EVALUATION OF BASIC WHITE MAIZE PRICING STRATEGIES VS SPOT MARKET PRICING STRATEGIES

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Abstract

The use of modern marketing strategies to minimize risk exposure is not a widely adopted practice amongst maize producers. The producers tend to use high risk strategies which include the selling of the crop on the cash market after harvest; whilst the high market risks require innovative strategies including the use of futures and options as traded on South African Futures Exchange (SAFEX). This is mostly due to a lack of interest and knowledge of the market. The purpose of the study is to examine whether the adoption of a basic routine strategy is better than adopting no strategy at all. The study illustrate that by using a Stochastic Efficiency with Respect to a Function (SERF) and Cumulative Distribution Function (CDF) that the use of five basic strategies namely a Put (plant time)-, Twelve-segment-, Three-segment-, Put (pollination) and Sell after pollination can be more rewarding. These strategies can be adopted by farmers without an in-depth understanding of the market and market-signals. The results obtained from the study illustrate that producers who tend to be more risk neutral would prefer using the Twelve-segment- or Spot-strategy whilst a risk averse producer would prefer the Three-segment, Feb-Put or Dec-Put strategy. It also indicates that no strategy can be labelled as the all-time best and that the choice between strategies depends on the risk aversion of the producer.

Keywords: Marketing strategies, futures, options, SERF

Sub theme: Marketing and Trade

1. Introduction

Profit is the reward for risk-taking and therefore profit seekers in the farming business, or in any other business, must be prepared to bear some risk (Varangis, Donald and Anderson, 2002). Large fluctuations in yields and prices in agricultural products create a high income risk profile for farmers (Jordaan *et al.,* 2007).

Price risk is a major source of risk to producers both locally and internationally (Woodburn, 1993; Coble and Barnett, 1999). Prior to the deregulation of markets in 1996, grain prices were determined by the Maize Board. This period of regulation ended with the promulgation of the Marketing of Agricultural Products Act of 1996 which regulated the demise of the control boards and price intervention. Groenewald *et al.* (2003) argue that the variability of maize prices has increased since deregulation. Jordaan *et al.* (2007) confirmed the increase of variability by means of determining the price volatility of field crops that are traded on the South African Futures Exchange (SAFEX). The increase in price variability has exposed South African producers' price risk management abilities.

The selection of good price risk strategies depends on the farm operator, the financial institution, and the risk attitude of the producer (Akcoa and Ozkan, 2005). There are numerous ways in which price risks can be managed; of which the use of the derivative market is only one method. However, forward contracting of produce is a relatively widely used form of risk management for farmers, the most common being a contract for the sale of a crop (Varangis, Donald and Anderson, 2002).

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In financial markets, the term derivatives are used to refer to a group of instruments that derive their value from some underlying commodity in the market. Forwards, futures, swaps and options are all types of derivative instruments and are widely used for hedging or speculative purposes (JSE, 2010). Applications of these instruments in a continuously changing market environment require an in-depth understanding of global markets and knowledge of present and future trends with regards to the agricultural sector.

Agricultural economists have devoted much effort on attempts to analyze agricultural commodity derivative markets in attempts to find guidelines on how risk-averse producers 'should' use such markets. However, reality is that rather few farmers actually use these markets to hedge their price risks in South Africa. Most probably the reason is because of a lack of knowledge on how the market works (Varangis, Donald and Anderson, 2002). Jordaan and Grové (2007) also found that only 44% of their sample of respondents used forward pricing strategies. None of these respondents used option strategies. These researchers indicated that respondents perceive the market as ineffective and that the producers have a lack of human capital to apply more complicated marketing strategies. Various international authors including O'Brien (2000), Zulauf, Larson, Alexander and Irwin (2001), Bates (2003), and local authors such as Grönum and van Schalkwyk (2000) Scheepers (2005) and Cass (2009) evaluated marketing strategies consisting of futures and options. In many instances these strategies are too complicated for farmers to apply.

