White maize futures contracts in South Africa

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The purpose of the study is to construct and test a regression equation that could explain the price of white maize futures contracts in South Africa. An error correction model with AR(2)-error terms are used in the regression analysis.

Opsomming

Witmielietermynkontrakte in Suid-Afrika

Trefwoorde: Witmielietermynkontrakpryse, Suid-Afrika, AR-foutherstellende model.

Produsente van landboukommoditeite, veral in ontwikkelende lande, word blootgestel aan prysrisiko's. Markte vir landboukommoditeite in Suid-Afrika, soos in die res van die wêreld, is die afgelope aantal jare gekenmerk deur prosesse van deregulering. Die bemarkingsrade wat aanvanklik verantwoordelik was vir die bemarking van landbouprodukte, het ontbind en produsente van landbouprodukte moes nuwe metodes vind om hulle produkte te bemark. Een van die metodes wat gebruik word, is termynkontrakte.

Witmielies en geelmielies is die twee landboukommoditeite wat in die grootste hoeveelhede geproduseer word in Suid-Afrika. Witmielies en geelmielies word as twee afsonderlike kommoditeite verhandel op die termynbeurs. Witmielies word hoofsaaklik aangewend vir menslike verbruik en geelmielies vir dierevoer. Hierdie studie fokus hoofsaaklik op witmielies.

Die prys van mielies word beïnvloed deur veranderinge in die vraag daarna en aanbod daarvan. Faktore wat die vraag en aanbod van mielies beïnvloed is, onder andere, oesskattings, reënval, die wisselkoers en die pryse van mielies op die buitelandse mark, veral die markte in die VSA. In Suid-Afrika vorm die invoerpariteit en uitvoerpariteit 'n band waarbinne die prys van mielies varieer.

Die doel van hierdie studie is om 'n regressievergelyking te konstrueer ten einde prys van die witmielietermynkontrakte te verklaar. Die regressie-analise word deur middel van 'n foutherstellende model met outoregressiewe foutterme behartig. Die regressie-analise slaag daarin om die prys van witmielietermynkontrakte te verklaar.

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CHAPTER 1: EXPOSITION OF THE STUDY

1.1. Introduction

The history of the futures market in South Africa dates back to an informal market started by a local merchant bank, Rand Merchant Bank, in April 1987. The futures market became an independent exchange in September 1988, when the decision was made to broaden the market. Since then the trading of futures contracts are managed by the South African Futures Exchange (SAFEX) (Gravelet-Blondin, 2001:15).

A futures contract (future) is a contract between two parties, for the delivery of a standardised quantity of a specified commodity, at a price and delivery date that is predetermined. A formal exchange exists for the trading of futures contracts (Van Zyl *et al.*, 2003:399).

A commodity may be defined as any object that is produced for the purpose of consumption or for the purpose of being traded in the market. The term is also used in a more narrow definition to denote those foodstuffs and raw materials that are widely traded internationally in organised markets, for example wheat, white maize, yellow maize, cotton and oil (Macmillan, 2003:69).

SAFEX established its Agricultural Markets Division (AMD) in 1995, when the trading of beef futures contracts commenced. In February 1996 white maize- and yellow maize futures contracts were introduced to the market. During the first half of 2001, members of SAFEX accepted an offer by the Johannesburg Securities Exchange (JSE) to become part of the JSE. As from August 2001, the AMD became the Agricultural Products Division (APD) of the JSE (SAFEX, 2003).

White- and yellow maize are being traded as two different commodities on SAFEX. Currently, white maize futures contracts are the most liquid contracts traded on the APD of SAFEX (SAFEX, 2003). Different grading methods are used for the two commodities. White maize is mainly used for human consumption, while yellow maize is mainly used for animal consumption (SAFEX, 2003).

For the purpose of this study, the main focus will be on white maize. However, futures contracts with commodities as underlying instruments will be discussed in general in Chapter 2 and Chapter 3 of the study. In Chapter 4 aspects pertaining to the total maize market in South Africa will be discussed, before focusing on white maize in the rest of Chapter 4 and in Chapter 5.

The major production areas for the commercial growth of white maize are situated in the North West, Free State and Mpumalanga. The production of white maize has increased with 9.3% from the 1998/1999 production season to the 1999/2000 production season (NDA-Trends, 2000). The current ratio of production of white maize to yellow maize is 67% white and 33% yellow (NDA, 2003).

1.2. Definitions

Definitions of important concepts in the study will be given as the study progresses. However, due to the technical nature of the topic a glossary of terms is added at the back of the study, on pages 92 and 93. The glossary of terms contains a list of all the important concepts as defined in the study.

1.3. Motivation for the study

Producers of certain commodities in developing countries are vulnerable to price risk. As an attempt to stabilise commodity prices, governments introduced a variety of price stabilisation techniques. Government intervention in the market for commodities has, for a variety of reasons, been proven to be unsuccessful and unsustainable over the long run. Trade agreements for the liberalisation of certain commodities markets will further decrease the success rate of price stabilisation schemes (Lence, 2002).

The unsustainability of price control for certain commodities is one of the reasons that lead to the deregulation of commodities markets in various countries, including in South Africa. Other reasons that also gave momentum to the deregulation process of certain commodities markets are political pressure and trade agreements that promoted the liberalisation of agricultural markets (Minister of Agriculture and Forestry, 2003)

In South Africa the demise of the Maize Board in 1996 has focused the attention of farmers on the management of price risk and the marketing of their products, since a single channel marketer (which were provided by the Maize Board) do no longer exist. Futures trading is one of the mechanisms used by farmers to manage their price risk and to market their products. Other price risk management methods used by farmers include option contracts and forward contracts. A brief discussion of forward contracts and option contracts can be found in section 2.2.3. of Chapter 2.

