The South African Futures Markets:
An Analysis of the Efficiency of the White Maize Derivatives Markets

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By
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Supervisor: Stuart Rees
I. Acknowledgements

I wish to thank Stuart Rees for his availability, assistance and guidance during the research period. It was an amazing experience to be educated by a man of his caliber.

I wish also to thank Chris Sturgess (Safex) and all other professionals listed in the report that I called, e-mailed and interviewed at random during the research process. They were always available to discuss relevant topics and theories and I thank them for sharing their knowledge and experiences.

I finally, I wish to thank my Parents, Family and Friends for their support during the year and for making this year possible by bringing me this far.
II. Declaration

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III. Abstract

The South African Futures Markets:  
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The study examines the fundamental criteria determining the efficiency of futures market in the context of the South African commodity market with specific reference made to the White Maize Futures (WMAZ) market¹.

The availability, reliability, and dissemination of market information and the effects thereof, with regard to price transparency, discovery, and dissemination of information were examined and were found lacking in this market. This finding has significant implications the validity of the Efficient Market Hypothesis in this context, the role of the South African Futures Exchange. It also challenges the extent to which fundamental theories such as the theory of Storage and the Convenience Yield afford market participants forecast power, which in turn has a negative impact on the power of decision making by hedgers and speculators.

It was found that the lack of the above contributes to the South African Futures Market’s higher levels of volatility relative to its developed and ‘efficient’ counterparts around the world, limiting its efficiency as a signaling mechanism. Yet, it is also important to consider the unique set of parameters and socio political backdrop that the market has developed from in order to comment on how efficient the market really is in terms of daily operations. It is in this light that a final, contradictory conclusion was reached. Considering the size of the South African market, and the need to have active participants² in order to have an actively traded market, the South African Market is as efficient as it can be for now.

This research suggests that there are opportunities to create a more ‘efficient’ market. The margins may be smaller in this market but this will be offset by higher participation/volumes traded. Participants will reap the benefits of more open and efficient market pricing.

¹ The WMAZ is the most actively traded futures contract in the South African Futures Market
² Hedgers and speculators
However, the question is whether the market participants really want the market to be more efficient – the evidence suggests that they are happy with its current levels of efficiency.

**Keywords:** Futures Market, Commodities, White Maize, Market Efficiency, Safex, JSE
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Actual or Physical

The actual physical commodity as opposed to the paper right to a commodity

Arbitrage

Trading strategies designed to profit from price differences for the same or similar goods in different markets.

Ask price

See Offer price

3 Content of URL’s are subject to change
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**Backwardation**

A situation which occasionally occurs in futures or options markets, whereby the cash or near month price is higher that the distant month price.

**Basis**

A measure of the price correlation between a hedging medium and the commodity being hedged.

**Bid price**

The quoted price at which a particular market dealer is willing to buy.

**Beta**

It measures the part of the asset's statistical variance that cannot be mitigated by sufficient diversification of the portfolio, because it is correlated with the variability of the other assets that are available in that market.

**Broking Member**

Member who has one or more registered dealers and the required clearing agreement and can trade on behalf of clients.

**Clearing**

The settlement of a transaction, often involving exchange of payments and/or documentation.

**Clearing House**

An organization, legally separate from the Exchange, which clears transactions and guarantees all trades (see “novation”).

**Clearing Member**

Member who clears deals on behalf of broking members.
**Contango**

A commodity market is in contango when futures prices are above spot prices. The opposite of backwardation.

**Convenience Yield**

The benefits from holding the physical asset.

**Cost of Carry Model.**

The cost of carry is the lost opportunity cost of purchasing a particular security rather than an alternative. $F = S e^{(r+s+c)t}$

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<td>forward price</td>
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<td>$S$</td>
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<td>$c$</td>
<td>convenience yield</td>
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<td>$s$</td>
<td>storage cost</td>
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<td>$e$</td>
<td>base of the natural logarithms</td>
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<td>risk free interest rate</td>
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<td>$t$</td>
<td>time to delivery</td>
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**Cover**

Cash or Bank guarantee put up by a member to the clearing house or by a client to his broker as security for the variation in the value of existing contracts resulting from a fluctuation in market prices.

**Daily Limit**

The maximum daily price movement permitted by an exchange before trading is temporarily suspended to enable prices to stabilize.

**Delivery Month**

The month in which a futures Contract matures and during which the physical deliver is to be made.
**Delivery Point**

Locations that are deemed acceptable for delivery of the commodity specified in the contract. (See silo locations in the report)

**Delta**

A measure of how much an option premium changes given a unit change in the price of the underlying.

**Derivative**

A financial security whose value is determined, in part, from the value and characteristics of an underlying asset e.g. futures, options (both exchange traded and OTC).

**Efficient Market Hypothesis (EMH)**

In finance, the Efficient Market Hypothesis (EMH) asserts that stock prices are determined by a discounting process such that they equal the discounted value (present value) of expected future cash flows. It further states that stock prices already reflect all known information and are therefore accurate, and that the future flow of news (that will determine future stock prices) is random and unknowable (in the present). The EMH is the central part of Efficient Markets Theory (EMT)

**Exercise**

Implementation of the right under which the holder of an option is entitled to buy (in the case of a call) or sell (in the case of a put) the underlying asset.

**Exercise price**

See strike price
**Expiry, expiration date, maturity date**

Date and time upon which an option or future, and the right to exercise them, ceases to exist. Most commonly used to describe when the buyer / holder of an option ceases to have any rights under the contract, or when a futures contract month ceases trading.

**Futures contract**

In finance, a futures contract is a standardized contract, traded on a futures exchange, to buy or sell a certain underlying instrument at a certain date in the future, at a pre-set price. The future date is called the delivery date or final settlement date. The pre-set price is called the futures price. The price of the underlying asset on the delivery date is called the settlement price. The futures price, naturally, converges towards the settlement price on the delivery date.

A futures contract gives the holder the right and the obligation to buy or sell. Both parties of a futures contract must exercise the contract (buy or sell) on the settlement date. To exit the commitment, the holder of a futures position has to sell his long position or buy back his short position, effectively closing out the futures position and its contract obligations.

**Hedge**

A conservative strategy used to limit price losses by effecting a transaction that protects an existing position. Dealing in such a manner as to reduce risk by taking a position that offsets an existing or anticipated exposure to a change in market prices.

**Initial Margin**

A good faith deposit which both buyer and seller must lodge with the clearinghouse as security.

**Location Differential**

This is the indicative cost of transporting stock from any “Safex” registered silo to Randfontein. The traded price is always referred to as a Randfontein price while the price the
buyer pays will be reduced by the cost differential to Randfontein of the silo he was allocated.

**Law of one price**

The law of one price is an economic law stated as: ‘In an efficient market all identical goods must have only one price.’ The intuition for this law is that all sellers will flock to the highest prevailing price, and all buyers to the lowest current market price. In an efficient market the convergence on one price is instant.

**Long position**

An investor has a long position when contracts are purchased.

**Margin**

Although the value of a contract at time of trading should be zero, its price constantly fluctuates. This renders the owner liable to adverse changes in value, and creates a credit risk to the exchange, who always acts as counterparty. To minimize this risk, the exchange demands that contract owners post a form of collateral known as margin.

**Margin (or Variation Margin)**

The cash payment that is required to maintain an initial margin position. This is determined daily by the Exchange via a process of mark-to-market.

**Mark-to-market (M-t-M)**

The revaluation of a futures or options position at its current market price. All positions are marked-to-market by the clearinghouse, once a day. The profit/loss that is revealed by the revaluation is received by or paid to the clearinghouse (known as variation margin).

**Novation**

The guaranteeing responsibility of a clearing house upon successful matching of a trade. The clearinghouse is substituted as the seller to every buyer and the buyer to every seller on a principal to principal basis.
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**Offer price (or Ask price)**

The quoted price at which a particular market trader is willing to sell.

**Open Interest**

Is the total number of long positions outstanding in a futures contract (equals the total number of short positions).

**Over the counter (OTC)**

Term used to describe trading in financial instruments off organized exchanges with the risk that performance by the counterparties is not guaranteed by an exchange.

**Perfect Market**

A market in which the products are homogenous, there is complete information, and no buyers or sellers may influence the market.

**Physical delivery**

The amount specified of the underlying asset of the contract is delivered by the seller of the contract to the exchange, and by the exchange to the buyers of the contract. Physical delivery is common with commodities and bonds. In practice, it occurs only on a minority of contracts. Most are cancelled out by purchasing a covering position - that is, buying a contract to cancel out an earlier sale (covering a short), or selling a contract to liquidate an earlier purchase (covering a long).

**Physical (spot/cash) market**

The current market in the underlying asset for immediate delivery.

**Premium**

The fair value of an option contract, determined in the competitive marketplace, which the buyer of the option pays to the option writer for the rights conveyed by the option contract.
Physical delivery

Safex makes use of a Safex silo receipt for physical delivery in completion of a futures contract. The silo receipt represents the specific quantity of stock in a registered Safex silo. The silo owner who stores the product guarantees the quality and quantity of the stock.

Random Walk

Sometimes called a drunkard's walk, is a formalization of the intuitive idea of taking successive steps, each in a random direction.

Risk management

The science of assessing and controlling risks with the aim of keeping them within acceptable bounds.

Settlement

Settlement is the act of consummating the contract, and can be done in one of two ways, as specified per type of futures contract.

Short position

Selling a derivative when one does not own the physical security but intends supplying the physical security upon expiry of the contract.

Silo receipt

A transferable, but not negotiable document that represents title to a specific quantity, of a specified quality free alongside rail at a registered Safex silo.

Spot market

See physical market
Spot Rate

The spot price or spot rate of a commodity is the price that is quoted by Safex for immediate (spot) settlement (payment and delivery). It also refers to the spot price that holders of the physical will sell their stock at any given point in time.

Systematic Risk

Also called market risk, or non-diversifiable risk. It is risk attributable to factors affecting all investments.

Theory of storage

Everyone who owns inventory has the choice between consumption today versus investment in the future. When inventories are high, this suggests an expected relatively low scarcity of the commodity today versus sometime in the future. Otherwise, the investor would not perceive that there is any benefit of holding onto inventory and therefore sell his stocks.

Underlying asset

The physical asset upon which a derivative contract is based (see also physical).

Unsystematic Risk

Or specific risk, is the risk associated with individual assets and can be diversified away.

