broad explanation from Bodie, Kane and Marcus (2002:980) states that a derivative is a tool "… providing payoffs that depend on or are contingent on the values of other assets such as commodity prices, bond and stock prices, or market index values". According to the International Accounting Standards Board (IASB) (2006), all derivative instruments encompass the following three characteristics, namely:

- their value fluctuate in accordance with changes in a specified interest rate, commodity price, foreign exchange rate, credit rating or credit index, or other variable;
- derivative instruments require an initial investment smaller than required for alternative types of contracts with a similar response to changes in market factors; and
- it is settled at a future date.

The value of derivative instruments, as defined above, are based on the price of an underlying asset (Brigham, Daves & Gapenski 1999). These assets include:

- Commodities.
- Currencies.
- Stocks.
- Interest rates (This paper concerns the price of a commodity, namely corn)

Derivative instruments can, furthermore, be classified as either futures contracts, forward contracts or options contracts. Even though the form and terminology of futures contracts and forward contracts differ substantially, the fundamental mathematics and economics of these derivative instruments remain the same (Skerrit 2002). However, this paper concerns the futures contract for corn and can be described as an agreed-upon price at a certain time in the future (Hull 2002). According to Petzel (1989), a well-functioning futures contract should be general enough in nature to apply to a broad range of buyers and sellers. Since futures are exchange traded contracts, the following characteristics are standardized:

- The asset-type.
- The quantity of the asset.
- The quality of the asset.
- The future maturity date.

For the purposes of this paper, it is also important to briefly give an overview of price-risk management in the futures market.

5 Price-risk management performance of stakeholders in the futures market

Price movement and volatility complicates price discovery and represents an economic risk to all participants. Agricultural producers and processors make use of futures prices in forming price expectations and production estimates. Therefore, the accuracy and effectiveness with which price discovery occurs has important social welfare consequences for all hedgers in the corn futures market. In addition, soft commodity futures markets have become widespread investment vehicles among asset managers as a form of strategic and tactical asset allocation.

The magnitude of price risks can be large and it is therefore clear that risk management is worthy of attention during research. As such, the effectiveness with which market participants are able to accurately forecast future price movements in order to mitigate the risk of price volatility on their business endeavours. This is necessary, as it is the foundation on which the proposed risk management methodology will be based.

The most important role-players regarding the forecasting of futures price movements are the producers, processors, market advisory services and speculators.

5.1 Producers

Producers are at the start of the chain and are therefore expected to bear the brunt of negative volatility forces since their revenue streams are linked to commodity prices as a whole. Ever since the deregulation and liberalisation of futures markets, producers have been exposed to numerous price variations and uncertainties. Whereas prices used to be determined by subjective government intervention, the liberalised futures market now faces a number of price variables affecting prices on a continuous and irregular manner.

US producers identify commodity price risk as the single biggest challenge they face, notwithstanding the existence of a number of price risk management tools at their disposal (Irwin, Good, Martines-Filho & Batts 2006). In addition to the high levels of price risk, which threaten producers, research suggests that price behaviour is the least manageable factor threatening producers (Nivens et al. 2002). Coble, Patrick, Knight and Buquet (1999) derived their findings from a survey conducted among producers in Indiana, Mississippi, Nebraska and Texas where they found that corn price movement has by far the most potential to affect net farm income.

A general perception exists that producers perform poorly in the managing of corn price risk (Irwin et al. 2006). This view is supported by Decision Commodities (2006) which states that two-thirds of producers, on average, hedge themselves in the bottom third of the annual price range. A trend determined by Jesse (2009), indicated that producers' hedging strategies were not able to exploit high prices during the spring and early summer. The subsequent freefall in prices from July 2008 as a result of the global credit crisis suggests that either few hedging strategies were put in place beforehand or strategies lacked the ability to capture high price levels. A major obstacle faced by producers in hedging grains for future delivery is the fact that the extent of risk reduction from futures contracting can be miniscule when yield variability is high and a negative correlation exists between yield and price (Harwood, Heifner, Coble, Perry & Somwaru 1999).

5.2 Processors

Corn processors have an intrinsic added value in their businesses achieved by converting the raw product into saleable outputs. Price volatility can have serious financial consequences on corn processors and they therefore need to follow disciplined and rigorous hedging methodologies in order to monitor and control price exposure to the market.

According to Irwin and Good (2009), the most important implication of exaggerated price movement is the timing of entering into a hedging strategy. The recent increase in price volatility had a negative impact on processors, stressing market participants and institutions beyond the breaking point. Since corn used in the production of ethanol and consumed as animal feed amounts to 75% of all US corn usage (Finnegan 2011), it is important to determine the effect of volatile corn prices and extreme market movements on these two business sectors.