Price risk is the results of volatility in the price of commodities. Prices of commodities are volatile due to instability in the supply and demand for the commodity. Worldwide the process of deregulating agricultural markets has received increased attention (Wiseman *et al.*, 1999:321-322). The Ministerial Conference of the World Trade organisation (WTO), held in Cancun from 10-14 September 2003, has indicated that the trend of deregulation of agricultural

markets worldwide is likely to continue in future. The reduction of agricultural subsidies in some industrialised countries is one of the points that were debated at this WTO-Conference (Cancun Declaration, 2003).

Surveys conducted show that the percentage of commercial maize producers (farmers) making use of futures contracts, has increased from 27% in 1998 to 49% in 1999/2000 (Brown *et al.*, 1999:275). In a survey conducted by Krugel in 2003, the number of farmers making use of futures contracts on a regular basis is approximately 60% (Krugel, 2003:6). However, farmers are not the only participators on the futures market, speculators also play an important role in assuring the liquidity the market needs to exist (Gravelet-Blondin, 2001:15).

Price volatility creates a price risk for the farmers. They could hedge themselves against price risk by making use of futures contracts. As mentioned above, instability in the levels of supply and demand is responsible for the volatility in the price of commodities, such as includes maize.

Different factors lead to the changes in supply and demand of maize in South Africa. The supply of maize is influenced by factors such as rainfall, the crop estimates and inventory levels. The demand for maize is influenced by the quantity needed for human consumption and animal consumption. Other factors that have an impact on both the supply and demand of maize include import- and export parity prices, prices of CBOT (The Chicago Board of Trade) and the exchange rate, to name but a few. Apart from prices being volatile, the magnitude of the volatility also varies over time (Pindyck, 2001:1).

1.4. Hypothesis

The white maize futures contract price in South Africa can, to a certain extent, be explained by some of the factors influencing the supply and demand of white maize in South Africa.

1.5. Aim of the study

The aim of the study is to test the hypothesis described in section 1.4. by making use of a literature review and an empirical study. The research methodology followed is explained in section 1.6. below.

1.6. Methodology

The study consists of a literature review and an empirical study. The goal of the literature review is to provide a background regarding the futures market (Chapter 2), futures contracts (Chapter 2), the pricing of futures contracts (Chapter 3) and factors influencing the supply and demand of white maize in South Africa (Chapter 4). An overview will also be given regarding the history of the maize market in South Africa, as well as the current situation in the deregulated maize market (Chapter 4).

The literature review is conducted by utilising sources such as textbooks on the subject of futures, academic articles, conference proceedings, the internet and interviews with experts in the field of futures markets.

For the empirical study (Chapter 5), specific factors that influence the supply and demand of white maize in South Africa will be considered in order to construct an equation that could explain some of the volatility in the price of white maize futures contracts.

The factors that will be considered for inclusion in the construction of the equation will be discussed in Chapter 3, Chapter 4 and Chapter 5 of the study. The constructed equation will then be tested empirically by making use of the applicable data. The factors to be included in the empirical testing of the equation depend on the availability of the data.

1.7. Broad overview of the study

The rest of the chapters in the study will take on the following format: In Chapter 2 some of the technical aspects of the futures market and futures contracts will be discussed. Attention will be given to the characteristics of futures contracts, the characteristics of the futures market, as well as the difference between futures contracts, options contracts and forward contracts.

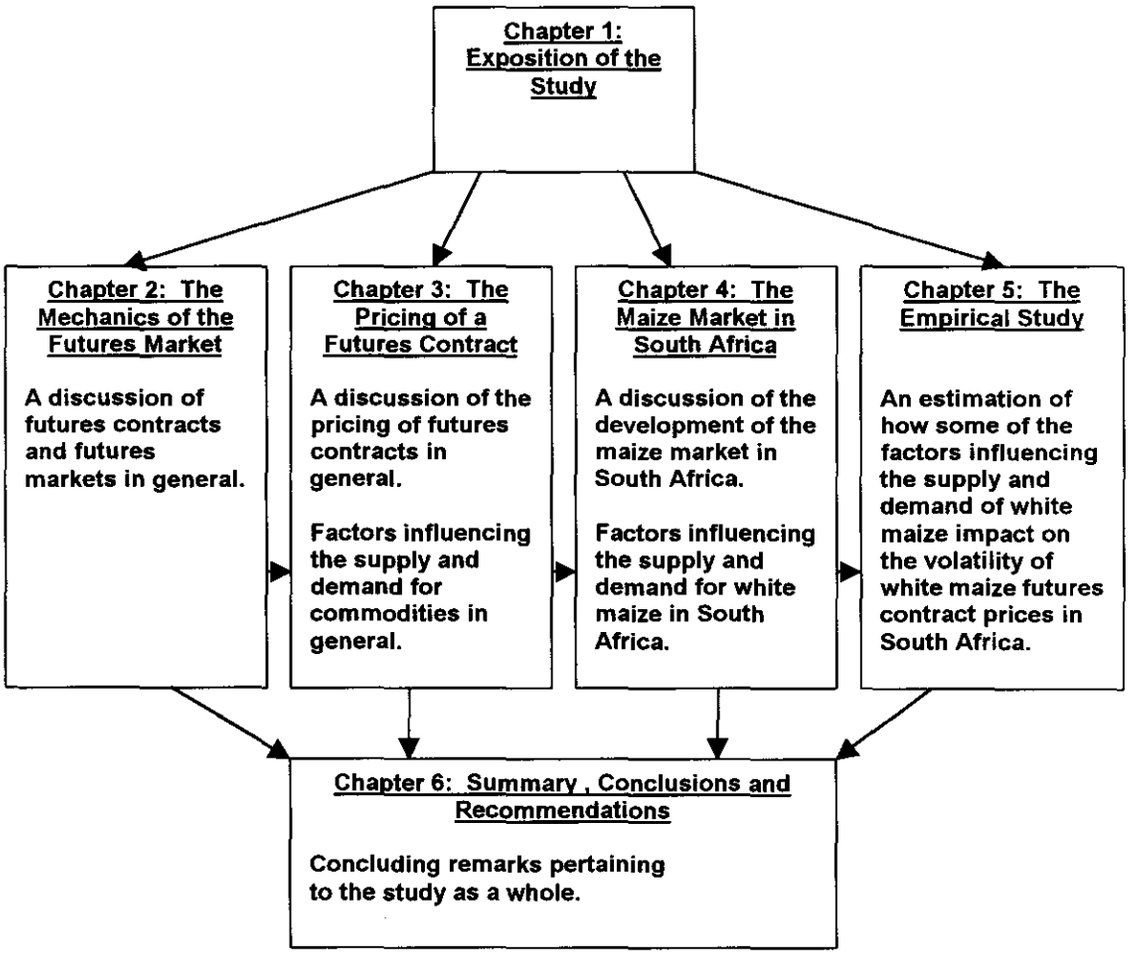
In Chapter 3 some of the theory regarding the pricing of futures contracts, the relationship between the cash price (or spot price) and the futures price of a commodity and the factors that influence the price of commodity futures in general, will be discussed. The cash price of a commodity can be defined as a price quotation obtained or a price actually received in a cash market or the price of a commodity if it was to be delivered immediately (Coopers and Lybrand, 1995:642).