Volatility

A measure of the fluctuation in the market price of the underlying security. Mathematically, volatility is the annualized standard deviation of returns.
1 Introduction

1.1 The South African Futures Market

The Safex\(^4\) market for the White Maize Future (WMAZ) has arguably become the de facto market for the economically important White Maize crop in South Africa. While a spot market for White Maize exists, it has become evident through the investigation of this report that it is not transparent and that price discovery is virtually non-existent. All markets are reliant on market participation and in the case of the South African Futures market, this is complicated by the fact that the market for White Maize is geographically dispersed, has different supply and demand factors, varying economies of storage, delivery, and environmental forces affecting the each region. It is partly due to these constantly changing variables that Safex have modeled the standardization of the WMAZ contract around the main region of the Randfontein silos. This approach in itself poses significant problems as it does not equally measure differentials from all silo locations across the country\(^5\). Safex calculate these differentials once per year suggesting that price movements in oil, transport costs, holding costs, and storage costs affect regional players on different levels. In the US for example, this ‘gap’ is smoothed by revisiting differentials more frequently and by basing differential costs on more than one location, thereby creating geographic spreads that are more efficient and thus more transparent in translating the value of the underlying asset into a publically traded prices\(^6\).

The existence of an active, efficient futures market provides numerous advantages, which include risk management, liquidity, price discovery, transparency, and indications as to where asset prices are headed. Market participants are interested in the forecasting characteristics and relationships between current spot prices (or cash prices), futures prices, and expected future prices for either hedging or speculative reasons. Hoos (1942) points out that it is the participative actions of both these parties that result in liquidity and transparency in the market. For White Maize market participants, the futures market provides pricing

\(^4\) South African Futures Exchange

\(^5\) See p34 for map of Silo locations. Randfontein is used as the central location on which Safex calculates differentials on a yearly basis.

\(^6\) See p34 for map of Silo locations. Randfontein is used as the central location on which Safex calculates differentials on a yearly basis.
information based on one location differential\(^7\), which is compared to current cash prices (which are the quoted spot prices from dealers, or from holders of the physical maize at any specific location at any point in time) of dealers. According to the Cost of Carry model, any difference between the two should be explained by transportation costs, storage costs and other risk associated costs. Quoted prices should therefore reflect the centralization of supply and demand in the market. (In addition to location differentials made available to the market by Safex, which are calculated on a yearly basis and are based on assumptions of cost of carry and other factors)

Anecdotal evidence suggests that the WMAZ spot price can deviate from the theoretical price which, given an active and transparent underlying market, would create arbitrage opportunities for participants in the WMAZ market. It is in essence the characteristics of arbitrage mechanics\(^8\) that naturally correct these price imperfections thus supporting the Efficient market Hypothesis (EMH).

From a market participation perspective, producers want to sell their commodity at a price higher than their production costs. Consumers seek to purchase a commodity at a price that ensures a return within their constraints. In other words, basic supply and demand variables drive this, or any other market. A futures market cannot exist without the active involvement of participating parties and their respective intentions to use the market for hedging or speculative purposes. (Hoos, 1942). Speculators in the physicals market seek to profit from changes in supply and demand, thus, they could either attempt to go long where they believe the price will rise, or go short where they believe the price will fall. Furthermore, according to Hoos, 1942, it is generally understood that if more speculators hold long, as opposed to short positions, the probability is there for futures prices to be less than the expected future Spot price. (In developed markets this theory holds but not in South Africa as participants are not required to disclose their net trading positions as either hedging or speculative at the close of every day’s trade as is the case in Chicago for instance) The underlying nature of the participants and the positions they take in the market are indicative of the information they possess, or the lack thereof. Speculators in this scenario stand to realize profits as the futures price converges to the spot price at maturity - this is a position

\(^6\) Effectively augmenting transparency of the underlying market assets
\(^7\) Randfontein
\(^8\) Arbitrage Mechanics is explained in further detail on p. 31 (Speculation and Arbitrage Mechanics)
known as Backwardation\(^9\). If more speculators hold more short than long positions, the inverse will happen where the futures prices will be greater than the expected future spot price, a situation which is known as Contango\(^{10}\). This research examines the extent to which the South African market differs from more developed spot and futures markets.

Depending on the item being traded, spot prices can, to a debatable extent, indicate market expectations of future price movements in a myriad of ways. For an asset or non-perishable commodity, (e.g. gold) the spot price reflects market expectations of future price movements. In theory, the difference in spot and futures prices should be equal to the finance charges, plus any earnings due to the holder of the asset, according to the Cost of Carry model. (Hull, 2005: 118) For the majority of investments, the Cost of Carry model aims to explain the opportunity cost of purchasing a particular asset rather than investing in a theoretically safe investment vehicle such as a money market account where a risk free rate of return could be earned (For physicals, storage costs should be added to the model). The cost of carry model expresses the futures price (or an approximation of the futures price) as a function of the spot price and the cost of carry. (In currency markets this model is called the Interest Rate Parity model\(^{11}\).

In finance, the Efficient Market Hypothesis (EMH) asserts that stock prices are determined by a discounting process such that they equal the discounted value (present value) of expected future cash flows. It further states that stock prices already reflect all known information and are therefore accurate, and that the future flow of news (that will determine future stock prices) is random and unknowable (in the present). The EMH is the central part of Efficient Markets Theory (EMT). Or in other words, EMH states that at any given time, asset prices fully reflect all available information, i.e. prices follow a random walk. The implication of this is that historical prices cannot be used to predict future price movements and, that the price of a futures contract and its underlying are perfectly correlated with no lead lag relationship since the two should hold the same market wide information simultaneously.

\(^{10}\) http://www.speculative-investor.com/glossary.htm
It would seem then that, in light of the above mentioned, in a perfect market, (one that closely approximates the conditions necessary for the EMH to hold), the relationship between futures and spot prices is a function of interest rates, storage costs, dividend payments\textsuperscript{12}, and convenience yields (and of course, reliable, relevant, timely information). Any deviation from the theoretical relationship will afford investors a riskless profit opportunity and will quickly be arbitraged away. (Guberman, D ,2006, Personal Interview) In the real world however, there are various market conditions that influence the degree to which this phenomenon can exist thus restricting futures price movements to within boundaries of a theoretical or expected price. Safex also have the reins\textsuperscript{13} on the market to some extent. For example, if there should be a sudden run on the market, they are able to close trading at their discretion in order to ‘give participants time to cool down.’ (Gravelet-Blondin, 2006, Personal Interview) In the past, the White Maize Futures (WMAZ) prices have deviated from the spot price and hence from the theoretical futures price as suggested by the no-arbitrage model (Guberman, D ,2006, Personal Interview). This could be because of inaccurate pricing strategies between market participants or because of the existence of market imperfections which will be discussed in the report.

It is possible and plausible to profit from taking long futures positions, (Christian, 2006) suggesting that WMAZ as an investment asset carries identifiable systematic, or market risk. However, beta (risk) does not play the integral part of investment and portfolio management strategies in the WMAZ market as it does in equity market (This point was confirmed with Rod Gravelet-Blondin in a personal interview). This raises questions regarding the information available in the White Maize Futures market and the role, or, responsibility of the exchange to provide it. This again suggests the need to examine the extent to which the SA WMAZ futures market is really efficient.

Risk and expected return partly contribute to the explanation of the relationship between futures prices and expected future spot prices in that “Investors require higher expected return than the risk-free rate of interest as compensation for accepting risk.” Hull (1998). In the discussion with Rod Gravelet-Blondin it became evident that risk (beta) for WMAZ was very difficult to measure and subject to controversy.

\textsuperscript{12} Not the case with White Maize

\textsuperscript{13} They control the transaction costs, deferential borrowing and lending rates, and restrictions on short selling.
It is a significant observation that proven theories based on correlations between the futures price of White Maize, the expected future spot price, and spot prices (cash prices), is still convincingly unanswered (i.e. forecasting power assumptions). Judging from past works by various authors\(^{14}\), it seems as though contradicting views exist primarily based on the fact that expected spot prices and spot prices (cash prices) are not adequately transparent.

Futures prices are determined by what is generally regarded by participants as an open and competitive market driven by forces of supply and demand. The crux of any market is information dissemination, which fundamentally directs the decision making process for all participants with regard to trading strategies, storage, production, consumption, and other factors\(^{15}\). This is primarily due to the fact that information about the spot, expected future spot, and cash prices are indicative of market behavior. However if a market is not efficient, then the messages contained in prices will be distorted, potentially leading to misallocation of resources. This study aims to establish the extent to which the South African WMAZ futures market is efficient by comparison of its current structure with that of other more developed markets.


\(^{15}\) Higher futures prices signal the need for greater storage and lower futures prices point to a reduction in current inventory.
1.2 Purpose and Significance of this Report

The research conducted focused on the South African Futures market (Safex\textsuperscript{16}) in its current form and state of affairs. Investigation was aimed specifically at the White Maize commodity as it is the most actively traded futures product on the market. This report examines the current efficiencies and inefficiencies of the South African futures markets and, as a result, alludes to the advantages and disadvantages inherent in this market, as well as opportunities that may or may not exist as a result of inabilities or restrictions, or, as opportunities not yet exploited by market participants.

The report comprises of comparative analysis between the South African market and that of the developed, efficient and mature markets in the United States of America (specifically Chicago). It also comprises of comparative analysis between the theoretical models and generally accepted trading practices currently in place today in the South African futures market.

- The report and addresses the following theoretical aspects:
  - The relationships between spot prices, futures prices and expected futures prices. It addresses fundamental underlying theories upon which efficiency is based like forecasting methodologies based on quantitative models and those based on more empirical models like using futures prices as a gauge to determine future spot price movements\textsuperscript{17} in order to formulate a clear structured understanding of the market and influencing factors.
  - Theory of storage, forecast power and convenience yield
  - Speculation and arbitrage mechanics
  - The use of futures in risk management

- The report addresses the following practical aspects:
  - Physical locations of the spot markets. (Silo Locations)

\textsuperscript{16} The South African Futures Exchange (Safex) consists of a financial markets division and an Agricultural Markets Division (AMD).

\textsuperscript{17} Futures prices can be calculated by incorporating complex factors but still provide mediocre forecasts. (Janse van Rensburg, 2006)
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• Market information available and users (without the necessary information assimilation and dissemination, various seemingly vital underlying theories are less convincible in a market shaped by a set of unique factors, some of which will be covered in the research)

• The role of the exchange

The following specific questions were identified:

1. To what extent does a reliable and visible spot price for the commodity exist?
2. Could the spot market be made more transparent by some means or another?
3. Given the current system of silo receipts, and given a viable spot market, would shorting of the underlying be possible?
4. How closely does the WMAZ track the underlying?
5. In theory, a transparent, active underlying market should improve the efficiency of the markets. To what extent does this reflect on the efficiency of the South African market?
6. Is the South African Maize market more volatile than that of other countries? Why and how does this affect the market characteristics?

Of these, it was found that it was not possible to answer question 5 as free, reliable, and transparent information on the spot was extremely difficult to come by and without extensive time and capital investments, the sample size would be too small to make any statistically significant conclusions.
2 Literature Review

2.1 Role of the Exchange

As mentioned, the Exchange plays an important role in the determination and dissemination of information thus contributing to the transparency of prices. In doing so, it provides an arena for speculation and risk management between participants with their respective profiles. Further, one could argue that the existence of these functions encourages productivity in that it provides a certain amount of protection for the producer/farmer. It also makes sense then to infer that the risk profile of lending institutions would indirectly also be reduced when dealing with clients who are effectively hedged. Through the nature of speculative participation, market liquidity is generated which is the life blood for participants who want to hedge. The Exchange brings these two parties from opposite poles together on a formally controlled platform. At the end of the day, due to the fact that prices generated on the Agricultural Derivatives Market (AMD), and are considered the industry standard and reference point in South Africa, the physical, or cash market is largely influenced by the efficiency of the Exchange to function effectively. There is however debate as to the degree that this influence extends.