5.3 Market advisory services

Limited research has been done on the effectiveness of recommendations from advisory services. The earliest study from Marquardt and McGann (1975) into price outlook newsletters suggested that futures prices tend to be a more accurate forecaster of prices than either public or private newsletters. In 1996, Kastens and Schroeder (1996) examined returns achieved from implementing strategies recommended by up to ten advisory services over an 8-year period, with mixed results over different commodities.

A study by Irwin et al (2009), suggests limited and irregular returns in the top-third of the price range similar to results achieved by producers without any assistance in the marketing of their grains. This indicates that market advisory services provide modest results at best. In addition, it is determined that advisory programmes have only a marginal chance of realising returns superior to that of the chosen benchmark. The conditional probability of winner and loser advisory services provide little evidence that future pricing performance can be derived from past performance. It is clear that advisory services, either individually or as a group, seems to lack the necessary expertise to outperform the market. Although producers tend to make use of these programmes in order to shift the decision-making responsibility from themselves, research on the effectiveness of market advisory services suggests that the results achieved are not sufficient to justify the costs associated with the programmes.

5.4 Speculators

Stewart (1934) is credited for his pioneering research on the profitability of speculators in the soft commodities futures market. In order to determine the ability of speculators to consistently outperform the futures market, he engaged in an analysis of more than 9 000 speculative accounts over a nine-year period. A prerequisite for these trading accounts was that trades had to be limited to exclusively grain futures positions. The results of the study were somewhat concerning, given that close to 75% of all speculative accounts lost money. In addition, the average loss on the accounts analysed amounted to six times the value of the average profit.

A major risk faced by speculators in the corn derivatives market is the formation of speculative bubbles as a result of increased speculative buying by mutual funds. This implies that the actual price of the underlying commodity by far exceeds the fundamental value (Masters & White 2008). The main thrust in the opposition to the formation of speculative bubbles is that large inflows of speculative money allows for significant and unwarranted support for commodity prices. Once the flow of speculative money is reversed by way of liquidation of speculative long positions, the bubble bursts and investors are subject to the risk of forfeiting all accrued profits and, in extreme cases, the starting capital as well (Irwin, Sanders & Merrin 2009).

The evidence discussed and presented in this section indicates that none of the market participants currently holds an edge over the futures market and that market volatility is to be blamed for the lack of successful hedging and speculative strategies. With market volatility expected to increase continuously in the future, the difficulty of managing and mitigating price risk is expected to grow along with price uncertainty.

6 A proposed price-risk management methodology

This section will focus on various individual technical analysis oscillators, as well as a combination of oscillators providing trading signals upon which a proposed price-risk management methodology will be based.

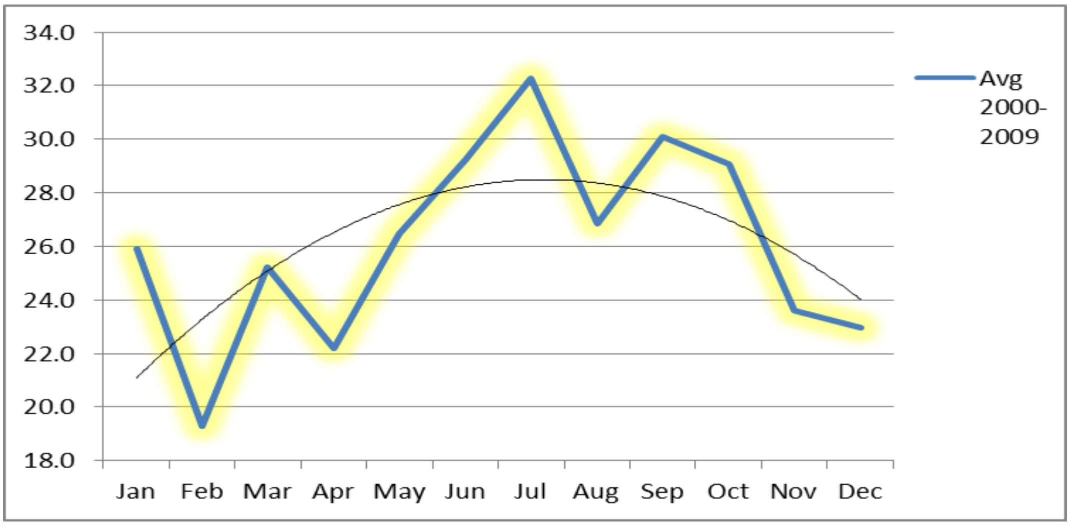
6.1 Technical analysis

Brown and Jennings (1989) define technical analysis as a forecasting method which uses past prices to infer private information. This is consistent with the definition by Blume, Easley and O'Hara (1994) who state that technical analysis is a method through which price and volume data are examined with the objective of obtaining information regarding future price movements. A description very much similar to this from Kleinman (2005) suggests that technical analysis encompasses research of past and current price action with the objective of accurately projecting future price action. He states that market technicians believe that the single most important factor necessary for price forecasting is price action.