Price risk management is hampered by the presence of highly sophisticated marketing strategies that are not likely going to be adopted by producers that are not highly skilled in the application of these strategies. The question therefore is to what extent less complicated marketing strategies (such as routine marketing strategies) could be effective in price risk reduction. O'Brien (2000) defined routine strategies as "Those in which grain is marketed each year during the same time period using the same marketing tools regardless of market conditions".

The main objective of this paper is to investigate the benefit of routine marketing strategies compared to a baseline where the produce (white maize) is sold at harvest time in the local market.

2. Alternative Marketing Strategies

There are a multitude of marketing strategies that can be used to manage price risks in marketing; many of them are highly complex for example: Bear put spreads or the butterfly strategies. These strategies however require a thorough understanding of the futures and option markets. The purpose of this research is to identify and evaluate basic routine strategies that could help producers to effectively market their produce.

2.1. *Strategy Spot: Sell the crop in the cash market after harvesting*

Strategy Spot is used as the baseline strategy and signifies a situation where no active marketing is done. More specifically it is assumed that the decision maker sells his produce in the spot market during July. The strategy is not amended with regards to price risk management and is only used to make comparisons.

2.2. *Strategy Put: Buy a put-option after commodity is planted*

A producer, who has just planted and is concerned that the market may decline sharply in the near future, will by a put. The producer buys the right to sell at a minimum price to manage the price risk. Thus, at the expiring date the producer will have the right to sell his crop at a price which was agreed on at planting time. When a producer exercises this option, he developed protection against falling prices and has the opportunity to benefit from increasing prices. The put strategy has the negative effect of a premium that must be paid for the put strategy.

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Data used for this strategy is SAFEX-prices on the 1st of December $_t$[44] this is also the strike price. The option cost is calculated by using the Black Scholes Model originally developed by Black and Scholes (1973), given the SAFEX-price (at the money) while historic volatilities are obtained from SAFEX. The expiry date for the option is July $_{t+1}$ and the July spot price is the alternative price when the option is not exercised (Spot price -premium).

2.3. *Strategy 3x: Sell production in three segments on the futures market*

When a producer is concerned that the price of the commodity will decline with the maturing of the season, the producer has the choice to sell his crop in the future market. The strategy states that the production is sold in three segments of equal quantities, the first is sold when the crop is planted (December), the second at pollination phase (February) and the third segment at harvesting (July) this is three important timeframes within the industry. To lock the producer's price level at the beginning of the season, the producer obtain a short position in futures.

2.4. *Strategy 12x: Sell crop in twelve segments*

Using the same concept as the previous strategy, the producers sells the crop in twelve segments starting at planting time and ending at harvesting time in a three-week interval. The producer still locks the price, but on twelve different time-frames at twelve different prices this strategy will spread the producer's risk and obtain an average price for the season. Prices are fixed every three weeks starting from December up to the end of July.

2.5. *Strategy Feb: Sell crop in February*

In this strategy the produce is in its pollination phase and the producer have a fair idea what his yields will be. The producer sell his produce in this month, in order to lock the producer's price level at pollination, the producer obtain a short position in futures.

2.6. *Strategy Feb put: Buy a put-option after pollination phase*

This strategy is the same as the Put strategy in section 2.2, however the only difference is that the put option is bought in February and not in December. The expiry date for the option is July $_{t+1}$ and the July spot price is the alternative price when the option is not exercised (Spot price -premium).

3. Risk Quantification

Eight years of historical volatilities, spot and futures contract prices for white maize were obtained from the Agricultural Products Division, better known as SAFEX (SAFEX, 2010) and used as data in order to quantify the price risk associated with each of the marketing strategies. In order to quantify the risk a cumulative distribution functions (CDF) of maize prices for the alternative marketing strategies were constructed. Resulting marketing prices were expressed in 2008 Rand values before constructing the CDF assuming each year has an equal chance of occurring.