Fundamentally an Exchange should provide the following services to its participants:

- Regulation
- Financial Integrity
- Margins
- Transparency

“Regulation - Safex Agricultural Products Division (APD) is a division of the JSE managed by the JSE and regulated by the Financial Services Board (FSB) which oversees the exchange’s reporting with regards to the Financial Markets Control Act of 1989 and the Stock Exchange Control Act of 1985”

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18 Risk variables include weather, farming/production management, seasonal conditions, financing, and others.
19 Generally, hedged clients can access funds at cheaper rates
20 http://www.safex.co.za
“Financial Integrity - When dealing with the exchange the exchange’s clearing house becomes seller to every buyer and buyer to every seller. Members are free to deal with each other without any credit risk. This eliminates counter party risk which is prevalent in the Over the Counter markets (OTC).”

“Margins - When trading Derivative products, the exchange requires the payment of both Initial Margins and Variation Margins. The Initial Margins are determined by the clearing house and vary depending on historical price Volatility. The variation Margin is a daily flow of funds (profits/losses) resulting from any open position calculated through a methodology of Mark-to-Market (M-t-M).”

“Transparency - Pricing is determined purely on the basis of demand and supply. Prices for each contract are negotiated between buyers and sellers via an electronic order-matching platform called the Automated Trading System (ATS). The presence of numerous buyers and sellers ensures that prices are always competitive and adjust efficiently to reflect changes in the underlying market.”

Legislation and Rules

21 http://www.safex.co.za/ap/rules.asp
Factors required for the operational existence of a futures market

2.2 Futures Prices, Spot Prices and Expected Future Spot Prices

As already mentioned, the cost of carry model can to a certain extent help determine futures prices of non-dividend paying assets but only on paper and in a perfect market. “To own an asset in the future, investors can enter into a futures contract now to purchase the asset at price \( F_{0,t} \) in the future, or they could buy the asset now at a price \( S_0 \) and hold it till a future date. Should they buy the asset now, they have to finance the purchase and carry the investment into the future. Paying \( S_0 \) now is equivalent to paying \( S_0(1+r)^t \) in the future. When prices are in equilibrium, then \( F_{0,t} = S_0(1+r)^t \).” (Hull, 2005)

“A higher futures price would make risk free Arbitrage possible in that investors could buy the underlying for \( S_0 \) (borrowing rate \( r \)) and simultaneously sell a futures contract at

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22 http://www.safex.co.za
F₀,t. At the expiry of the futures contract the investors then deliver the asset to the buyer, repay their loan²³ and show a riskless profit²⁴. Inversely, if the futures price is lower than that of the cost of carry relationship, investors could sell the asset short at S₀ (investing at rate r) and simultaneously buy the futures contract at F₀,t. At expiry, they can accept delivery of the asset and use the it to honor the short sale commitment, pay F₀,t for the asset from their investment²⁵, and show a riskless profit²⁶.” (Hull, 2005)

Proof that the existence of an efficient futures market provides a facility to hedge against price risk is indisputable. Hedgers and speculators base their trading assumptions and strategies on either future expectations (expected futures prices) or on historical data (spot prices. (As mentioned, in a perfect market, the price of an asset today is the best indicator of the price tomorrow)²⁷. There is value in forecasting power for all participants and recognizing a reliable strategy is imperative. Here too however, the debates over the forecasting ability of current spot prices are often as good as those based on the futures price. (French, 1986) According to French, 1986, there may be nothing for the futures market to forecast. “If the current spot price equals the true expectation of the future spot price, the futures market cannot provide a better forecast.” He also contends that “forecasts may be obscured by the unexpected element that will already be built into a current spot price. In reality, the expected future spot price, as with any prediction, is unobservable. It is thus this approximation of expectations that creates uncertainty around forecasting power.”

The inability to detect good quality forecast power in futures prices is evidence of market inefficiency. Unfortunately, sufficient data could not be analyzed in order to draw conclusive results based on this conclusion. It would be a good exercise to test the extent to which the spot price tracks the futures price of White Maize. This however once again brings us to the point of an efficient and reliable spot price that is discussed in this report. Generally speaking, a theoretical spot price is determined by the expectations of a future price plus a risk premium and ultimately, by factors of supply and demand. It is the case that the futures and cash markets converge at expiration giving solid indication that the market is in fact efficient. (Bird, 2006, Personal Interview)

²³ S₀(1+r)ᵗ
²⁴ F₀,t > S₀(1+r)ᵗ (The proceeds are greater than the amount owing)
²⁵ S₀(1+r)ᵗ
²⁶ F₀,t < S₀(1+r)ᵗ (Investment exceeds payment amount)
²⁷ Including external influencing data like rainfall, supply and demand etc.
2.3 The Theory of Storage, Forecast Power, and Convenience Yield

The notion of Convenience Yield is defined as “the benefit or premium associated with holding an underlying product or physical good, rather than the contract or derivative product.”

In addition to production costs, investors buying a commodity such as Maize incur additional costs when insuring, storing, and transporting their assets. These need to be built into the cost of carry model: (Hull, 2005)

\[ F_{0,t} = S_0(1+r+s)^t \]

Owners of physical maize and holders of WMAZ carry similar risks although manufacturers and producers would rather hold the physical maize than the WMAZ. The benefit is that is can be used as raw material at any point in time should the unanticipated demand arise. This benefit is called the ‘Convenience Yield’ of a commodity. It is complex to quantify, varies over time, is high for commodities with uncertain demand and supply and is seasonal for commodities with a seasonal demand and supply. (Kaufman, 2005) “The

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28 http://www.investopedia.com/terms/c/convenienceyield.asp
The benefit obtained from the Convenience Yield can be incorporated in the cost of carry relationship just like the dividend yield. If the Convenience Yield is \( d \) percent per year, and the commodity has a storage cost of \( s \) percent per year, then the cost of carry relationship becomes:” (Hull, 2005)

\[
F_0, t = S_0(1+r+s-d)^t
\]

“We have seen that the Futures price of a commodity will usually be higher than the Spot price. It is possible for a commodity to have such a high Convenience Yield \( (d) \) that this exceeds the sum of the financing cost \( (r) \) and the storage cost \( (s) \). The term within brackets \( (1+r+s-d) \) will then be less than 1, and the futures price will be lower than the Spot price.” (Hull, 2005)

Analysis of the theory of storage was done as it aims to explain the difference between spot and futures prices by analyzing the reasons why market participants would hold inventories. After discussion with Rod Gravelet-Blondin, it was established that there is no accurate means to determine inventory-holding forecasts in South Africa as no systems for data collection are formally in place. The Bureau for Food and Agricultural Policy (BFAP) has done extensive modeling on this topic and their forecasts were used in this report. In their (BFAP and other similar organizations) efforts to provide a solution to the information gap, their estimates have become somewhat of an industry yarn. They don’t have the funding or the support from government, market participants or the exchange to put systems, tools and technology in place to adequately install a solution that will fulfill the needs of all participants. In the United States for example, they make use of satellite imagery to estimate future stock levels together with weather pattern forecasts and reliable carry over stock levels. When compared to the United States, we in South Africa do not have the level of reliability efficiency with regard to information, which comes as an opportunity costs to the market and its participants. In addition to this information, the disclosure of net trading positions of hedgers and speculators at the end of each trading day would go even further in explaining market information and give participants more transparency upon which forecasts could be made.

29 Should there be a sudden drought and the demand for Maize increases, the difference between the first purchase price of the Maize versus the price after the shock would be the convenience yield
Much of the literature reviewed in the subject of price determination of storable commodities have advocated the fact that information on the quantities produced and stored is vital for the derivation of viable, efficient forecasting models.

*Carry over* is the remaining stock levels from a previous year’s harvest (supply), plus the current year’s production and imports, less current demand. “*Carry over links futures prices in different crop years particularly when there is a decrease in demand in one year, carry over to the next crop year will increase and prices will generally drop that year.*” (Geman, 2005) When considering the fact that carry over stock has the potential to be extremely volatile, good data in this regard has immense power and contains valuable information explaining price volatility. It is a known fact that statistical studies on commodity futures have shown that variance in price is correlated to inventory levels. Helyette Geman (2005) has showed that volatility is an inverse function of inventory. I would therefore assume it safe to state that reliable data regarding stock levels does have huge potential to effect spot and futures prices therefore affecting the spread between them. This assumption was confirmed in an interview with Rod Gravelet-Blondin.

Considering the recent agricultural outlook for commodity markets sourced from the Bureau for Food and Agricultural Policy (BFAP), it is fair to state that price volatilities are not only explained by current stock, but also reserves. It seems to be the case in commodities that the more uncertainty there is around forecasts of supply, the higher the expected futures price is. This is in contrast to equity markets where the volatility and uncertainty around a particular stock tends to reduce demand and therefore price and visa versa.

The question of the effects of futures trading on the stability of spot prices has also been extensively studied and contended. According to Rod Gravelet-Blondin, market participants in South Africa have blamed the futures market for destabilizes prices, resulting in financial losses and added burden for many years now. One must consider the socio-political environment that South Africa has come through when analyzing this section of literature. Previously, government regulated all agricultural activities and as a consequence, it is understandable that the current futures market may seem to have destabilized prices even though it makes more economic sense to operate on an open market basis than not. Empirical studies ((Turnovsky, 1983), (Kawai, 1983)) show no conclusive evidence to suggest that the
The South African Futures Markets:
An Analysis of the Efficiency of the White Maize Derivatives Markets

existence of futures markets destabilize prices or of the opposite. It must be noted that the South African futures market certainly is one built on a foundation of unique characteristics that are explored within this report.
2.4 Speculation and Arbitrage Mechanics

Arbitrage is possible when an asset does not trade at the same price on different markets (‘the law of one price’) or when asset with a known futures price trades at a different spot rate. (Hull, 2005). The latter was discussed with a current market trader (Darron Guberman – personal interview), and according to him, arbitrage positions only exists for a few moments before the position is traded out in the South African Futures market. This is essentially what can be expected from arbitrage mechanics as arbitrage brings abnormalities in prices back into equilibrium or with what can be rationally expected. According to Darron Guberman the margins are generally very small and potential for large profits are restricted by market constraints such as stock availability and the time that the position may exist before it is traded out. Arbitrage is complicated even further if you take it in context of the real world. Disparities in finance charges, location differentials, holding and storage costs, and others add complexity to the already small window of opportunity available in which to take advantage of this phenomenon. Although the focus of this report is not to analyze trading strategies, it is important to see how markets are kept in line by means of arbitrage mechanics.