6.2 Technical oscillators

Oscillators are indicators which determine when a market is trading in overbought or oversold conditions. Prices do not move straight up or straight down forever without corrective moves. At an uncertain time and price level in the future, prices will turn, either temporarily or permanently. According to Kleinman (2005), a market is said to be overbought when the specific oscillator reaches an upper extreme. At that moment, the market is deemed too high since it is running out of buyers and is therefore about to fall under its own weight. Once the oscillator fluctuates at a lower extreme, oversold conditions are present. This represents a period when the market is running out of sellers and prices approach a level at which a bounce can be expected.

Figure 1. Average monthly corn futures price volatility for period 2000–2009



Source: CME Group (2011)

The most common oscillators used by technical analysts in the forecasting of prices include the relative strength index (RSI) and slow stochastic. Whilst the moving average is not recognised as an oscillator, it remains an essential forecasting tool when futures prices are in a trending phase.

In order to confirm the trend in the volatility of corn futures contracts, the average monthly volatility is calculated over the period 2000–2009. The monthly average over the ten-year period is determined in order to present the researcher with the eventual trend for the period under scrutiny. Figure 1 graphically illustrates the average monthly corn futures price volatility for the period 2000-2009, as well as the polynomial trendline. The result supports the findings of Goodwin and Schnepf (2000) as well as those of Seeley (2009).

6.2 Price risk management methodology

In contesting the notion of the efficient market hypothesis, it is proposed that a combination of technical analysis and observable market trends can be exploited in a manner that will enable the trader to achieve returns superior to those offered by the market. This section will aim to describe the background on the methodology underlying the trading strategy.

For the purposes of this study, the methodology was applied to the main CBOT corn delivery month (December) over the course of the calendar year (first trading day to last trading day of the specific futures contract).

6.3.1 Price risk management methodology

The methodology is discussed with reference to particular trading dates.

6.3.1.1 1 January – 30 April

For the period 1 January to 30 April, the producer (processor) and speculator entered into trading transactions once all of the technical indicators had been aligned simultaneously in a sell (buy) signal. This included the RSI >70% (<30%), stochastic indicator >70% (<30%) and the 9-day moving average > (<) 21-day moving average. If no trading signal had been received before 30 April, the trades had to be entered into automatically on 30 April notwithstanding the absence of technical signals.

These transactions included:

- On the first day a sell (buy) signal was indicated, the producer (processor) entered into an at-the-money long put (call) position. The purpose of the methodology was to mitigate price risk. By engaging into a long at-the-money option, the risk of adverse price movements was addressed while still providing the option holder with the *force majeure* characteristic, which eliminated the risk of delivery. This trade was entered into specifically before 30 April as option volatility on average tended to increase dramatically from May onward, which resulted in a higher option premium.
- In an attempt to exploit volatility movement, a 20% out-of-the money put (call) option was also purchased with the objective of selling the option at a higher volatility level and therefore option premium during the next buy (sell) signal.
- The long option positions entered into may have proved to be quite expensive given the duration until option expiration. In an attempt to soften the initial option cost, the trader should have exploited the time value of options by selling a 20% out-of-the money call (put) option. This option trade was reversed on the following buy (sell) signal after gaining time value. Had the 20% out-of-the money option proved to be worthless (i.e. worth $0.01 or less), it would have been bought instead as the maximum risk equaled possible transaction costs.

6.3.1.2 1 January to last trading day

It was important to monitor the long at-the-money put (call) position continuously throughout the course of the trading year. On each of the successive sell (buy) signals the strike level of the long option was compared to the current market price. In the instance where the current futures price on a sell (buy) signal was trading higher (lower) than the original strike price by 10% or more, the long put (call) option had been sold and replaced with an at-the-money long put (call) option. This is referred to as rolling the option up (down) and this took place until option expiration. The original at-the-money option was sold only in the instance where the option was worth $0.01 or less, otherwise it was carried forward to the following signal. By doing this, the strategy allowed the user to move with the market and continuously achieve higher (lower) minimum (maximum) price levels.