4. Stochastic Efficiency Analysis

4.1. *Stochastic efficiency with respect to a function (SERF)*

The stochastic efficiency of alternative marketing strategies for decision-makers with varying levels of risk aversion is determined with a technique developed by Hardaker *et al.* (2004) called stochastic efficiency with respect to a function (SERF). SERF is based on the notion that ranking risky alternatives in terms of utility is the same as ranking alternatives with certainty equivalents *(CE)*. *CE* is defined as the sure sum with the same utility as the expected utility of the risky prospect (Hardaker *et al.*, 2004). Thus, the decision-maker will be indifferent to both the *CE* and the risky prospect. *CE* is calculated as the inverse of the utility function and is therefore dependent on the

[44] Year of planting

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form of the utility function. Assuming an exponential utility function and a discrete distribution of *x, CE* is calculated as (Hardaker *et al.*, 2004:257):

$$CE\left(x, r_a\left(x\right)\right) = \ln\left\{\left(\frac{1}{n}\sum_{j}^{n} e^{-r_a(x)x_j}\right)^{\frac{-1}{r_a(x)}}\right\} \quad (1)$$

where $r_a(x)$ is the level of absolute risk aversion and *n* defines the size of the random sample of risky alternative *x*. The relationship between risk aversion and *CE* is determined by evaluating Equation (1) over a range of $r_a(x)$ values. Repeating for different risky alternatives yields the relationship for several alternatives which are best compared by means of graphing the results (Hardaker *et al.*, 2004). The alternatives are ranked based on *CE* whereby the alternative with the highest *CE* is preferred given the specific level of risk aversion. The difference between two alternatives at a specified $r_a(x)$ level yields a utility weighted risk premium[45] which is defined as the minimum sure amount that has to be paid to a decision-maker to justify a switch between a preferred and a less preferred alternative (Hardaker *et al.*, 2004).
Application of SERF requires from the analyst to quantify the risk associated with a risky alternative as a CDF and to specify the range of risk aversion levels. The analyses are conducted in Excel© using the SIMETAR add-in (Richardson *et al*., 2004).

5. Results

5.1. *Stochastic efficiency of marketing strategies*

5.1.1. Marketing risk

Producer's main objective is to receive the price for the produce, in order to test which strategy will present the highest price over the long term the prices of every strategy were graphed in Figure 1.

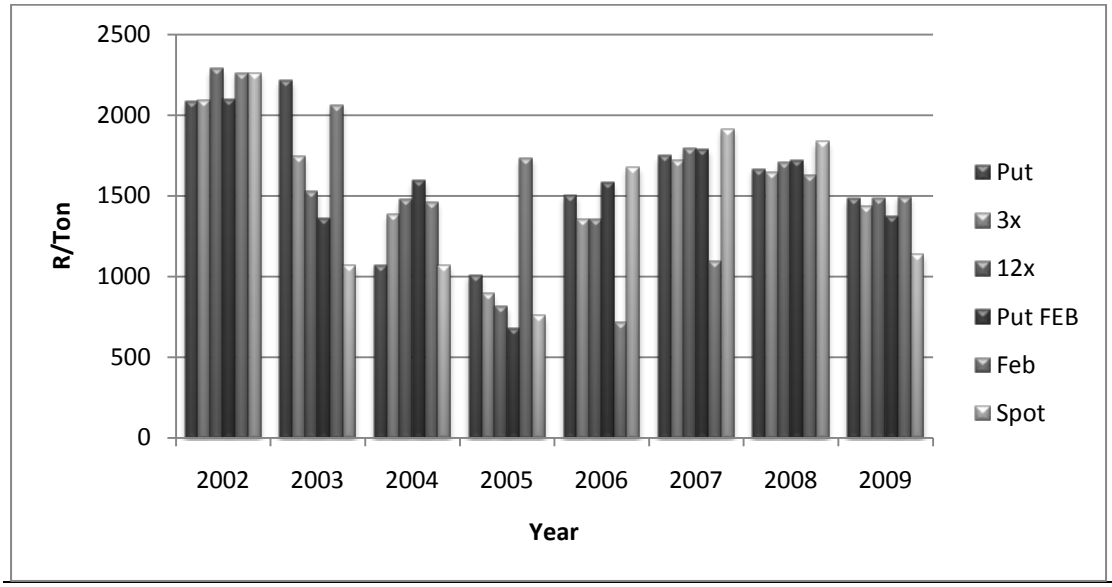

Figure 1: Prices obtained by different strategies for eight years

When evaluating each year separately it is difficult to identify one strategy that continuously performed the best, reason being the volatility of the market.