Except for Futures trading, White Maize can be purchased in the cash market too, stored and traded at any time in the future (bearing in mind the constraints associated with regard to perishable commodities). Differences between holding a physical and buying it on the futures market are the financing of the purchase (interest=spot price \(\frac{\text{Life of Futures}}{\text{Contract}}\) - 1), the cost of storage, the convenience cost (convenience yield), and the opportunity this position affords the holder to process or sell as the need arises. (Kaufman, 2005)

2.5 Using Futures and Risk Management

The delivery and settlement on exchange traded derivative contracts are one hundred percent guaranteed through the process of novation. (Sturgess, C, 2006, Personal Interview). In essence, the clearinghouse assumes the position of buyer to every seller and seller to every buyer and as a result participating parties never deal with each other directly. The exchange matches all long and short positions by means of Information Technology (IT) infrastructure.
Hedging is a risk management strategy used by both producers and users of maize to protect themselves against general supply and demand factors affecting spot market price movements. For the most part, producers will use futures contracts to partially hedge themselves as opposed to fully hedging themselves in order to leave themselves open to the potential upside of the market. This makes sense in that the more risk, or the less they hedge, the more the expected return and visa versa. Users of maize, like millers, also try to protect themselves for the same reasons by using hedging strategies.

30 http://www.safex.co.za/ap/clearing_risk_management.asp
31 Currently, the clearing members consist of South Africa’s biggest financial institutions thus guaranteeing that participants are always sure of contractual performance.
The actual use of futures as both a risk management and speculative instrument is what fundamentally pulls the market together. Since these factors in combination with others mentioned in the report form the basis for the existence of the market, it is important to note how effectively participants are able to make use of these tools.

It is on the basis of the above mentioned that investigation into the actual market practices was conducted. The advantages and disadvantages associated with having only one location for differential calculation\(^{32}\) and the information consequences of inefficient data regarding stock levels in silos\(^{33}\), impacts on the operational characteristics of hedgers and speculators (market users) and essentially the characteristics of daily operations within the market.

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\(^{32}\) Revised only once per year

\(^{33}\) Carry over is the remaining stock levels from a previous year’s harvest (supply), plus the current year’s production and imports, less current demand “Carry over links futures prices in different crop years particularly when there is a decrease in demand in one year, carry over to the next crop year will increase and prices will generally drop that year.” (Geman, 2005) When considering the fact that carry over stock has the potential to be extremely volatile, good data in this regard has immense power and contains valuable information explaining price volatility.
3 Research Methodology

The formal research process began with the submission of the Research Proposal after which it moved through various phases from establishing the focus of the research to primary data collection (which mainly took the form of academic literature), to market research and finally analyzing the data collected in order to draw conclusions based on these findings.

Methodology

The next logical step was to start gathering data pertaining to the factors that affect the efficiency of a market. The underlying theories, already described in the report were used as a basis on which interviews were conducted with industry leaders and market participants throughout the value chain. Their views and opinions are documented and are contained within the report. It was however the case that certain views and opinions expressed by individuals were requested by them to remain anonymous. In these cases, the information was expressed as an aggregation. This approach brought to light the varying dynamics and characteristics of market participants at all levels, and ultimately helped to clarify the requirements for market efficiency at different levels. It was therefore on the basis of actual market conditions that the comparison between underlying theories and their application in practice was investigated. It was on this foundation that some contradictory evidence, and some supporting evidence was discovered which is discussed throughout the report and summarized within the final findings and conclusions section.

Initially it was thought that a balance between qualitative and quantitative research would constitute an optimum foundation to base sound conclusive research on. However, it

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34 These include the underlying theories discussed in earlier parts of the report.
was discovered that collecting primary spot (cash) price data from all the Silo locations in South Africa for a period of one year would be almost impossible considering the time constraints and disparity and availability of market information. Also, looking at too small a sample size would yield no statistically significant findings. After investigation, it was also established that many silos do not keep daily track records of these prices. If this data were available, and statistical regressions were run in so far that valid conclusive evidence could prove correlative relationships between the tracking of WMAZ and the spot (cash) prices, it is my opinion that valuable information would be derived on which plausible assumptions about the efficiency of the South African Futures market. It is for this reason that all data contained in this report consists of historical studies and literature.

The market research took the form of interviews with various market participants throughout the value chain. These ranged from the head of Safex Agricultural Products Division, analysts, futures traders, physicals traders, brokers, professors, and farmers/producers themselves. All interviews were informal and were conducted over the Internet, telephonically or on a physically present basis. A key focus of the interviews was a comparison between the South African Futures market and those of more developed economies like the United States of America (Chicago). This gave useful insight into the efficiencies and inefficiencies of the South African market. After a process of extensive research and learning was done, findings were scrutinized and reanalyzed with specific individuals in order to determine their validity and relevance.

Table of Interviewees

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Location</th>
<th>Name</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Derivatives (Pty) Ltd</td>
<td>Newlands</td>
<td>Chris Derksen</td>
<td>Trader</td>
</tr>
<tr>
<td>Cargill RSA (Pty) Ltd</td>
<td>Johannesburg</td>
<td>Shane Bird</td>
<td>Trader</td>
</tr>
<tr>
<td>Grainman International (Pty) Ltd</td>
<td>Stellenbosch</td>
<td>Stefan Janse v Rensburg</td>
<td>Trader/Logistics</td>
</tr>
<tr>
<td>Grainman International (Pty) Ltd</td>
<td>Cape Town</td>
<td>Murray Derksen</td>
<td>Trader</td>
</tr>
<tr>
<td>Tradekor (Pty) Ltd</td>
<td>Randburg</td>
<td>Dawie Serfontein</td>
<td>Trader/Logistics</td>
</tr>
<tr>
<td>JSE Limited</td>
<td>Johannesburg</td>
<td>Chris Sturgess</td>
<td>Senior manager - Agricultural Products Division. JSE</td>
</tr>
<tr>
<td></td>
<td>Johannesburg</td>
<td>Rod Graevert-Blondin</td>
<td>Head - Agricultural Products Division. JSE</td>
</tr>
<tr>
<td>Tuolumne Trading, Pty. Ltd.</td>
<td>Cape Town</td>
<td>Darron Guberman</td>
<td>Trader</td>
</tr>
<tr>
<td>Dept of Agricultural Economics</td>
<td>Bloemfontein</td>
<td>Dr CF (Kit) le Clus</td>
<td>Professor</td>
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<tr>
<td>University of the Free State</td>
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36 Interviews were conducted with numerous individuals but the list contains the names of those who contributed mostly to the findings of this report.
4 Market Research

4.1 Silo Locations
This map illustrates the physical locations of silos where White Maize can be stored in South Africa. On the basis of Randfontein (Red Block), yearly Safex differentials are calculated. This map gives a clearer understanding into the difficulties and barriers which exist in a geographically dispersed market. It has been established with the head of Safex Agricultural Products Division, Mr Rod Gravelet-Blondin in a personal interview, that the underlying transparency and reliability across locations will be smoothed in the case of numerous location differential basisis. The practicality and logistical viability of this idea is however another question. Safex has tried in the past to implement this but to no avail. This was mostly due to insufficient market participation, both because of pure numbers and economies of scale in the various regions due to the opportunities of users (millers) to exploit holders of the underlying until they are ready to sell.

The fact that the market will be able to derive a more efficient and reliable spot price if calculations were based on more than one differential location and if they were revised more than once per year is indisputable and was reaffirmed by all participants interviewed. It is also obvious that speculators would wish for information to remain a reasonably scarce resource available only to them, however that would not necessarily, under any other circumstance be expected from an exchange. The fact of the matter is once again simply that without market participants there is no market. In South Africa, the futures market is heavily reliant on its participants unlike those exchange markets of more developed economies. It is for this reason that the Exchange embraces this current state of affairs. This is controversial and it is my opinion that with the necessary training, information systems and flows, and over time, users in the market will realize that by foregoing the margin, they will make up in volume, which is a more sustainable model in any traded contract on all exchanges all over the world.

37 The major production areas for white maize are the Free State, North West and Mpumalanga.
As already noted, Futures traders are comprised of two main groups, hedgers and speculators. Both these groups are particularly interested in the reliability of various forecasting techniques offered by the models discussed in this report and others.

Near the beginning of the investigation into the White Maize Futures (WMAZ) market I was led into the topics of what relationships existed between trading activities of large market participants and price movements in the WMAZ futures market, and, the extent to which hedgers and speculators were able to participate in the market. This was mainly due to research done by Paul Mehl\(^{39}\), and after the professed ‘lead steer’ theory was introduced to me by Joel Stern from Stern Stewart & Co. The lead steer theory states, “*If you want to know where a herd of cattle is heading, you need not interview every steer in the herd, just the lead steer.*” (Stern, J, 2006, Personal Interview). The idea is that there is a group of investors called ‘lead steers’ who fully understand economic models and who are responsible for setting prices and determining market movements. It is for this reason that the question remains as to what extent market players that set prices have the purchasing power to shift or

\(^{38}\) http://www.safex.co.za  
\(^{39}\) (Mehl, 1940)
control markets. Further investigation into South African markets would indicate either how efficient the market is or, how solid the lead steer theory is. According to feedback from various traders interviewed, there are some players capable of pulling off big enough trades, which immediately filter through the market. Rod Gravelet-Blondin maintains that the exchange has adequate control over participants to prevent this kind of control.

“It takes volume to make prices move” (Anonymous Wall Street cliché)

It would seem evident from the literature reviewed that ‘price movements and volumes traded on Futures exchange are not independent variables.’ (Mehl, 1940). This statement is substantiated by numerous other empirical studies (Holbrook (1962) Tomek (1997)). According to Rod Gravelet-Blondin from the Agricultural Products Division (APD) of the Johannesburg Stock Exchange (JSE), there is no consistent correlation that can be relied upon to make accurate forecasts from. “At the end of the day, Supply and Demand is what matters” (Gravelet-Blondin, R, 2006, Personal Interview). Disagreement, however, would probably be found as to the nature of these relationships and their significance.

In the United States, the Commodity Exchange Administration reporting regulation requires that all participants holding open positions on the Futures market are required to disclose their net trading positions and capacity as active participants (hedging or speculative). (Mehl, 1940). In South Africa, the regulating body is the Financial Services Board (FSB) and it does not require this information. This once again is an indication of the transparency of the market participants and their influences on the market. According to Chris Sturgess, the FSB do not have the capacity to implement such a data center and even if they did, it would not add the value required to see a return on investment. One reason for this may be because the market is still too small. Another may be that, because all participants will have more reliable, relevant information at hand, the opportunities for easy pickings may be reduced considerably. This may censure traders for obvious reasons but, it is in my opinion and that it is the responsibility of the exchange to make the market as efficient as possible. It is however understandable that they are at the mercy of participants at the end of the day. If participants are not going to trade on the exchange, the will be no exchange.