The history of the South African maize market and current developments in the maize market will be discussed in Chapter 4 of the study. Chapter 4 will also pay attention to some of the unique factors that may influence the price of white maize futures contracts in South Africa. The empirical part of the research will be discussed in Chapter 5. The aim of the empirical research is to construct an equation that may explain some of the volatility in the price of white maize futures contracts. The constructed equation will then be tested empirically.

In Chapter 6 a brief summary of the key findings of the study will be given, as well as conclusions and recommendations pertaining to the literature review and the empirical study. Comment regarding the possibility of future research in the field of white maize futures contracts in South Africa will also be made in Chapter 6.

The following diagram, figure 1.1., is an aid in understanding the relationship between the different chapters of the study: Chapter 2 is a discussion of the more general topics regarding the futures market and futures contracts; Chapter 3 is a discussion of the aspects pertaining to the pricing of futures contracts in general, as well as factors leading to the instability of the supply and demand of commodities in general; Chapter 4 is a discussion of the situation in the South African maize market and Chapter 5 concludes with a summary and recommendations regarding the study as a whole.

Figure 1.1: A broad overview of the study



CHAPTER 2: THE MECHANICS OF THE FUTURES MARKET

2.1. Introduction

It has been common practice to make advance pricing arrangements since the days of antiquity and forward contracting for commodities had been refined considerably by the medieval times. However, the innovators of the futures markets were the Japanese. A well-structured futures market for rice was officially recognised in 1730 (Falkena *et al.*, 1991:1-2).

In the mid-nineteenth century, futures trading began in the United States. Futures contracts for maize and cotton were traded in New York and Chicago. Today, the trading of futures and options are commonplace throughout the world. Futures and options contracts are traded on a variety of commodities, financial instruments and indices (Futures Industry Institute, 1998).

Table 2.1. is a list of some of the exchanges in the world where futures contracts are traded. The web page referred to in the last column of Table 2.1. is a web page where information regarding the specific exchange is available.

Table 2.1. List of some futures exchanges in the world

Acronym / Abbreviation for Exchange	Name of Exchange	Web page with information on Exchange
CBOT	The Chicago Board of Trade	*www.cbot.com*
SAFEX	The South African Futures Exchange	*www.safex.co.za*
KCBT	The Kansas City Board of Trade	*www.kcbt.com*
MGEX	The Minneapolis Grain Exchange	*www.mgex.com*
NYBOT	The New York Board of Trade	*www.nybot.com*
SFE	The Sydney Futures Exchange	*www.sfe.com*
LIFFE	The London International Financial Futures Exchange	*www.liffe.com*
TGE	The Tokyo Grain Exchange	*www.tge.or.jp*

Futures markets provide important economic benefits, including the ability to shift or otherwise manage the price risk of the cash market. Futures markets are open markets where a large number of potential buyers and sellers compete for the best prices. The large numbers of potential buyers and sellers involved in the futures market ensures the liquidity of the futures market (Futures Industry Institute, 1998).

Rules and procedures have been developed to regulate the trading of futures contracts on the futures market. Certain basic principles apply to futures markets world wide, but the detail may differ from one market to the next.

As explained in Chapter 1, Chapter 2 is a discussion of certain general aspects pertaining to futures markets and futures contracts. In Chapter 2, the characteristics of a futures contract in general, the differences and similarities between futures contracts, option contracts and forward contracts, the characteristics of a futures market, and the role of the futures exchange in the trading of futures contracts will be discussed. The reason for the inclusion of the discussion regarding option contracts and forward contracts is because forward contracts and option contracts are sometimes mistaken for futures contracts. In the last part of Chapter 2 a discussion of hedging with futures contracts and the advantages and disadvantages of making use of futures contracts will follow. The pricing of futures contracts will be discussed separately in Chapter 3.