[45] Note that this concept is different from the risk premium defined by Pratt (1964).

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Evaluating the average gross production value of 8 years for each strategy as shown in Figure 2 indicates that the Put-strategy showed the highest average gross production value of R 7 359/ha. The Spot-strategy have the lowest average gross production value which were R6 806/ha. Nevertheless, the decision on which marketing strategy to implement cannot be based only on the average gross production values the best strategy must be based according to a producers risk aversion levels.

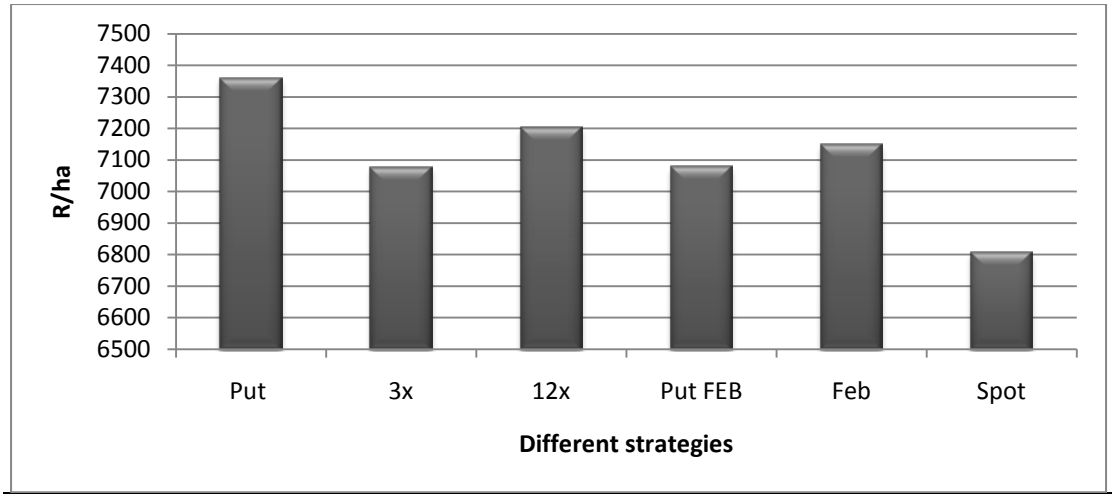

Figure 2: Average Gross Production Value of 8 years for each strategy

A number of statistical measures are also used in order to identify the most sufficient strategy which is presented in Table 1.

Table 1: Statistical moments of alternative marketing strategies.

	Unit	***Put***	***3x***	***12x***	***Put Feb***	***Feb***	***Spot***
Mean	*R/ton*	**1596**	1531	1556	1524	1554	1464
Minimum	*R/ton*	**1006**	893	810	679	711	755
Maximum	*R/ton*	2215	2088	**2288**	2096	2261	2261
Standard Deviation	*R/ton*	430	**353**	418	415	498	527
Coefficient of variation	*%*	27%	**23%**	27%	27%	32%	36%

Mean price received: The mean price received from alternative grain marketing strategies is a primary indicator of their relative performance. The grain marketing strategy that returns the highest mean price compared to another will always be the best strategy given that price variability is not a concern. In this study the put strategy have the highest mean price and the spot strategy have the lowest mean price.

Minimum and Maximum: The minimum and maximum prices indicate the low/high range of the marketing strategy price outcomes over the period of 2001 up to 2009. The strategy with the highest price is the 12x strategy and the strategy with the highest minimum is the Put strategy.

Standard deviation and Coefficient of variation: The standard deviation of the selling price received for a particular market strategy is used as a statistical measure of annual price variability. The higher the standard deviation of annual selling prices of a specific strategy the more variable its return is. The 3x strategy have the lowest standard deviation and coefficient of variation while, the spot strategy have the highest standard deviation and coefficient of variation which highlights the importance of the other strategies to reduce the price variability.