The discoveries of relationships are important when looking at the topic of price discovery and transparency for evident reasons. One being that if there are constant, reliable,
and persistent relationships between daily trades of hedgers and speculators, inferences can be made as to the extent to which hedging and speculating is possible and in fact, practical. In this case, information is the currency that can buy the optimal trading strategy for both hedgers and speculators, and it is just this information and the use of it, that gives indications as to how efficient the market really is.

The JSE is currently transforming its IT systems to newer architecture in order to operate more efficiently at lower costs. This 27 month transformation entails taking 42 systems and consolidating them into 16, in joint partnership with Accenture. This is great for proponents of efficient markets and fundamentally indicated that the Exchange has identified the need for more efficient systems and is in the process of bringing their systems and technology up to speed. This is unquestionably a step in the right direction and it will be interesting to see the effect that the proposed new system has on the efficiency, reliability, and transparency of the market in years to come.

The agricultural market has moved away from a government-regulated environment to an economically driven environment. This could be due to a number of reasons, some of which may include the need to be internationally competitive, government inefficiencies in the old regime, and general market forces produced by market participants, and so forth. Registered brokers can log onto the Automated Trading System (ATS) from any remote location in order to access information and trading interfaces required for processing orders which are then automatically matched at random. As mentioned, one of the exchanges responsibilities will then be to guarantee contractual obligations.

The growth in the market has resulted from an increased number of participants, greater understanding of the market and the development of a broader base of marketing strategies based on the derivative products. (JSE, 2006) “The use of the transferable Safex silo receipt has added to the efficient trading of the commodities to such a degree that many of the financial institutions have begun accepting it as collateral.” (JSE, 2006)

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40 See Appendix for details on the Automated Trading System (ATS)
41 The physical IT infrastructure is located in London due to technological advantages, business continuity and contingency, and redundancy
42 http://www.safex.co.za/ap/about_da.asp
43 http://www.safex.co.za/ap/about_da.asp
4.3 Seasonality

For White Maize, the market appears to be dominated by planting and harvest, storage, exchange rates, weather related events, political agendas, and other factors. Even when the impact of these events on the market is not clearly transparent from price movements, they are always there, adding fuel to the futures engine. (Kaufman, 2005). With this said, it is obvious that seasonality would play a big role in the WMAZ futures market, as it does in the financial or equity markets but once again, theory and practice do not seem to come together incessantly. In the White Maize futures market there are factors that remain constant year on year thus providing a great deal of insight for market participants on which they base their trading strategies. According to Kaufman, 2005, from an economic or basic supply and demand perspective, one would infer that more Maize is sold during harvest time than any other time of year. In addition to the obvious increases demand for storage, (when available) farmers generally need to service financing operations and thus need to sell their harvest as soon as possible resulting in greater sales volumes on the market causing prices to decline.

Once again, here we can clearly see the link between proposed theories and that of experience in the market and yet, “At the end of the day, Supply and Demand is what matters” (Gravelet-Blondin, R, 2006, Personal Interview). According to Chris Sturgess, a senior manager at the Agricultural Products Division of the JSE, there are other factors that affect this relationships robustness like that of carry over and planting operations by farmers that are not recorded or projected by the exchange. The South African Grain Estimation Service (SAGES) and BFAP understand the value of such information and have built models that attempt to project and understand market forced that drive production and therefore demand and supply.

It is fair to say, and has been confirmed with likes of Rod Gravelet-Blondin and others, that there are areas on which improvements can be made within the South African futures market with regard to the informational dissemination and statistical research. This impacts greatly on the transparency, spot price determination, efficiency of the market (EMH), and other factors.

44 BFAP results and predictions were used in the economic outlook section of this report.
45 Further investigative information was sourced from http://www.fao.org/giews/workstation/page.jspx
5 Findings and Conclusions

To recap: In a perfect market, according to the theories proposed and investigated, the relationship between futures and spot prices depends on interest rates, storage costs, convenience yields, and other random influencing factors like acts of God. Any deviation from the theoretical relationship will afford market participants opportunity for profit, which will quickly be arbitrated away, alluding to the fact that the market is in fact, efficient.

It was established that a system whereby a more active and transparent spot market could be developed is most certainly possible and plausible but not likely to be backed by current traders and other market participants. (This was also discussed in section 3.1. Silo Locations and other sections of the document.) In essence however, a market can only exist if it has the support and active participation of its members and users. The more efficient the market, the more it eliminates the uniqueness of available information, which affords participants marginal profit taking opportunities. It is the unjustified or ‘perceived’ threat that these opportunities will be reduced, that creates resistance in the market itself, and its participants, to actively pursue the implementation of systems which will increase efficiencies. The bottom line is that the South African market is just not big enough yet to warrant this kind of infrastructure spend with regards to asset allocations. To bring the market up to speed in this regard, major information systems, generally accepted reporting practices, and tools such as satellite feed and aerial surveying and mapping technologies would have to be implemented across the board. Moreover, the controversial views of prominent participants suggests that in the light of current volumes, the market is better off to remain as ‘inefficiently efficient’ as it currently operates, in order to attract the participative levels of market users.

If it is the role of an exchange to provide transparency through platforms they put in place, then surely it is their responsibility to ensure that transparency is reflected in market efficiencies? At this point, it is important to consider the socio political background of South

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46 Such as those in the US discussed whereby every market participant has to disclose their net daily trading position and whether that position was taken from a hedging or speculative point of view. As discussed, these factors hold great informative value that have the power to affect forecasting abilities of underlying methodologies used by the market participants. As a result, it fundamentally shapes market conditions.

47 Aggregated views as interviewees (to protect anonymity)
Africa and recognize from where we come. Prior to the open market conditions we currently enjoy, the government controlled and set prices of the underlying. It is in this light that many producers argue that the existence of a futures market has destabilized the market and as a result, has added unnecessary risk into their operating activities. However conceptually true this may be, we examined the benefits of open markets in this report, and essentially history has taught us that they far outweigh those of closed and controlled markets. It is the case that if markets were more efficient and transparent, that margins would be reduced. However, it is my opinion that in principal, market participants should support the development of a more efficient market scenario as they would reap the benefits of more sustainable, liquid markets with higher volumes and the numerous benefits associated with augmented market efficiency and enhanced competition. In efficient markets, information levels the playing field for all participants and although margins may decrease, volumes will make up for the difference and in the long run, will be better for all participants.

Due to the manner in which the South African futures market developed over time, there is today still a certain level skepticism when different role players release information. During the research process I realized that in this competitive environment, information can become very costly. It is the opinion of numerous prominent participants that the information supplied by South African Grain Estimation Service (SAGES), among others, is not sufficiently reliable and has become a bit of an “industry yarn”. (Gravelet-Blondin, 2006). Although it appears as though SAGES is trying to correct these inefficiencies, they neither have the support or the funding to do so currently with the vigor required. (Gravelet-Blondin, 2006). It is therefore fair to say that a major opportunity for the exchange to play a role in supplying timely, accurate and relevant information is at hand. It is the opinion of Rod Gravelet-Blondin that this is not really the responsibility of the exchange although he agrees that this could only add to the efficiency of the market and is an area that is left wanting. “In comparison to the United States Department of Agriculture (USDA), a properly constituted, unbiased group of statisticians and other experts are responsible for putting together the crop estimates. The National Agricultural Statistical Service (NASS) has indicated the importance of a proper crop estimate to their senate, which immediately allocated additional money in order to get proper co-operation in the various States in America. They also make use of satellite imaging in an effort to improve the estimate, especially of the hectares

48 See p. 33 *
planted. The Maize Board in the past also compiled a data bank via satellite images with the Institute for Soil Climate and Water”. I thus concur with Keyser and Mehl\textsuperscript{49} by also affirming their belief that the time has arrived that serious thought must be given to the manner in which crops are estimated. In this regard South Africa can learn extensively from, amongst others, the US.”

It is important that should the Exchange introduce committees to develop these estimates, they remain unbiased and dislocated from trading operations in order to maintain integrity. We have discussed the importance of information derived from supply and demand, and their influence on the decision making processes of all market participants. It seems to be a general opinion that prices of commodity futures are, or at least should be, the market expression of consciously formed opinions on probable prices in the future. (Working, 1942). ‘Futures prices are viewed as a highly sensitive index of the supply and demand for a particular commodity’ (Hoos, 1942). Working goes further to state that dealers consider them to be a barometer of the interaction of current price determination influences. This point was discussed with Rod Gravelet-Blondin and Chris Sturgess and it seems as though this is the case too for South Africa. Futures prices are viewed as some sort of standard with which spot prices are compared to and determined in South Africa. For this reason, physical maize prices at the different locations are quoted at near dated futures price based on Randfontein differentials. Spot prices, on the other hand, are generally supposed to reflect anticipations of the future to some degree, with foreseeable implications. In South Africa there is no definite commercial connection between spot and futures prices (Gravelet-Blondin, R, 2006, Personal Interview). According to Working, 1942, ‘The futures price set becomes a matter of prediction in a sense involving guesswork instead of commercial calculation of probabilities.’

The question about whether futures prices are able to supply information about forecasts of price changes is answered by the literature, however, I would agree with Working, in that “futures prices afford forecasts of change that will probably occur in the response to specific influences. These influences are difficult to define and are open to misinterpretation. Relations between futures prices, spot and expected futures prices, indicate merely the market assessment of price changes that are likely to occur in consequence of anticipated marginal net costs of carrying the commodity.” (Working, 1942)

\textsuperscript{49} Keyser, 2003., Mehl, 1940
It was the general consensus from the population of farmers/producers that were interviewed that the risk management facility provided makes life more predictable. They do however have concerns about the implied volatility introduced to the market by the existence of a futures market. This is a topic of great controversy according to Rod Gravelet-Blondin. It is my opinion that the Exchange still has a major role to play in the education of market participants. It is the case in South Africa that many of the older generation farmers are still very skeptical of the benefits associated with using the market to their advantage. As a result, their hesitation and behavior impacts on their participation and thus impacts the market, the information dissemination and other factors that affect the efficiency at the end of the day. An example of this was described as: “last year farmers all said they were not going to plant White Maze and bumped the price for R500 to R1200. They all planted and benefited greatly. But is this really manipulation of the market?” (Bird, S, 2006, Personal Interview).

Considering the socio political background of South African, it is safe to state that the futures market is relatively efficient considering the unique environment in which it operates. The literature research has covered the most pertinent aspects of theory associated with agricultural derivatives, these have been discussed with a number of prominent market participants in order to determine their place in the South African market. The findings that this report produced have also been discussed with a number of individuals in order to assess their validity.