2.2. The product to be traded

2.2.1. The futures contract

Futures contracts fulfill mainly two purposes: Firstly, hedgers (buyers or sellers of a commodity) are able to use futures contracts to hedge themselves against adverse price risk in the cash market and secondly, futures markets are associated with a high degree of leverage, making futures contracts an attractive profit option for speculators (Falkena and Kock, 2000). In section 2.2.2. of Chapter 2 the role of hedgers and speculators in the futures market will be discussed in more detail. Hedging refers to an action taken by a buyer or seller of a commodity to protect his income against adverse price movements in future (Macmillan, 2003:180).

From the definition of a futures contract or a future (see section 1.1. of Chapter 1), certain specifications or characteristics pertaining to futures contracts in

general can be identified. Each of these specifications will now be discussed separately.

2.2.2. The specifications of the futures market

Due to the standardised nature of a futures contract, an exchange must specify in detail the nature of the futures contract. The asset should be specified, as well as the contract size, how prices will be quoted, as well as where and when delivery will be made.

2.2.2.1. The asset

The assets underlying a futures contract can be divided into two groups, namely futures contracts on specific assets and futures contracts on notional assets.

Futures contracts on specific assets are based on *(a.)* real assets or commodities or *(b.)* notional assets. An example of a futures contract based on a real asset or a commodity is a futures contract with maize as the underlying asset. Settlement of the contract takes place through delivery of the underlying asset or through cash settlement. The futures contract may also be closed out by an offsetting transaction (or opposite transaction) before the expiry date. A futures contract could be closed out by buying a futures contract of the same size if a contract was sold or selling a futures contract of the same size if a contract was bought.

Futures contracts on notional assets differ from other futures contracts because settlement can only take place by means of cash. Cash settlement is the only option because the underlying instrument is of a fictitious nature that cannot be delivered physically. An example of a futures contract with a notional asset as the underlying instrument is a futures contract based on a stock index (Falkena and Kock, 2000).

In order to ensure the successful trading of a futures contract, the underlying asset should have the following characteristics (Falkena *et al.*, 1991:1-2):

- The units should be homogenous, i.e. one unit of the commodity must be interchangeable with the next. Different units of the same asset should be identical in quality and quantity.

- If all units of the commodity are not identical, the different units of the commodity should have the ability to be grouped and graded according to quality and price.

- None of the possible buyers or sellers of the asset should have the ability to manipulate the price of the asset. A large number of possible buyers and sellers should participate in the market to ensure market liquidity.

- Market freedom should exist. The commodity must move from the producer to the consumer free from government intervention or other market restrictions.

- A level of uncertainty should exist regarding the supply and demand of the product. Changes in supply and demand are the primary cause of price changes. For a futures contract to exist, there should be a price risk involved in buying or selling the asset.

- The asset should have limited ability to perish and must be capable of being stored for delivery for several months after its production.

2.2.2.2. The contract size

The amount of the asset that has to be delivered under one contract, is specified by the contract size. The contract size depends on the type of asset traded. The contract size should not be too large or too small. If the contract size is too large, investors and speculators with smaller portfolios will not make use of the futures contract. On the other hand, if the contract size is too small, trading costs will increase since there is a cost associated with trading each contract (Hull, 1997:18).

The contract size of white maize futures contracts traded on SAFEX are 100 metric ton per contract (SAFEX, 2002).

2.2.2.3. Delivery arrangements or settlement

On the date specified by the futures contract, the seller of a futures contract delivers the agreed asset to the buyer, via the clearinghouse. However, very few of futures contracts are held until the delivery date and most contracts are liquidated or closed out by an opposite transaction before the delivery date.

The standardised nature of futures contracts ensure that one futures contract could be substituted for another futures contract with the same delivery date and therefore the position of the futures contract buyer could be closed out by selling a futures contract with the same delivery date and vice versa (Sutcliffe, 1993:31).

If delivery on a futures contract does take place, the futures market specifies the place of delivery. In the case of commodities, the place of delivery is of particular importance, since there may be transportation costs involved (Hull, 1997:19).

The delivery month is used to refer to a futures contract. For example there would be referred to white maize futures contracts with December as the month in which delivery should take place, as December white maize futures. The

exchange specifies the precise period of time during a month when delivery can be made. The delivery month may vary from contract to contract and is chosen by the exchange to meet the needs of the market participants (Hull, 1997:19).

The delivery months for white maize futures contracts traded on SAFEX are March, May, July, September and December (SAFEX, 2003). Futures contracts for the closest delivery month and the following two delivery months are traded at any given time. The volumes traded from futures contracts closest to delivery are higher than the volumes traded for futures contracts further from delivery, since many market participants choose to close out their position before the delivery date (Sutcliffe, 1993:33). The futures market specifies when trading in a particular month's futures contracts will commence, as well as when the last day of trade will be for a contract close to delivery (Hull, 1997:19).

2.2.2.4. Quoting of prices

Futures prices are quoted in a way that is convenient and consistent with the asset being traded (Hull, 1997:19). The price of white maize futures contracts traded on SAFEX is quoted in rand per ton (SAFEX, 2002).

2.2.2.5. Daily price movement limits

For most futures contracts, daily price limits are specified by the futures exchange. The daily price limit refers to the maximum amount the price of a futures contract can move upward or downward from the settlement price of the previous day. If the price of a futures contract moves upward by the amount equal to the daily price limit, the contract is said to be *limit up* and if the price of a futures contract moves downward by the amount equal to the daily price limit, it is said that the contract is *limit down* (Sutcliffe, 1993:39 and Hull, 1997:20).