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Table 1 illustrates that all of the alternative marketing strategies are better than the base strategy (spot), however one cannot pin point the most efficient strategy from these statistics. To gain more insight in the distribution of prices associated with each marketing strategy the CDF of each of the strategies are portrayed in Figure 3 and Figure 4.

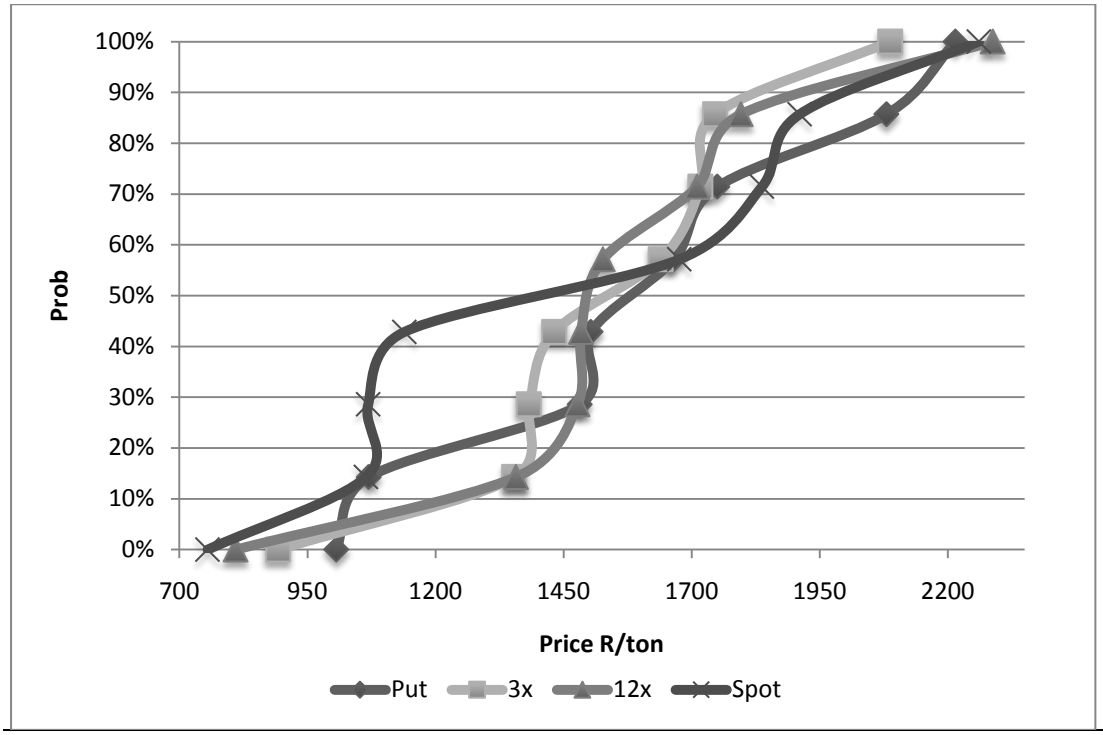

Figure 3: Cumulative Distribution Function for price for alternative marketing strategies