In summary, there are areas where the market can be made more efficient. Based on the fact that the future and cash markets converge is in itself indicative of an efficient market. (Confirmed with Bird, 2006). The extent to which a reliable and visible spot price for the commodity exists is manifest in the market architecture and distribution of silo locations. It would make sense to say that if more than one silo location was used to calculate the yearly differentials, a more realistic spot would be derived. However, it seems as though the market is just not big enough to warrant this kind of implementation right now. It would also make sense that location differentials should be calculated more often instead of establishing a fixed rate for the year. Here too, the reasons for this framework are a result of the South African logistics market.
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There exists little protection and support for local markets in the form of infrastructure too. For example, a trader wishing to export maize can only do 30 000 tons per month, and this needs to happen within an average 6 week window. The Spoornet infrastructure from ports inland and visa versa do not provide the infrastructure needed for local traders to really be a competitive force internationally. “The international demand is there, yet we are unable to exploit them. (Bird, S, 2006, Personal Interview)

It is still not established whether it is the responsibility of the Exchange to pursue efficiency any further, or if it is even worth their time and effort since they are reliant on market participants’ approval and buy inn.

As far as shorting the underlying is concerned, it is possible yet not really feasible. The market has been shaped by the needs of current participants and no reason for shorting the underlying could be established with any of the individuals interviewed or in literature reviewed.

Unfortunately, it could not be established exactly how closely WMAZ (White Maize Futures Contract) tracks the underlying spot (over the life of the futures contract). If there was an active underlying market (there is one in the actual physicals but it is not transparent and not actively traded over the exchange), which there is not, this could be established. Moreover, if there were many silo differential locations,( and given that there were enough market participants to create the necessary volume/liquidity for both hedgers and speculators to actively participate given reduced margins but accepting higher volumes as the trade off), and all these locations made available their stock levels and their daily spot rate, this would be possible. As it stands at the moment it would be tremendously difficult to come to any reasonable conclusion about carry over, daily spot rates across different silos in the country with each region driven by its own forces of supply and demand for the goods.

It was however established after interviews with basis traders that there really is no application for this kind of information in South Africa as once again, the market is too dispersed and is too small. Establishing an active market for the underlying has been attempted in the past but it only attracted interest from the local participants closest to specific silo locations. The opinions of prominent market participants are both contradictory.
and controversial, and, depending on whether you are hedging or speculating, you would want the market to be more transparent or not!

Finally it seems as though it is common knowledge in the industry that the South African Maize market has been more volatile than those of more developed countries. Even though no beta (measure of risk and associated with volatility) for the WMAZ market was established in this report (due to restricted and unavailable information), considering the socio political background of South Africa and the teething problems associated with growing markets, exchange rate volatility (associated with the R/$), and other factors discussed, that the markets would invariably be more volatile. “For the past three years our market has been one of the most volatile in the world” (Bird, S, 2006, Personal Interview).

To conclude, inefficiencies in the market will decreases as the factors transparency with regards to information, pricing and general market accessibility increases. The most pertinent learning point of the research was that although theories are the basis on which financial markets are built, there are other socio economic, informational and operational environment forces that mould markets into the shapes they ultimately take. It is based upon this that I conclude that the futures market in South Africa is as efficient as it needs to be in order to operate effectively, yet, there are major opportunities to make it more so which have been discussed in the report. Perhaps as the market, South Africa, and the environment in which they all operate develops over time (creation of more educated and active participants), we will start seeing some of these improvements.

Finally, “The current excitement about the futures market, and the new types of futures now being traded, mean that futures prices are studied with great diligence. In spite of such concentrated attention, there are many issues about which people disagree” (Kolb 1998)
6 Appendix

6.1 Economics

Carry-in\textsuperscript{50} stock levels, current year production, crop estimates, imports, exports and other economic forces affect supply and demand of White Maize in South Africa. Ultimately all information affecting price volatility in conjunction with the natural state of environmental and Government policy will be built into the price of any product or service. Clearly there is no point in taking expected futures modeling to the extreme, but there is merit in understanding the forces that play a role in determining the price at the end of the day.

Numbers like the Stocks-to-use Ratio expresses how supply affects volatility, \textit{“and is a is a key number in technical analysis rules of trading in commodity markets”} (Geman, 2005).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{demand.png}
\caption{Demand graph showing price and quantity relationship.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{elasticity.png}
\caption{Elasticity graph showing price elasticity at different demand points.}
\end{figure}

\textit{“In economics, elasticity is the ratio of the incremental percentage change in one variable with respect to an incremental percentage change in another variable”}\textsuperscript{51}.

Elasticity explains what happens to demand for White Maize when prices change. Usually as prices of products rise, consumers demand less. There may be several reasons for the reduced demand like, reduced consumption because of product substitution, declining

\textsuperscript{50} Surplus Stock left from previous year.

\textsuperscript{51} Wikipedia. \url{http://en.wikipedia.org}. [Online] [Cited: July 15 2006.], \url{http://en.wikipedia.org
population fashion, seasonality etc. The greater the extent to which demand falls as prices rise, the greater is the price elasticity of demand. Elasticity also behaves differently in the short and long term. This concept has a wide range of applications in economics particularly in understanding the dynamics of market responses to forces of supply and demand. (Wikipedia, 2006)52

This section will have a quick look at some of the economic variables that affect the price of White Maize in South Africa purely from an investigative point of view. The projections, graphs and opinions contained within this report were modeled by the Bureau for Food and Agricultural Policy (BFAP). The accuracy of their projections are not being questioned however, it is the opinion of numerous prominent market participants that the information available to participants in the South African futures market is left seriously wanting.

The data following below was aggregated and taken from a modeled BFAP report53. It contains none of my own views or opinions. It is necessary to include this information as it forms part of the base on which complete analysis of the future market and the economic environment in which it operates will be used to drawn on for conclusions.

Crop54 land has declined from 2002 and is projected approximately 4,2 million hectares. The per capita consumption of White Maize is projected to decrease. Population growth is a key driver in the demand for food products and is estimated to hang about a maximum of 47.7 million in 2007 after which it will start decreasing to a level of 47,2 million in 2011. The main reasons for the declining trend are changing lifestyles where families are generally smaller, and HIV/Aids related deaths. The Rand/Dollar exchange rate remains a strong driving factor of price levels and trade volumes of food products in the South African agricultural sector. During the past decade, significant exchange rate variability has been experienced, this fact substantiates the opinion of Shane bird that the South African market is one of the most volatile in the world. The gross value added of the agricultural sector is the contribution of the sector to the total GDP of the economy. It has experienced a downward trend since 2002 but an annual average growth rate of 3% is expected from 2007 to 2011. The

52 http://en.wikipedia.org/wiki/Elasticity_%28economics%29
53 http://www.bfap.co.za/pdfs/BFAPOUTLOOKJUNE2006_2.pdf
54 Maize, wheat, etc
reason for the change in trend is mainly due to the benefits of economic growth which is
expected to spill over into the agriculture sector. During the past decade, the gross value of
field crops displayed significant variability in response to fluctuations in markets and climate
and has shown a continued decline in the past three years as a result of a fall in the price of
major crops. It is expected to reach its lowest level in 2006 after which it is projected to
increase marginally at a 1% annual average growth rate from 2007 to 2011. The White Maize
areas harvested decreased in 2006 by 43%, mainly because of low producer prices during
2005 which resulted in an increase in prices to between R1 000/ton and R1200/ton on
average for 2006. The projected increase in Maize prices during 2006 caused planting to
increase significantly in the 2006/07 season. During the remaining period, area harvested is
projected to remain stable, with prices moving between R800/t and R1000/ton. Total Maize
production for 2006 is projected to decrease to 5,9 million tons due to the lower area
harvested as well as lower yields compared to the 2004/05 season. Maize production is
projected to increase above long term average levels during 2006/07 after which it is
projected to decrease during 2007/08 and then move around levels of 8,9 million tons.

Human consumption is projected to decrease slightly, while animal feed consumption is
projected to increase slightly. Reasons for lower per capita consumption of Maize could be
explained too by consumers who are substituting grain products for meat and other
foodstuffs. Maize exports are one of the key factors driving prices in the domestic Maize
market. Maize exports are projected to decrease significantly in 2006 compared to 2005 in
response to lower Maize production. During 2007, exports are projected to increase slightly
over the period analyzed. White Maize exports can be influenced mainly by levels of Maize
production in other countries as well as changes in transport infrastructure and administration
that either facilitate improved export efficiency or hamper exports. This point was reinforced
by Shane Bird from Cargill RSA (Pty) Ltd, one of the biggest trading organizations in South
Africa. Rainfall statistics of the past 30 years indicate a high probability of 545 mm of
rainfall over the summer grain production area during the months critical for grain
production. The likely minimum average rainfall is 368 mm and the likely maximum average
633mm.

Given the possible variation in rainfall, exchange rates, and planted area of White Maize,
the White Maize price can vary significantly during the period 2006 to 2011. A possible
range within which the average annual White Maize can trade during the period 2007 to 2011
is between R776/ton and R1 249/ton. (These are annual average Randfontein prices).
The stochastic simulations do not take the impact of the possible introduction of biofuels, variations in rainfall and exchange rate into account. Hence, probability or stochastic simulations are done in order to take variation, and thus risk, into account. All the variables are presented in the form of probability distribution functions, with likely lowest value (left line), mean value (middle line) and likely highest value (right line). This does not imply that the variables cannot move outside of these values.

**Summary of White Maize Variables in South Africa**

<table>
<thead>
<tr>
<th>White Maize</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area Harvested</td>
<td>2,083</td>
<td>1,842</td>
<td>1,700</td>
<td>973</td>
<td>1,670</td>
<td>1,435</td>
<td>1,483</td>
<td>1,525</td>
<td>1,525</td>
</tr>
<tr>
<td>Yield</td>
<td>3.06</td>
<td>3.15</td>
<td>3.85</td>
<td>3.64</td>
<td>3.67</td>
<td>3.7</td>
<td>3.73</td>
<td>3.76</td>
<td>3.79</td>
</tr>
<tr>
<td>Production</td>
<td>6,366.0</td>
<td>5,805.0</td>
<td>6,541.0</td>
<td>3,538.1</td>
<td>6,127.1</td>
<td>5,314.7</td>
<td>5,537.8</td>
<td>5,739.5</td>
<td>5,784.1</td>
</tr>
<tr>
<td>Feed Consumption</td>
<td>641</td>
<td>733</td>
<td>606</td>
<td>593</td>
<td>729</td>
<td>653</td>
<td>646</td>
<td>670</td>
<td>691</td>
</tr>
<tr>
<td>Human Consumption</td>
<td>3,687.0</td>
<td>3,766.0</td>
<td>3,746.5</td>
<td>3,624.9</td>
<td>3,768.0</td>
<td>3,699.8</td>
<td>3,672.4</td>
<td>3,652.5</td>
<td>3,626.2</td>
</tr>
<tr>
<td>Total domestic use</td>
<td>4,925.0</td>
<td>4,814.0</td>
<td>4,672.5</td>
<td>4,462.7</td>
<td>4,821.6</td>
<td>4,677.4</td>
<td>4,643.5</td>
<td>4,646.9</td>
<td>4,642.3</td>
</tr>
<tr>
<td>Ending Stock</td>
<td>2,123.0</td>
<td>2,402.0</td>
<td>2,356.0</td>
<td>998.8</td>
<td>1,338.3</td>
<td>1,178.3</td>
<td>1,180.3</td>
<td>1,279.1</td>
<td>1,374.7</td>
</tr>
<tr>
<td>Exports</td>
<td>1,069.0</td>
<td>712.0</td>
<td>1,914.5</td>
<td>554.6</td>
<td>968.7</td>
<td>837.7</td>
<td>911.4</td>
<td>993.7</td>
<td>1,046.2</td>
</tr>
<tr>
<td>Imports</td>
<td>33</td>
<td>0</td>
<td>0</td>
<td>122.1</td>
<td>2.7</td>
<td>40.4</td>
<td>19.2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Average Safex Prices</td>
<td>1,004.4</td>
<td>919.1</td>
<td>682.3</td>
<td>1,189.5</td>
<td>895.3</td>
<td>1,051.4</td>
<td>1,099.3</td>
<td>1,092.7</td>
<td>1,086.0</td>
</tr>
</tbody>
</table>
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[Graphs and data visualizations related to rainfall, grain production, exchange rates, population, and agricultural sector income and crop prices]
6.2 Maize

Maize is the largest grain crop in the world and is used for human consumption, livestock feed, ethanol and fuel applications, nonfuel industrial, beverage industries, and more. (Wikipedia, 2006).