If a futures contract reaches the price limit at any given time during the trading day, trading of that futures contract will cease for the day, but the exchange has the authority to change the limits if the interest to buy or to sell the futures contract is still there. Some markets have so-called *variable limits*, where the price limit is increased if the market closes *limit up* or *limit down* in a trading session. An example of a market with a variable limit is the futures market for soybeans in the United States (Kleinman, 2001:6)

Price limits are used to counter excessive speculative movements in the market, but might impose unnecessary restrictions on the market. Controversy exists surrounding the use of price limits for futures contracts (Sutcliffe, 1993:39 and Hull, 1997:20).

In South Africa the price limit for white maize futures contracts stays unchanged for relatively long periods of time.

2.2.2.6. Position limits

Position limits place a restriction on the number of contracts that a single trader can hold in a particular future. Position limits prevent speculators from manipulating the market; therefore position limits are only applicable to speculators and not to *bona fide* hedgers. *Bona fide* hedgers are producers or consumers of a certain commodity who wish to hedge themselves against adverse movements on the cash market. The primary reason *bona fide* hedgers make use of futures contracts is to reduce their price risk (Sutcliffe, 1993:40).

Currently no position limits exist for white maize futures contracts traded on SAFEX, but position limits do exist for other futures contracts traded on SAFEX, for example sunflowers and wheat (SAFEX, 2002).

Futures contracts are sometimes mistaken for options and forward contracts. Although options and forward contracts are also derivate instruments used in the hedging process, definite differences exist between futures contracts, options and forward contracts. A brief description will be given to clarify the difference between these three derivative instruments.

2.2.3. Futures contracts, option contracts and forward contracts

2.2.3.1. Futures contracts and option contracts

An option contract gives the holder of the option contract the right, but not the obligation, to buy or sell a certain asset at a set price, on or before a given date (Strong, 2002:429). The holder of the option contract is also referred to as the holder of the long position.

Futures contracts and option contracts (or options) are similar in two ways: Both involve a price and a contract duration that is predetermined. A difference between a futures contract and an option is that the holder of an option has the right, but not the obligation, to exercise the contract. On the delivery date the option holder has the choice to exercise the contract, otherwise the contract will expire unexercised. If a futures contract is held until the delivery date, a trade *must* occur and the contract will not expire if not exercised: One party must deliver the underlying asset (the seller of the futures contract or the holder of the short position) and the other party must pay the amount due to buy the underlying asset (the buyer of the futures contract or the holder of the long position) (Strong, 2002:192).

The long position refers to the ownership of a financial instrument, i.e. the person who is in the possession of the financial instrument or buying the financial instrument (Coopers and Lybrand, 1995:653). The short position, on the other hand, refers to the person who is not in the possession of the financial instrument

or the person who is selling the financial instrument (Coopers and Lybrand, 1995: 660).

2.2.3.2. Futures contracts and forward contracts

A forward contract may be defined as a non-marketable agreement between two parties to exchange certain assets at a set date in future (Strong, 2002:425).

According to Alexander (1996:16) a forward contract and a futures contract are similar to the extent that both are an obligation to deliver or buy a specific asset at a specified future date. The major difference between a forward contract and a futures contract is that a futures contract is standardised and traded through an exchange, while a forward contract is not traded though an exchange and the quantity of the asset, as well as the date of delivery is specified by the parties to the contract.

The standardised nature of futures contracts lowers the costs involved in the acquiring of information and the trading costs. Lowered costs justify the costly establishment for a formal exchange, the trading place of a futures contract (Falkena and Kock, 2000).

2.3. The trading place

2.3.1. Characteristics of the futures market

According to Falkena and Kock (2000), futures markets display the following major characteristics:

- Contracts are traded either by open outcry on an exchange or by using electronic methods with automated trading systems by means of a computer network;

- contracts traded on a futures market are standardised, with specified quantities and trading in specific months;

- delivery of the underlying asset to the futures contract is secured through a clearing system and a clearing house that guarantees fulfillment of the futures contracts;

- actual delivery of the underlying asset to a futures contract rarely takes place;

- liquidity of the futures contract should be high to ensure the successful trading of the contract;

- trading costs associated with the futures market tend to be relatively low when compared to other markets such as the equity market;

- prices of futures contracts are publicly disclosed; and

- profits and losses on futures contracts are settled on a daily basis.

An example of an exchange where trading still takes place by means of an open outcry system is the CBOT. However, the CBOT also makes use of electronic methods to trade futures contracts (CBOT, 2003).

Different groups of market participants in the futures market can be identified. These different groups will be discussed in the following sections.

2.3.2. Futures market participants

According to Falkena *et al.* (1991:19) the participants in the futures market can be divided into four main groups, namely hedgers, speculators, arbitrageurs and investors.

2.3.2.1. Hedgers

Hedgers face some type of economic risk and they choose to eliminate or reduce that risk by some type of offsetting transaction (Strong, 2002:426). On the futures market, farmers are hedgers who face a price risk and try to eliminate or reduce this risk by using futures contracts.

To explain the offsetting transaction a hedger would use to reduce or eliminate his price risk, an example would be used: If a farmer intends to deliver his products on a future date, he would *sell* a futures contract now. The farmer holds the long position in the cash market. To hedge himself against a price risk, the farmer would go short in the futures market. The farmer could then deliver the underlying asset on the delivery date of the futures contracts or he could close out the contract before the delivery date. In section 2.4. of Chapter 2 the process of hedging with futures contracts will be discussed in more detail.

2.3.2.2. Speculators

In the futures markets a speculator is a person who, for a price, is willing to bear the risk that the hedger does not want (Strong, 2002:431).

A speculator accepts the risks involved in adverse price changes, thereby allowing the hedger to reduce his price risk. A hedger foregoes the profit involved in a favourable price change and a speculator then receives the profit.