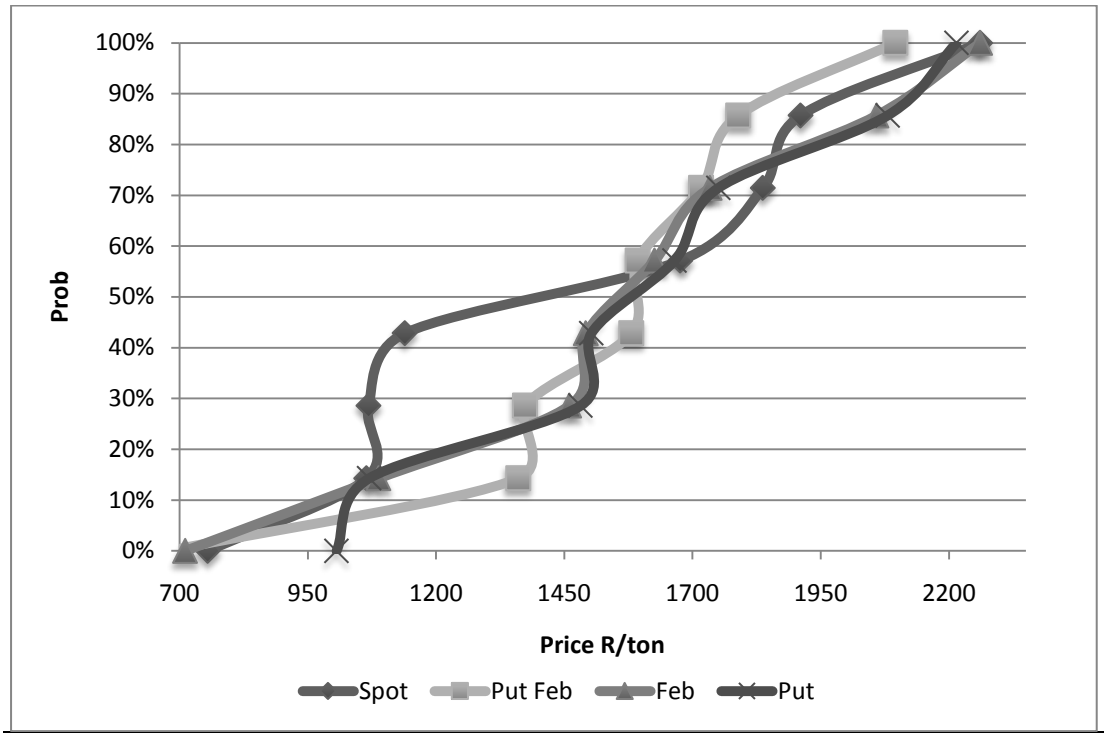

Figure 4: Cumulative Distribution Function for price for alternative marketing strategies

The CDF illustrates that if the producers decide to implement the spot strategy there is a 57% that he will receive a lower price than with the other alternative strategies. Thus, the alternative

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marketing strategies proof to be valuable in increasing prices at the lower probability ranges. The rest of the strategies follow similar trends with the 3x strategy having a higher minimum value and a lower maximum value. The put strategy has the highest minimum price of an R1000/ton but between 5% and 25% it is dominated by strategy 3x, 12x and Put Feb strategies. The put strategy also has a 75% change of obtaining a higher outcome when compared to strategy 3x, 12x and Feb. Compared to the Put Feb strategy the Put strategy only have a 50% change of obtaining higher prices. Choices between the alternative marketing strategies are difficult since none of the strategies clearly dominates the others and the choice will depend on the risk preferences of decision makers. However, overwhelming evidence exist that the alternative strategies are capable of increasing minimum prices which is the main purpose of a risk management strategy.

5.1.2 Utility weighted premiums

Negative exponential utility weighted risk premiums are graphed for decision-makers with varying degrees of absolute risk aversion in Figure 5. Risk neutrality is characterised by a zero absolute risk aversion level and risk aversion increases with increasing levels of absolute risk aversion. The premium at a specific level of risk aversion indicates the difference between CE of the spot market and the alternative marketing alternative with which the spot marketing strategy is compared.