- The 20% out-of-the money put (call) option was sold on the following buy (sell) signal, except when it was worthless (in this case, it was carried forward to the next trading signal). Given the volatility trend identified, it was more than likely that this would occur at higher volatility levels. In order to exploit the higher volatility levels, the option was replaced with a short 20% out-of-the money put (call) option, only if the option was worth more than $0.01. Had the futures price moved beyond the strike of the short option, it had to be hedged through delta trading of futures contracts. The option was liquidated on the next sell (buy) signal.
- The short 20% out-of-the money call (put) option was reversed on the following buy (sell) signal after gaining time value. This was done if the option was worth $0.01 or less, otherwise it was carried forward to the following signal. Had the futures price moved beyond the strike of the short option, it had to be hedged through delta trading of futures contracts.

In the instance where the option was initially worthless and as a result a long position call (put) option was entered into, the option was reversed on the following sell (buy) signal.

6.3.1.3 Option expiration

On option expiration, the producer (processor) ended up with one short (long) futures position for every long option contract initially entered into.

The speculator had no positions as the short future and long future offset each other. Therefore:

- If the long put (call) option was in-the-money on option expiration, a short (long) futures contract would automatically be realised through the exchange. If the long put (call) option was out-of-the-money on option expiration, the producer (processor) would enter into a short (long) futures contract at current market prices. The same scenario applied to speculators.
- Had the put (call) option still been open and worthless, it would have expired without any addition of futures contracts. If the long option was in-the-money, profit should have been taken by the trader at current market levels. If the short option was in-the-money, it should already have been mitigated by means of delta transactions and therefore not impacted on the net futures position.
- Had the short put (call) option still been open and worthless, it would have expired without any addition of futures contracts. If the short option was in-the-money, it should already have been mitigated by means of delta transactions and therefore not impacted on the net futures position.

7 Evaluation of risk management methodology versus benchmarking

The feasibility and success of the price risk management methodology applied on futures prices can only be determined once its performance has been compared to the returns offered by the market. The specific calculation of the market return is an important consideration in the evaluation of a strategy. The concept underlying the evaluation of the performance of a risk management strategy is the comparison of net prices achieved by the strategy versus the returns offered by the passive market. This benchmarking serves as an objective standard of performance (Irwin et al. 2006).

Benchmarking, according to external benchmarks, is based upon the efficient-market theory. This entails that markets are rational, all-knowing and that competition among participants in the marketplace will immediately eliminate all possible arbitrage opportunities available through the exploitation thereof (Irwin et al. 2006). For the purposes of this study, the benchmark that will be used to evaluate the performance of the proposed methodology is the average market price for the December corn futures contract over the period 1 January to 30 November.

7.1 Returns achieved versus benchmark 2000–2009

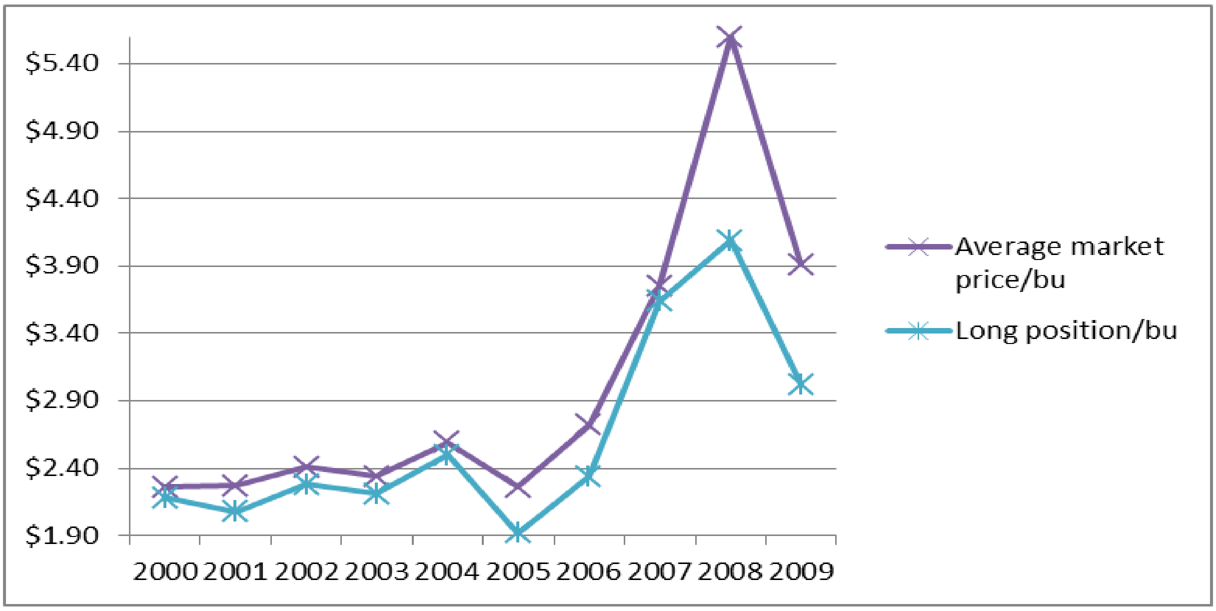
In order for the proposed price risk management methodology to be accepted and therefore to challenge and contest the notion of efficient markets effectively, the price risk management methodology needs to achieve returns superior to that of the chosen benchmark, i.e. the average market price, consistently. Table 1 reflects a summary of the net returns (after adjustment for option costs) achieved by the methodology versus the average market price.