However, should the price move adversely for the speculator, he bears the risk the hedger would have borne. Speculators provide the necessary liquidity to the market, while hedgers are important to add integrity and substance to the market (Gravelet-Blondin, 2001:15).

Speculators consist mainly of brokers and professional traders and can be divided into four sub-groups (Falkena and Kock, 2000):

- Position traders: Position traders take a long-term view on price trends and buy and sell accordingly. Position trading refers to the type of trading where derivative instruments are held for an extended period of time (Coopers and Lybrand, 1995:657).

  Neither Coopers and Lybrand (1995:657) nor Falkena and Kock (2000) specifies the length of the long term view that position traders take when trading with futures contracts.

- Day traders: Day traders take a short-term view on prices and would close their position prior to the closing of the market in the afternoon. For example, if a day trader bought a futures contract, he would sell the futures contract before the end of the trading day.

- Scalpers: Scalpers close their positions (sell a futures contract if they bought one or *vice versa*) after only a few points' profit are gained, but may expose themselves for a period of more than a day.

- Spreaders: Spreaders take different positions across different contracts. For example a spreader would buy or sell white maize futures contracts for delivery in December and white maize futures contracts for delivery in March.

2.3.2.3. Arbitrageurs

Arbitrage refers to the simultaneous purchase and sale of the same asset in different markets. An arbitrageur may buy maize on the cash market and sell a futures contract on the futures market to profit from the price differentials or mispricing that may exist between these two markets. Arbitrageurs seek risk-free profits (Falkena *et al.*, 1991:20).

2.3.2.4. Investors

Investors may establish a synthetic position in the futures market as an alternative to purchasing the assets in the cash market. For instance, an investor may decide to buy maize futures contracts instead of buying maize in the cash market, because he considers the liquidity of a futures contract a more attractive investment option.

To ensure that trades between market participants take place in an orderly fashion, the clearinghouse of the futures exchange handles all trades.

2.3.3. The clearinghouse

The clearinghouse of a futures exchange acts as an intermediary (or middleman) in futures transactions. The performance of the parties to each transaction is guaranteed by the clearinghouse (Hull, 1997:23).

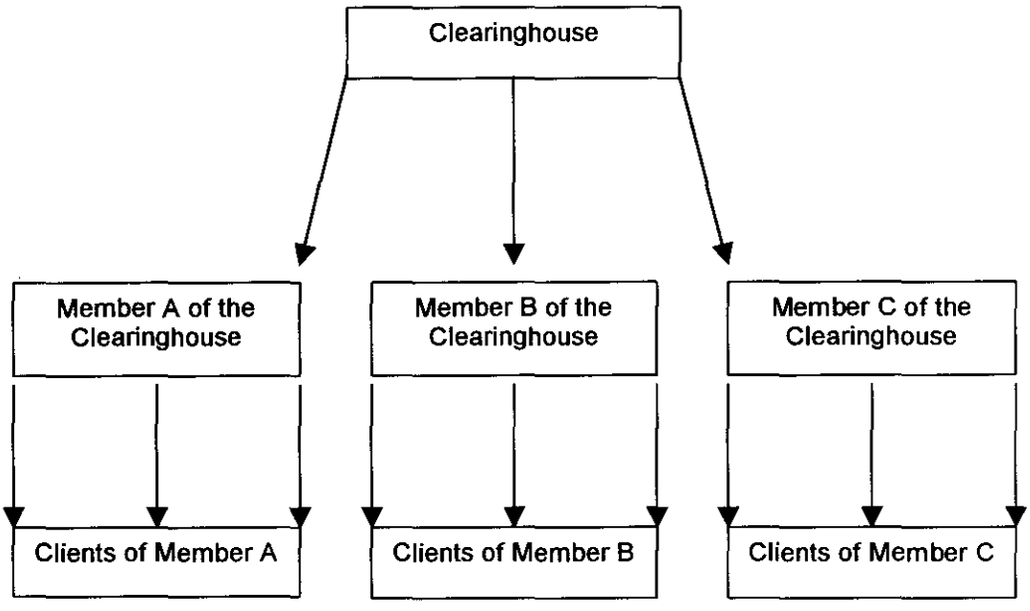
For a futures contract to be established, there must be both a buyer (holding a long position) and a seller (holding a short position). The clearinghouse interposes itself between the buyer and the seller. The buyer has a contract with the clearinghouse and not with the seller, while the seller has a contract with the clearinghouse and not with the buyer. In this context buyer and seller refers to the registered members of the clearinghouse, conducting the trades on behalf of their clients, the individual traders.

The existence of the clearinghouse simplifies the administration of futures contracts, since every contract is with the clearinghouse (Sutcliffe, 1993:30). The clearinghouse takes responsibility for the default risk of the parties to the futures contract. The default risk is also referred to as the risk of non-compliance.

Figure 2.1 illustrates the relationship that exists between the clearinghouse, the buyers and sellers and the individual traders: Suppose a farmer (a client of member A of the clearinghouse) instructs his broker (member A of the clearinghouse) to buy maize futures contracts. Member A of the clearinghouse then agrees a trade with member B of the clearinghouse, who is selling maize futures contracts on behalf of one of his clients, a maize miller.

If the farmer defaults, the clearinghouse will expect member A of the clearinghouse to perform according to the futures contract. Should member A of the clearinghouse not be able to perform according to the contract, the clearinghouse will perform. If the maize miller defaults, the clearinghouse will expect member B of the clearinghouse to perform according to the contract, and if member B of the clearinghouse defaults, the clearinghouse will perform. However, if one of the clearinghouse members defaults, the clients of that specific clearinghouse member (non-members of the clearinghouse) cannot call on the clearinghouse to guarantee performance.