Information about what Maize is used for, and the degree to which consumption effects factors of supply and demand in South Africa are all important considerations to take into account when looking at price discovery, Government policy, production factors, and market behavioral characteristics in general.

For any commodity to qualify for trading on the Futures market, it has to meet specific requirements such as grade, quality, quantity, species, etc. The market must be big enough and may not be subject to any control over supply and demand. (Hoos, 1942). This said, the notion of control is also one of much controversy. According to Shane Bird, all participants have the ability to manipulate the market. White Maize is an annual crop planted that offers producers flexibility in that they are able to switch between crops in responds to movements in demand, supply and ultimately price expectations. As mentioned "last year farmers all said they were not going to plant White Maze and bumped the price for R500 to R1200. They..."
The South African Futures Markets:
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all planted and benefited greatly. But is this really manipulation of the market?" (Bird, S, 2006, Personal Interview). Leading on from this statement, it is obvious that higher White Maize prices could entice farmers to plant more acreage at the expense other crops. This situation could lead to an oversupply of the commodity thus starting the cycle yet again. Over supply results in a price reduction causing farmers to substitute their crop (reduction in planting), causing market participants to trade the Futures market in expectation that the reduced production will in fact result in reduced supply and increased prices⁵６.

“Supply and demand are important, but the importance of factors like emotions, panic and the power of the mind cannot be measured, and play a big role in influencing the market. Confidence has economic value!” (Gravelet-Blondin, R, 2006, Personal Interview)

Human consumption of Maize constitutes a staple food in many regions of the world and is also used as a feed for livestock, forage, silage or grain. It also has many industrial uses, including transformation into plastics and fabrics. Maize can be treated to produce syrups, sweeteners, or fermented and distilled to produce alcohol. Maize is sometimes used as a biomass fuel, (diesel out of the biogas). Sasol has seriously pursued this area of application using their unique Fischer Tropsch technology. Increasingly ethanol is being used as an additive in gasoline for motor fuels to increase the octane rating, reduce its pollutant capacity petroleum use.⁵⁷

The Maize Genetics Cooperation, located in the Department of Crop Sciences at the University of Illinois has a total collection of nearly 80,000 different Maize samples.⁵⁸

Because futures contracts are standardized, they are easily bought and sold over the exchange. (This brings contract liquidity into the market). Standardization is achieved by specifying the underlying, the type of settlement (cash or physical), the amount and units of the underlying asset, the currency, the grade, the delivery month, the last trading date, and

⁵⁵ http://en.wikipedia.org/wiki/Maize
⁵⁶ And visa versa until market is in equilibrium
⁵⁷ http://en.wikipedia.org/wiki/Maize
⁵⁸ http://en.wikipedia.org/wiki/Maize
other details such as the commodity tick, and minimum permissible price fluctuation.\(^{59}\) (JSE, 2006)\(^{60}\)

African Maize stem borer (Busseola fusca) and the Chilo stem borer (Chilo partellus) are the most harmful pests to Maize in South Africa. Damage caused by Busseola fusca has been estimated to result in a 5–75% yield reduction and is generally accepted that to reduce the South African Maize crop by an average of 10% across years and regions. This translates into an average annual loss of about one million tons of Maize worth approximately US$130 million. (Wikipedia, 2006)\(^{61}\)

### 6.3 Risks associated with the Agricultural Industry

- **Asset Risk**: Theft, fire and other loss or damage to assets used for production.
- **Production Risk**: Extreme weather events and plant diseases.
- **Yield Risk**: Measured by yield variability
- **Price Risk**: Measured by the volatility of commodity
- **Financial Risk**: Fluctuations in the cost of borrowing, insufficient liquidity and loss of equity
- **Ecological Risk**: Pollution and climate change, or the result of the management of natural resources such as water.
- **Market Risk**: Demand and Supply
- **Currency Risk**: Fluctuations in exchange rates

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\(^{59}\) See contract specifications in appendix.

\(^{60}\) http://www.safex.co.za/ap/contract_specs.asp

\(^{61}\) http://en.wikipedia.org/wiki/Maize
6.4 Automated Trading System (ATS) used by SAFEX

6.4.1 Function of the ATS

The ATS combines two functions, namely that of a deal booking system and that of a price publication system.

The booking system exists in four versions simultaneously and all may be used at any time. The off ATS deal system allows the booking of deals by telephone. The bid/offer system allows prices quoted on the screen to be accepted by the click of a button after which a deal will result. The results of the deal booking system are identical—finally creating a deal between the member and Safex. There will always be an equal and opposite deal at the end of the day, leaving Safex neutral. The deals will result in a change to the position of the principal of the deal. Whereas the deal is concluded between the member and SAFEX it may have as a principal one the member's accounts sub or a member's client. The price publication system allows members to publish the prices at which they are willing to trade and/or request publication of prices by other members.

6.4.2 Communication Philosophy

There is a set of personal files on the member's computer or network. These files can be re-created at any time and copies of the current live data will automatically be copied from Safex, so providing current up-to-date files.

This activity is required when the member connects at the beginning of the day. If the member goes off-line during the day and connects later and suspects that files may have changed due to executed orders. When status data such as registered clients or dealers and the local files have to be updated. Once a member is connected, the system and files will be updated on a continuous basis by direct communication between the member and the Safex central computer.

At the end of the day a member may create ASCII file copies of files or use the Btrieve version to load a computer system used for the administration of 'mark-to-market'. Users are expected to have a personal directory on their terminal or LAN where their personal files exist.

6.4.3 The Futures Contracts Window
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This window displaying the master list of 'Futures Contracts' appears on first logging in to the system and remains visible at all times, regardless of whatever other windows are opened on top of it. This window is loaded from the active display file maintained by the central ATS Module. The order of the contracts on this master list can be arranged by means of the menu item "Arrange Contracts".

6.4.4 Bid for a Futures Contract

Highlight the contract on which you want to place a 'Bid' for a Futures Contract.

To open the 'Enter Buy' window in which to place the bid, click on 'Bid' on the "Orders" menu, or click on the Bid area if the Futures Contracts screen. See below: Select the bid type: FOK, TOK or NOR. The bid type defaults to NOR prior to opening, to NOR if no corresponding 'Ask' exists and to FOK if an ask price exists. Once all the fields have been entered correctly, click on 'OK'. To abort an entry, click on 'Cancel'. Verification of all input is done and controlled by the limits set in the Setting Limits configuration.

6.4.5 Ask on a Futures Contract

To enter an 'Ask' on a Futures Contract, highlight the contract for the 'Ask'. On the 'Options' menu, click on 'Ask' or press F3. The 'Enter Sale' window will appear. See below: Enter the details into the fields. To move from one field to the next, press the 'Tab' key. Once all the fields have been entered correctly, click on 'OK'. To abort the entry, click on 'Cancel'. The input will be verified and controlled according to the limits set in the configuration. If the Confirm an Order option has been set in the Setting Limits window, a prompt will appear asking you to confirm your order as a Bid, Sell or Double. Enter an 'S' for Sell.
### 6.5 Contract Specifications

Maize Futures Contract (White & Yellow Maize) Specifications

<table>
<thead>
<tr>
<th>Code</th>
<th>WMAZ/YMAZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underlying Commodity</td>
<td>Maize” means white/yellow maize from any origin, of the grade “WM1” (“YM1”) as defined in the South African Grading regulations, that meets all phyto-sanitary requirements and import regulations, but is not subject to the containment conditions for the importation of genetically modified organisms</td>
</tr>
<tr>
<td>Trading Hours</td>
<td>09h00-12h00</td>
</tr>
<tr>
<td>Contract Size</td>
<td>100 Metric Tons</td>
</tr>
<tr>
<td>Contract Months</td>
<td>March, May, July, September, December</td>
</tr>
<tr>
<td></td>
<td>All other calendar months are introduced 20 business days preceding the new month. Once the month is introduced it is traded in the same fashion as the 5 hedging months.</td>
</tr>
<tr>
<td>Expiration Date and Time</td>
<td>12h00 on the eighth last business day of March, May, July, September and December. Physical deliveries from the first business day to the last business day of expiry month.</td>
</tr>
<tr>
<td>Settlement Method</td>
<td>Physical delivery of Safex silo receipts giving title to maize in bulk storage at approved silos at an agreed storage rate.</td>
</tr>
<tr>
<td>Quotations</td>
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<td>Minimum Price Movements</td>
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<td>Initial Margin</td>
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<td></td>
<td>At extended price limits, requirements increased to R13 000/contract</td>
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The South African Futures Markets:  
An Analysis of the Efficiency of the White Maize Derivatives Markets

<table>
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<td>Expiry Valuation Method</td>
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<td>Maximum Daily Price Movement</td>
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<td>R13 000/contract up to expiry day.</td>
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<td>R23 000/contract up to last delivery day.</td>
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<td>R2 000/contract for calendar spreads.</td>
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<td>R2 250/contract for white spreads.</td>
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6.6 Silo Receipt Process

How Silo Receipts are Issued and Traded with Particular Reference to the Agricultural Products Division (APD) Of the JSE

The producers of maize will deliver their produce as it is harvested from their fields. They will, for example, deliver 5 tons on one day, 10 tons on the next and so forth. After each delivery, the silo owner will issue them with a confirmation of delivery receipt that states the quantity and quality held on behalf of the producer. This receipt is utilized as proof of delivery by the producer and confirms that the commodity was delivered to the silo owner.