Table 1. Methodology returns vs. benchmark 2000–2009

Year	Average market price	Long position	Short position	Speculative profit
2000	$2.26	$2.18	$2.30	$0.12
2001	$2.27	$2.08	$2.30	$0.22
2002	$2.41	$2.28	$2.56	$0.28
2003	$2.34	$2.21	$2.34	$0.13
2004	$2.59	$2.50	$2.70	$0.20
2005	$2.26	$1.92	$2.28	$0.36
2006	$2.72	$2.34	$3.13	$0.79
2007	$3.75	$3.64	$3.78	$0.14
2008	$5.60	$4.09	$5.97	$1.88
2009	$3.91	$3.02	$4.58	$1.56

The annual long position price level obtained through application of the derivative price risk management methodology versus the benchmark average market price is depicted graphically in Figure 2.

Figure 2. Performance evaluation of methodology: Long position vs. benchmark 2000–2009



As is evident from the graph, the methodology consistently achieved a long position at a price level lower than the comparative benchmark after adjusting for relevant option costs. As a result, the conclusion can be reached that the methodology has a high degree of price forecastability through which market movement can be exploited.

Figure 3 illustrates the annual short position price level obtained through application of the derivative price risk management methodology versus the benchmark average market price. The graph clearly indicates that the methodology was consistently able to achieve a short position at a price level superior to that of the comparative benchmark average market price, even after subtracting the option costs from the returns achieved. Therefore, the conclusion can be made that the methodology has a high degree of price forecastability by which market movement can be exploited.

Figure 3. Performance evaluation of methodology: Short position vs. benchmark 2000–2009