Figure 2.1: The parties to a futures contract



Adapted from Sutcliffe, 1993:30

Only members of the clearinghouse can submit trades to the clearinghouse. Clearinghouse members are all members of the exchange, but not all members of the exchange are clearinghouse members. Being a member of the clearinghouse, involves financial responsibilities and requirements over and above the responsibilities of exchange membership (Futures Industry Institute, 1998).

One of the measures used by the clearinghouse to guarantee the integrity of contracts is the collection of monetary margins from its members.

2.3.4. The process of margining

Two types of margins are payable by clearinghouse members: The initial margin and the variation margin (Kleinman, 2001:10). Margins are not only payable to the clearinghouse by the clearinghouse members; clients of the clearinghouse

also pay margins to the clearinghouse members. Clients of the clearinghouse may include hedgers, speculators or any of the futures markets participants discussed in section 2.3.2. of Chapter 2. Where reference is made to the margin payments of the clearinghouse members to the clearinghouse, it is therefore also applicable to the margin payments of clients of the clearinghouse members to the clearinghouse members and vice versa.

2.3.4.1. The initial margin

The initial margin is the amount payable before a trade can take place. Although clearinghouse members could issue credit, most clearinghouse members require that the initial margin is available in the account of a client before a trade can take place (Kleinman, 2001:10).

The initial margin is based on the historical price volatility of the futures contract price. The initial margin is set at a level sufficient to protect the clearinghouse against the maximum price movement that could take place in one day (according to historical data) in the particular futures contract (Futures Industry Institute, 1998).

On SAFEX, the initial margin for white maize futures contracts is R70 per ton (SAFEX, 2002). The initial margin is also referred to as the original margin (Futures Industry Institute, 1998).

2.3.4.2. The maintenance margin and the variation margin

The maintenance margin is the amount that must be available in the account of the clearinghouse member as long as the futures position is active. A futures position is still active if a futures contract was bought or sold but not closed out by an offsetting transaction (Kleinman, 2001:10).

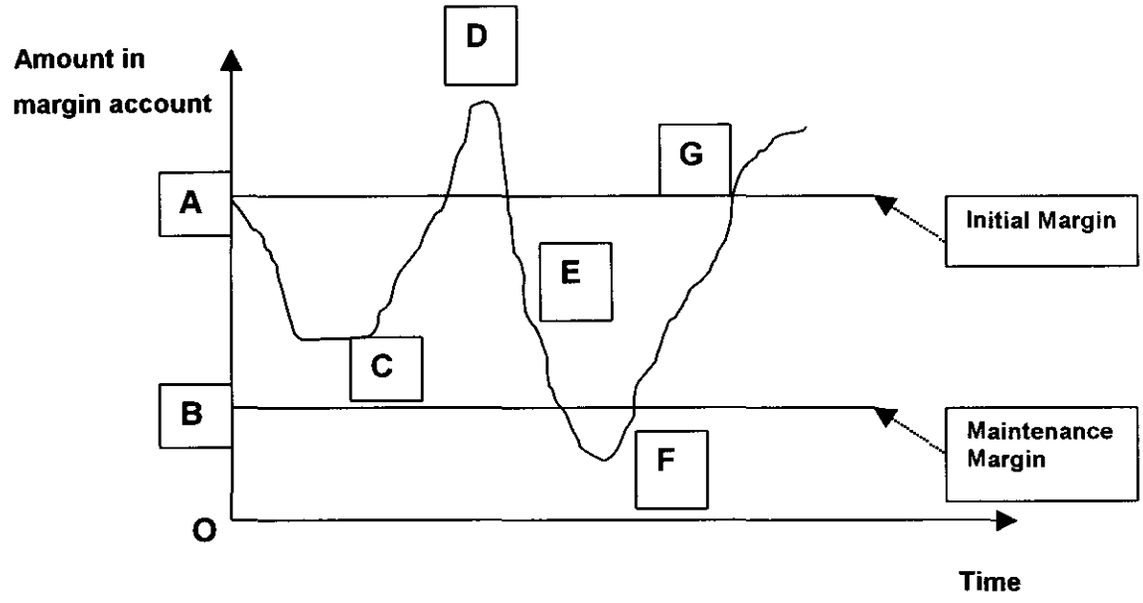
If the amount available for the initial margin or the maintenance margin is not sufficient, the clearinghouse member will receive a margin call. According to Strong (2002:428) a margin call is the requirement to pay an amount into a margin account at the clearinghouse because of adverse price movements or new transactions. If the clearinghouse member fails to meet a margin call in a timely manner, the clearinghouse has the right to liquidate the position of the clearinghouse member (Kleinman, 2001:11).

The maintenance margin forms part of the marking to market of future contracts. Marking-to-market refers to the practice in the futures market of transferring funds from one account to another account at the end of each trading day. The transferring of funds takes place because of price movements in the specific futures contract. The amount to be transferred depends on the size of the profit or loss (Strong, 2002:428). At the end of each trading day, the account of the clearinghouse member is adjusted to reflect a gain or loss. Losses will be paid from the margin account of the clearinghouse member bearing the loss to the margin account of the clearinghouse member who gained the profit (Hull, 1997:20).

The clearinghouse member may withdraw any balance in the margin account that is in excess of the initial margin, but the maintenance margin must still be available in the margin account (Hull, 1997:21). The maintenance margin is usually somewhat lower than the initial margin, but may be increased in volatile markets and the clearinghouse member might receive a margin call before the end of the trading day (Futures Industry Institute, 1998). The extra funds deposited into the margin account to maintain the maintenance margin, is called the *variation margin* (Hull, 1997:21).