6.6.1 The Safex silo receipt

The farmer will keep on delivering grain at the silo and when he has delivered 100 tons (or amounts as per the standardized futures contract) he may request the silo owner to issue a Safex silo receipt in his name. The Safex silo receipts are sequentially numbered and forwarded to each registered silo owner by the JSE. The silo owner issues the receipt in triplicate and hands the original to the owner of the grain in question. The silo owner keeps a copy for his own records and the other copy is forwarded to the APD by courier. The Safex silo receipt has unique asset features, being a hologram and distinct watermark. The receipts are individually numbered with APD keeping records of the receipts issued. These asset features coupled with the retention of the two copies by the silo owner and the APD make it

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63 Published to the web in document ‘What are Silo Receipts? (pdf)’
http://www.safex.co.za/ap/docs/education/SILO%20RECEIPT%20PROCESS.pdf
virtually impossible to forge a receipt or to obtain grain by producing a forged silo receipt. There have not been any forgeries of any Safex silo receipts to date.

6.6.2 The silo owner’s own receipt

The producer can also ask the silo owner to furnish him with the silo owner’s own receipt but this receipt may not be utilized for delivery in terms of a futures contract listed on Safex. The silo owner’s own receipt is, however, proof of delivery of the quantity and quality of grain delivered by the producer. A Safex silo receipt is a receipt that is issued by an approved silo owner in the form as set out by the JSE and in the terms set out in the futures contracts.

6.6.3 Who may issue a Safex silo receipt?

A Safex approved silo owner can only issue the Safex silo receipt. There are currently +-200 delivery points (silos) in South Africa. This is unique in terms of world standards as the Chicago Board of Trade has only four delivery points. The silo receipt may be freely transferred and quite often will have the names of many prior holders endorsed on the receipt before the receipt is cancelled and the product physically out loaded.

6.7 Exchange Traded Agricultural Derivatives and structure of the South African Futures Market. (Safex)

Futures market structure

Futures market - 24 hour cycle
The Agricultural Market is open from 09:00 am - 12:00 pm with allocations closing at 12:45 pm. The Financial Market Closes at 17:30 pm and Allocations Close at 17:45pm.

Systems & Technology

The JSE is currently transforming its IT systems to newer architecture in order to operate more efficiently at lower costs. This 27 month transformation entails taking 42 systems and consolidating them into 16, in joint partnership with Accenture.

The Exchange has identified the need for more efficient systems and is in the process of bringing their systems and technology up to speed. This is unquestionably a step in the right direction and it will be interesting to see the effect that the proposed new system has on the efficiency, reliability, and transparency of the market in years to come.

The agricultural market has moved away from a government-regulated environment to an economically driven environment. This could be due to a number of reasons, some of which may include the need to be internationally competitive, government inefficiencies in

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64 http://www.safex.co.za/ap
65 See Appendix for details on the Automated Trading System (ATS)
the old regime, and general market forces produced by market participants, and so forth. Registered brokers can log onto the Automated Trading System (ATS)\textsuperscript{66} from any remote location in order to access information and trading interfaces required for processing orders which are then automatically matched at random. As mentioned, one of the exchanges responsibilities will then be to guarantee contractual obligations. Prices are quoted on the ATS as Month of expiry, year of expiry, and the four-letter code of commodity (JUL06 WMAZ). (One WMAZ Futures contract = 100 tons of White Maize) (JSE, 2006)\textsuperscript{67}

The Agricultural Markets Division (AMD) was established in January 1995 as a division of the South African Futures Exchange (Safex). In 2001 the JSE Securities Exchange bought out Safex and moved the Agricultural Products business into a division known as Safex Agricultural Products Division (APD). In South Africa, they have established themselves as a market leader in the industry and have gained international respect as a competitive player even though the market size is considerably smaller. During 2001, Safex was bought out by the Johannesburg Stock Exchange (JSE) and currently operate from their central office in Johannesburg, South Africa. “Growth continues to be most encouraging as the exchange trades on average 200 000 tons of maize a day and options on these are increasing daily.”

The growth in the market has resulted from an increased number of participants, greater understanding of the market and the development of a broader base of marketing strategies based on the derivative products. (JSE, 2006)\textsuperscript{68} “The use of the transferable Safex silo receipt has added to the efficient trading of the commodities to such a degree that many of the financial institutions have begun accepting it as collateral.” (JSE, 2006)\textsuperscript{69}

6.7.1 Delivery of the Safex silo receipt in completion of a futures contract.

All products traded on the agricultural market of Safex are physical deliverable at expiry. This does not mean that 100 tons of maize for example is delivered by truck to Safex to complete the physical delivery process, but rather the JSE makes use of a Safex silo receipt

\textsuperscript{66} The physical IT infrastructure is located in London due to technological advantages, business continuity and contingency, and redundancy
\textsuperscript{67} http://www.safex.co.za/ap/about_da.asp
\textsuperscript{68} http://www.safex.co.za/ap/about_da.asp
\textsuperscript{69} http://www.safex.co.za/ap/about_da.asp

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which represents the specific quantity of stock in a registered Safex silo. The silo owner who stores the product guarantees the quality of the stock.

The Safex silo receipt is a transferable but not negotiable document that represents title to a specific quantity of specific quality product free alongside rail at a registered Safex silo.

Delivery can take place anytime during the particular delivery month. (A futures position in the July contract can only be delivered on during July) With the introduction of the constant month contracts maize can be delivered every month of the year while wheat and sunflower only during the five hedging months of March, May, July, September and December.

Physical delivery on the exchange takes place over a two-day period, the notice day followed by the delivery day (the next business day).

6.7.2 Notice Day

The short position holder (seller of maize) will notify his APD broker that he intends to give notice of delivery to close out the futures position. Notice can be given any time during the delivery month. The last notice day being the second last business day of the delivery month. Only one day’s notice is required for delivery of the commodity. For example the short position holder could give notice on the September futures contract on the 31 August for delivery on the 1 September or his last notice day would be the 29 September for delivery on the 30 September. (For all delivery dates see Agricultural Derivatives – Contract specifications on the web page). The commodity has to be issued from a registered JSE silo owner on a Safex silo receipt for it to be valid. The delivery notice has to be received by the exchange before 12h45 to be included in the day’s deliveries.

The deliveries are computer allocated in such a fashion that large long position holders have a greater possibility of receiving stock first. The long position holder who is allocated stock will be notified through the clearing member the same afternoon what stock has been received.
The closing price (mark-to-market) on the notice day is the price at which the contracts are closed. The location differentials and any outstanding storage is deducted from the amount payable by the long position holder. (in the case of wheat a grade discount is also applicable) No prepayment of storage is taken into account by Safex and so any storage that is prepaid will be forfeited by the seller. The long position holder will be charged a standard storage rate fixed for each marketing season and will be responsible for storage from the delivery day onwards.

6.7.3 Delivery Day

The silo receipt has to be delivered to the broker who will in turn insure that it reaches Safex no later than 12h00 on the delivery day. Payment for the product will take place by 12h00 on the delivery day once the silo receipt has been received. The long position holder is able to collect the silo receipt from 14h00 onwards. The exchange will receive the funds from the buyer and pass these onto the seller through the registered broker.

Positions can still be opened or closed during the delivery month until the last trading day. The last trading day is always the eight last business day of the month. Once the contract has closed for trading any position still open will have to be honored, either delivered or paid for.

Margin requirements that are used as a guarantee by the exchange vary during the delivery month. A contract traded before the first notice day will have initial margin requirements of R10000 for white and yellow maize, R3000 for wheat and R5000 for sunflower. On the first notice day initial margin is increased to R13000 per contract for all maize contracts traded. This is done since the potential risk against one party defaulting has increased and the price limits applicable to the contract have been removed. The initial margin requirement is changed again on the last trading day. After this day that particular contract is closed and all short position holders will have to deliver a Safex silo receipt however they have until the last business day of the delivery month to do so. In the same way all long position holders will have to take delivery once they are assigned. Since the risk of possible default of the client is at its maximum the initial margin requirements are increased to R23000 per maize contract.
Using a futures exchange to deliver or source any commodity will always be guaranteed. This is due to the tier system that the exchanges use. Should the client default on a contract the APD broker will assume his positions. He could then close that position off and use the initial margin of the client to cover his loss. If the broker is unable to assume the client’s position, his clearing member will stand in for him and assume the position. This tier system will always ensure that the client on the other side is guaranteed of his position.

6.7.4 Transfer of the Safex Silo Receipt

Once the Safex silo receipt is received by the exchange, properly signed off by the previous owner, it will be handed over to the new buyer who will sign and accept ownership of the receipt. This transfer of ownership takes place on the back of the original Safex silo receipt, due to the tradability of the silo receipt this may take place a number of times before the product is finally out loaded.

6.7.5 Financing product through Silo Receipts

A number of institutions will offer financing of the silo receipt. In this case the silo receipt is handed over and transferred in the name of the financing institution, which will keep the silo receipt as asset. Should the client default on the transaction the institution will trade the silo receipt in the market place to settle the loan.

6.7.6 Out loading of the physical stock and final cancellation of the Silo Receipt

Once the owner of the silo receipt has decided to collect the physical product represented by the receipt, the original silo receipt is presented to the silo owner who issued it. The silo owner will check the validity of the silo receipt and once all outstanding storage has been paid, will out load the product as per the final buyer’s instructions. At this point in time the silo receipt is cancelled and cannot be traded any longer.

6.7.7 Lost or missing Silo Receipts

Due to the physical nature of the silo receipt, from time to time receipts are lost or stolen. In this case they are immediately cancelled at the silo owner who will also notify the JSE, should it be a safex silo receipt. Records are kept of the cancelled silo receipts and should they be tendered for delivery at any stage, will not be accepted.

6.8 Mark to Market (M-t-M) Calculation of Futures (Settlement price)
“The Mark-to-Market (M-t-M) for the day, AKA, the settlement price, is determined randomly at any time during the last 5 minutes of trading at the discretion of the exchange. If a bid is better than the last traded price, the bid will be used as the M-t-M price. Should an offer be lower than the last traded price, the offer will be used as the M-t-M. A volume weighted average price (VWAP) is used to calculate the M-t-M for all liquid contracts. It is a fundamental characteristic of the market in that every contract is adjusted according to profit and loss (P&L). As prices move, the positions holders trading account is adjusted in order to maintain margin requirements. This process thus protects market participants against contract default while at the same time bringing reliable, transparent pricing information to the market.

70 Any expiry that trades 100 or more contracts in the last half hour of trading
71 http://www.safex.co.za
## JSE Agricultural Products Division Active Members and Clearing Members

<table>
<thead>
<tr>
<th>Member</th>
<th>Code</th>
<th>Location</th>
<th>Name</th>
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<tr>
<td>Absa Bank Ltd</td>
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<td>Johannesburg</td>
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<td></td>
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### The South African Futures Markets: An Analysis of the Efficiency of the White Maize Derivatives Markets

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<tr>
<th>Company Name</th>
<th>Contact Details</th>
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# The South African Futures Markets: An Analysis of the Efficiency of the White Maize Derivatives Markets

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  - Thys Claassens
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<table>
<thead>
<tr>
<th>Clearing Members</th>
<th>Johannesburg</th>
<th>Contact Person</th>
<th>Telephone</th>
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<tbody>
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