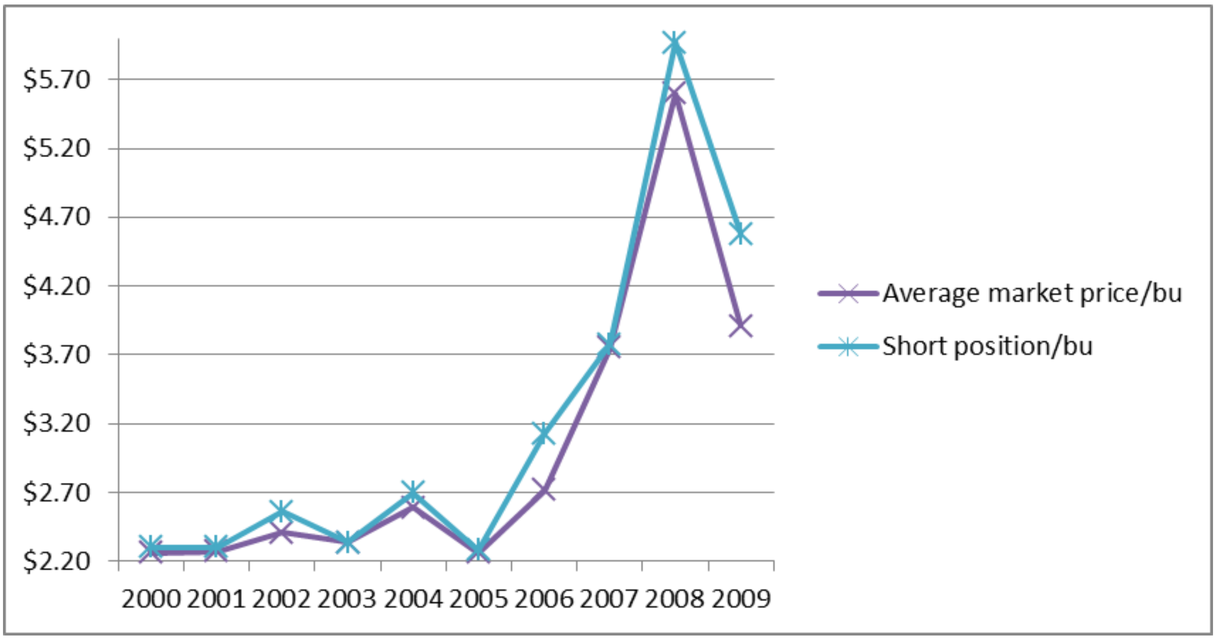
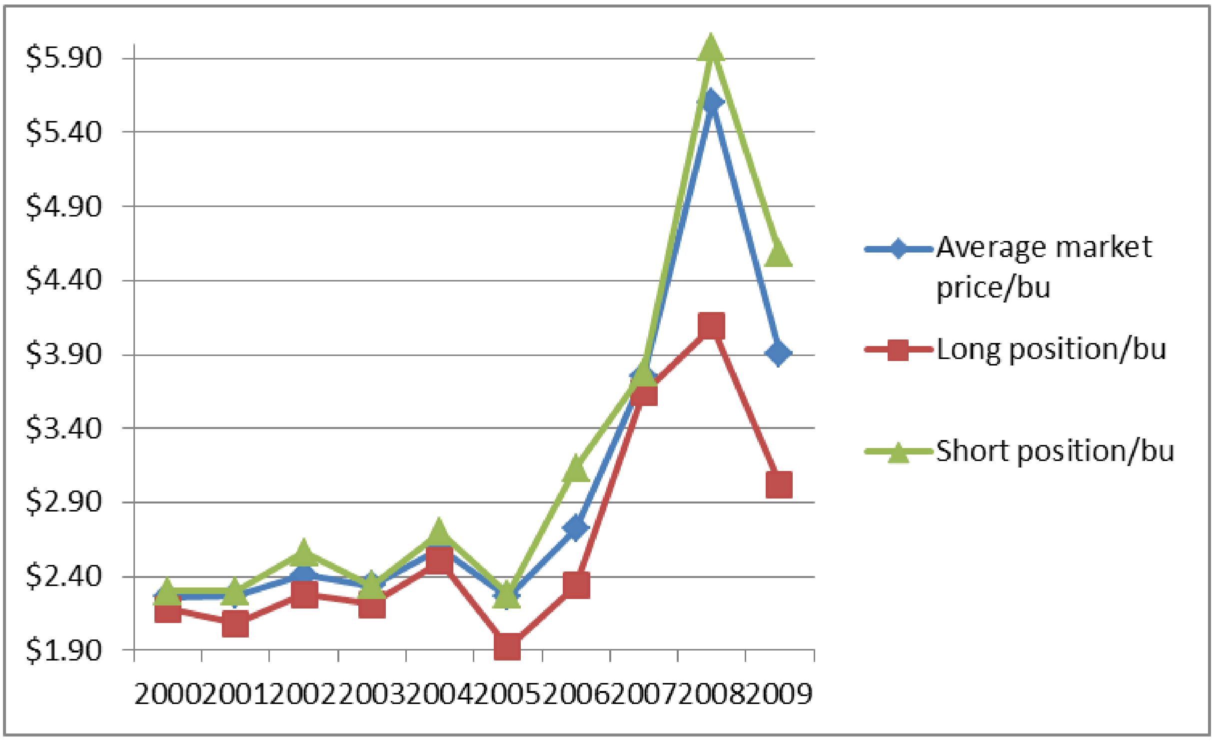


Figure 4 graphically reflects a summary of the methodology returns as presented in Table 1. It is evident from the illustration that the benchmark average market price is outperformed on an annual basis by both the long position price level and the short position price level.

Figure 4. Summary of financial performance of methodology vs. benchmark 2000–2009



If the conclusion holds that the methodology is able to realise a long position price level lower than that of the comparative benchmark as well as a short position price level higher than that of the comparative benchmark, it is obvious that speculative profits should be made when simultaneously engaging in a long- and short position by using exactly the same methodology. This is depicted in Figure 5, which confirms an annual short position in excess of the annual long position on a consistent basis. Figure 6 indicates the net speculative profit realised on an annual basis after adjusting for option costs.