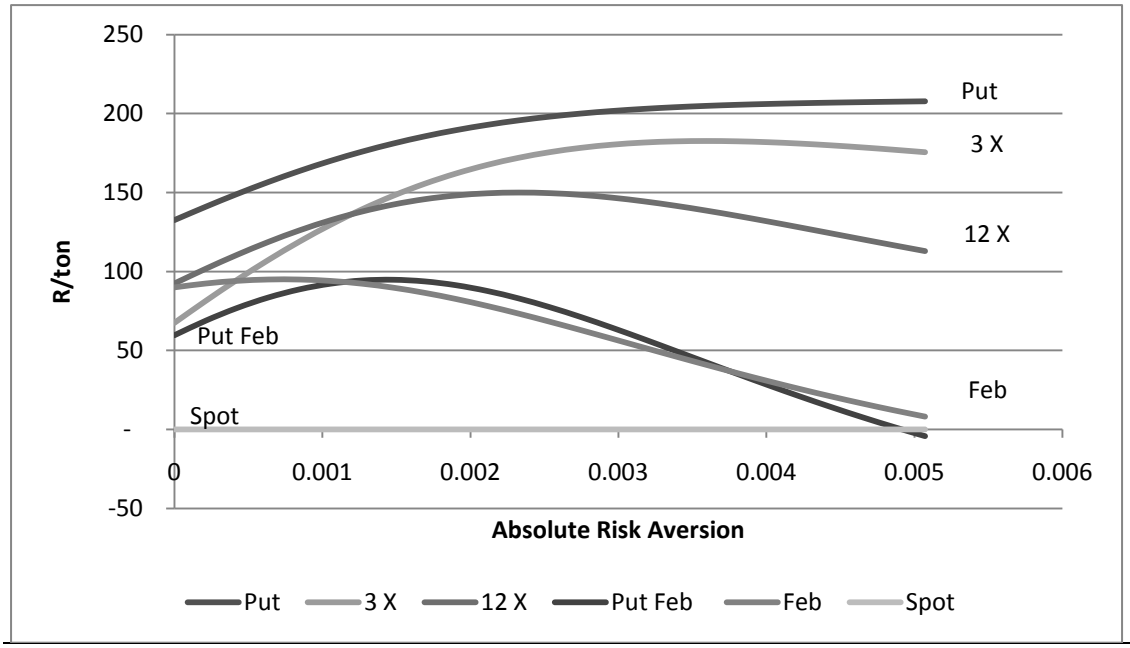

Figure 5: Negative Exponential utility weighted risk premiums relative to Spot

Results indicate that risk averse decision-makers will benefit most from employing the put strategy. More specifically the calculated benefit for a risk neutral producer to move from the spot market strategy to the put strategy is R130 per ton. The benefit increases to over R200 per ton for a decision maker that is severely risk averse. When the 3x and 12x strategies are compared to the baseline none of the strategies clearly dominates the other. The differences between these strategies are also rather small when the range of risk absolute risk aversion levels is considered. For most of the range the absolute difference is no more than R25 per ton. At relatively lower levels of risk aversion the 12x strategy is more beneficial whereas the 3x strategy dominates at higher levels of absolute risk aversion. The trade-off between the two strategies is governed by the specific form of the CDF of the two alternatives. However, more important is the fact that both strategies are significantly more beneficial when compared to the spot market.

When the rest of the strategies are compared one can conclude that the Feb and Put have lower benefits than the other strategies. The Feb and Put Feb strategies are almost similar and no one

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strategy clearly dominates the other. However, it is important to notice that both strategies are significantly more beneficial when compared to the spot market.

6. Summary and conclusions

According to Jordaan and Grové (2007) most of the producers in the Vaalhart region do not make use of pre harvesting strategies. One of the reasons for this could be that producers do not have the knowledge to apply complex strategies. Various authors such as O'Brien (2000) and Scheepers (2005) proofed that the derivative market is efficient. The main objective of this paper was to evaluate the risk efficiency of alternative routine market strategies The five strategies that were compared with the spot market are selling in three segments (3x) on the futures market, selling in twelve segments on the futures market (12x) buying a put at plant time (Put) buy a put at pollination (Put Feb) sell the produce after pollination (Feb).

Quantifying the risk of the alternative strategies clearly indicated the potential of the alternative marketing strategies to increase minimum prices. The CDFs of the alternatives marketing strategies indicated that the spot strategy has a 50% change of generating lower prices when compared to the alternative strategies. Utility weighted premiums indicated that significant benefits are possible when a put strategy is employed. Little difference exists between the 12x and 3x strategies and it is clearly dominated by the put strategy. However, these two strategies were also able to realise significantly larger prices compared to the Feb, Put Feb and spot marketing baseline. Thus, the conclusion is that routine marketing strategies that employ little information requirements might be of significant benefit to maize producers. Cognisance should be taken that the analyses are based on relative short time series of price information and the probabilities might not be associated with the true underlying probabilities.

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