Figure 5. Summary of long position price level vs. short position price level 2000–2009

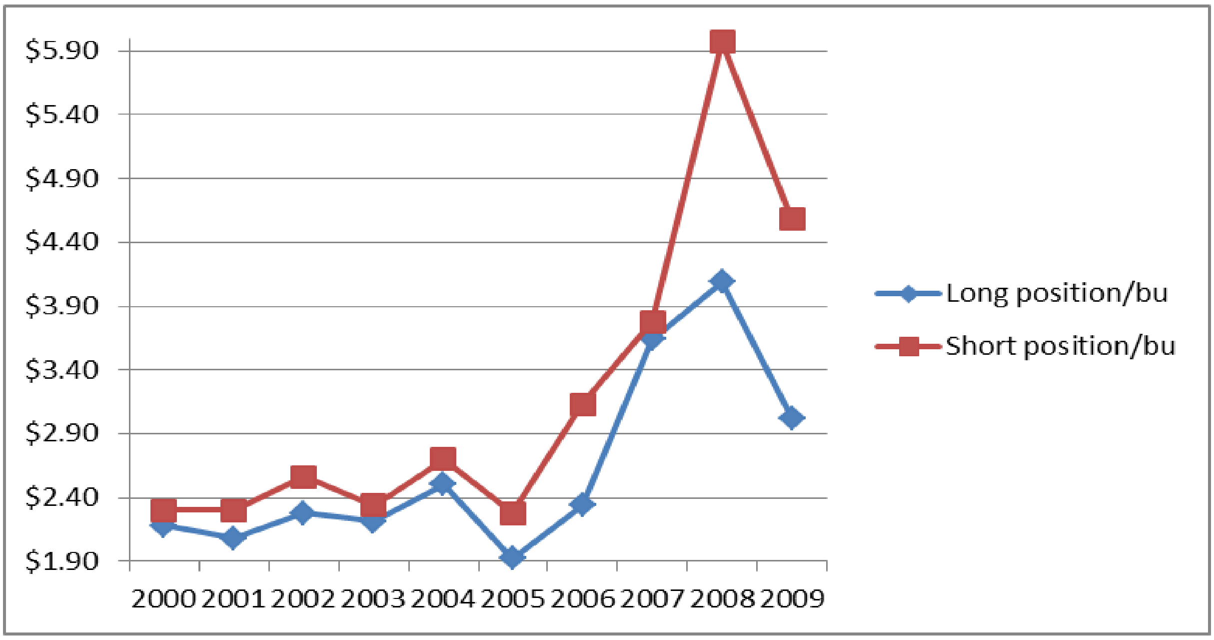
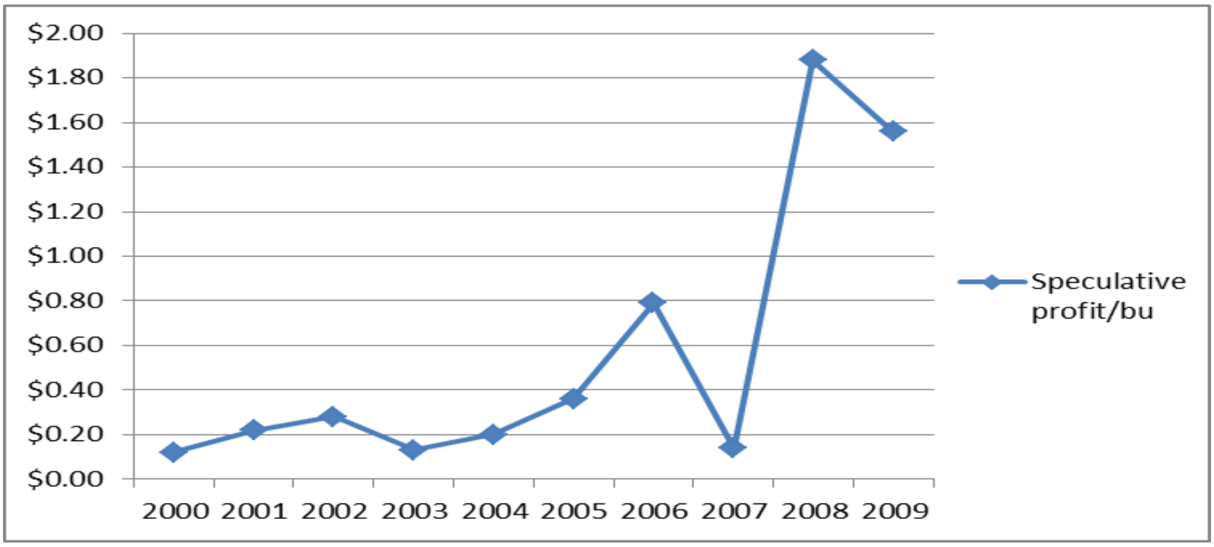


Figure 6. Speculative profits achieved by means of application of methodology 2000–2009



7.2 Application of methodology on random data sets

In order to obtain scientific credibility and to prevent the possibility of data snooping or bias when applying the derivative price risk management methodology on historical data, a number of data sets are randomly drawn after which the methodology is applied in terms of the data obtained. A successful application will further enhance the feasibility of the methodology and provide additional support for ultimately accepting the methodology in contesting the efficient market hypothesis.

7.2.1 Calculation of random data sets

The price data are gathered by application of the random function (in Microsoft Excel) in terms of randomly chosen data:

- The base price used on the first date of trading equals $3.00 per bushel (bu).
- In order to calculate the technical oscillators, a daily high, daily low and daily closing price needs to be obtained.
- The daily close is calculated firstly by assigning a random price movement of between -$0.30/bu and +$0.30/bu (limit down to limit up) on the closing price of the previous day.
- The daily low is calculated by randomly assigning a trading range of between -$0.30/bu and $0.00/bu on the daily closing price already obtained.
- For the calculation of the daily high, a randomly selected value of between $0.00/bu and +$0.30/bu is applied in terms of the daily closing price already obtained.
- Once these sets of data have been summarised, the methodology is applied in terms of the random data in order to evaluate the effectiveness of the price risk management methodology in contesting the efficient market hypothesis.

7.2.2 Returns achieved through application of methodology on random data sets

Table 2 reflects a summary of the net returns (after adjustment for option costs) achieved by the methodology versus the average market price as depicted by the series of random data sets.

Table 2. Methodology returns versus benchmark on random data sets

Sample	Average market price	Long position	Short position	Speculative profit
1	$3.21	$2.35	$4.23	$1.88
2	$2.20	$0.70	$3.14	$2.44
3	$4.40	$3.09	$4.51	$1.42
4	$2.52	$0.45	$2.65	$2.20
5	$3.04	$0.48	$3.43	$2.95
6	$3.45	$3.19	$4.45	$1.26
7	$2.87	$0.91	$4.85	$3.94
8	$3.89	$3.41	$3.90	$0.49
9	$2.59	$2.58	$2.90	$0.32
10	$2.65	$1.15	$2.65	$1.50

From these results, it is evident that the proposed methodology was able to outperform the relevant benchmark as presented by the randomly chosen independent data. It is therefore suggested that the methodology is indeed capable of successfully contesting the notion of efficient markets.

Of interest though is the impact of a trendless market on the application of the methodology. Since the randomly chosen data sets are involuntary in nature, they do not adhere to a price trend as observed over the period 2000–2009 in terms of which the methodology is applied. During these ten years, a total of 20 observations were made (consisting of long positions and short positions) of which only three required delta trading in order to offset a short position in an option. The 20 observations made in the ten randomly chosen data sets required delta trading in eleven instances. It can therefore be concluded that trendless markets require a trader to delta out short options positions in comparison to trending markets more frequently.

8 Conclusion

This study indicated that the majority of previous research on the subject accepts and confirms the validity of the efficient market hypothesis. A literature study among producers, processors, speculators and market advisory services further enhanced the view that market participants are unable to mitigate the risk of price movement and subsequently cannot outperform the returns offered by the market.

The proposed price risk management methodology aims to create social wealth through an increase in profits. This is achieved by creating the trading methodology in a manner that does not rely on human intervention but rather implies that the art of trading should be performed in a routine process as stipulated by the methodology. The underlying concept of the methodology is to allow the user to enter into trades not based on emotion or market sentiment, but rather on a trading signal which is based on a basic market analysis that does not have to incorporate human intervention. Upon implementing these trading signals, the user should achieve profits superior to the average market return. This methodology addresses the problems as highlighted in the empirical research regarding the need for a strategy, which mitigates risk, incorporates a *force majeure* and provides superior returns. In short, the methodology improves decision-making by allowing the trader to base trading decisions on an automated trading suggestion.

Since the average market return is outperformed on a consistent basis, the efficient market hypothesis is contested successfully and previous findings supporting the hypothesis should be questioned. Even though the view that futures prices already incorporate all relevant market information is not questioned, it is suggested that a thorough market analysis may allow for trading opportunities, which might deliver superior results.

The proposed methodology does not suggest being exhaustive in any manner, and similar alternative strategies should exist in theory. It does however confirm that market participants should be able to exploit market movement for their benefit. After considering the results of this study, the following recommendations are made to assist traders in mitigating the impact of price volatility:

- Increase individual knowledge on derivative instruments through thorough education on the mathematics underlying futures and options contracts.
- Support the development of core/satellite price risk management strategies which consist of trading methodologies based on an indexing strategy.
- The trading function should in part be outsourced to professionals specialising in exotic options based on the expectation of achieving above-average prices.

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