Figure 2.2. is used to explain the process of margining and the relationship that exists between the different types of margins.

Figure 2.2: The role of margining



(Adapted from Sutcliffe, 1993:37).

A clearinghouse member decides to buy futures contracts. The initial margin that is payable before the trade can take place, is indicated by line **OA** and the maintenance margin is indicated by line **OB**. Suppose there is an adverse movement in the futures price the following day: The loss would decrease the available amount in the margin account to point **C**. At point **C**, the clearinghouse member will not be required to pay any further funds, since the available amount in the margin account is still above the maintenance margin.

If the futures price moves in a favourable direction the second trading day, the profit will be paid into the account of the clearinghouse member and the available amount in the margin account will rise to point **D**. The clearinghouse member may remove any excess amount from the margin account, as long as the amount available in the account is equal to or greater than the maintenance margin.

Suppose that the clearinghouse member decides to remove some of the excess funds from the margin account. The available balance in the margin account will now be at point **E**.

On the third trading day, the futures price once again moves in an adverse direction. Funds are transferred from the margin account of the clearinghouse member showing the loss to the margin account of another clearinghouse member, from which the futures contracts were bought. The available balance in the margin account will subsequently decrease to point **F**, below the level of the maintenance margin. The clearinghouse member will now be required to pay a variation margin in order to increase the available balance in the margin account to point **G**, equal to the initial margin. If the amount in the margin account drops below the maintenance margin, the amount in the margin account must be increased to a level equal to the initial margin. By increasing the amount available in the margin account to level of the initial margin, it is ensured that there are enough funds available in the margin account, should there again be an adverse price movement the following trading day (Hull, 1997:21).

2.3.5. The role of the exchange in futures trading

In the previous sections the role of the clearinghouse in futures trading (as a part of the futures exchange) was discussed. The following section will focus on the part the futures market plays in the process of futures trading.

The exchange brings together the buyers and sellers of futures in an orderly and efficient manner. According to Bernstein (2000:53) a futures exchange performs four tasks for the open market economy:

2.3.5.1. Price discovery

The futures exchange does not set prices, but it does create a market for the buyers and sellers of futures to discover the price of a futures contract through the market system. The futures exchange is also involved in the process of the dissemination of price information so that all market participants could have access to the market information (Bernstein, 2000:53).

2.3.5.2. Risk transfer

In a futures transaction, risk is an inherent part of the trading process. The exchange, however, creates a setting in which the risk can be transferred from the hedgers to the speculators (Bernstein, 2000:53).

2.3.5.3. Liquidity

For risk to be transferred efficiently, a large equal number of buyers and sellers must participate in the futures market. The number of buyers and sellers of futures contracts determines whether transactions can take place quickly. If a large number of buyers and sellers participate in the futures market, a buyer or seller of a futures contract needn't wait for a long period of time before the futures contract could be bought or sold (Bernstein, 2000:53).

2.3.5.4. Standardisation of contracts

The specifications written for each futures contract by the exchange, enables almost any hedger or speculator to make use of futures contracts. The standardised nature of futures contract also ensures that a futures position could be closed out prior to the delivery date of the future (Bernstein, 2000:53).

As discussed in section 2.2.2.1. of Chapter 2, assets traded on a futures exchange are homogenous or graded according to quality. The quantity traded under one futures contract is also specified. The specified quality and quantity ensure that a buyer of futures contracts could close out his position by selling an equal number of futures contracts with the same underlying instrument than the one he has bought and *vice versa*.

2.4. Hedging with futures contracts

As discussed in section 2.3.5. of Chapter 2, the futures exchange plays an important role in the transfer of risks form hedgers to speculators, but how does a hedge take place? The following two sections give more information regarding the process of hedging.

2.4.1. An example of a hedge

Suppose a farmer is planting maize that he intends to sell for cash in six months. The farmer is exposed to the risk that the price of maize could have decreased in six month's time. Since the farmer intends to sell the maize on the cash market in six month's time, he can sell a futures contract now. The farmer holds a long position in the cash market. To hedge himself, the farmer will go short in the futures market. If the price of maize has increased after six months, the farmer will profit on his sale in the cash market, but will lose money on the futures position. Conversely, if the price of maize decreases, the farmer will lose money in the cash market, where he sells his maize, but will gain in the futures market. By hedging himself against the price risk through the futures contract, the farmer has ensured a fixed price for his maize crop or "locked in" the price.

By fixing his price, the farmer has, however, also cut his profit potential. A buyer of a commodity could hedge himself in the same way and lock in the buying price by buying a futures contract. The farmer has the choice of delivering on the delivery date of the futures contract or he could close out his position before the delivery date by an offsetting transaction. The farmer could close out his position by buying the same amount of futures contracts than the amount he has sold. If the farmer decides to close out his position by using an offsetting transaction, he could still sell the maize on the cash market. If he chooses to wait, the farmer could deliver the maize according to the futures contract.

2.4.2. Advantages and disadvantages of hedging

According to Bernstein (2000:42-43) there are certain advantages and disadvantages to the process of hedging. An advantage to making use of hedging is the possibility of locking in the price of the commodity for both the buyer and the seller. A locked-in price gives the hedger the opportunity to plan ahead and know in advance what his profit or loss from the transaction will be.

However, there is a disadvantage to locking in costs or profit: If a hedger takes a futures position too soon, he could limit his profit potential, but the standardised nature of futures contracts ensure that a hedger could close out his position at any time before the delivery date of the futures contract.

Apart from the advantages and disadvantages of hedging, futures contracts have certain advantages and disadvantages for those who use them, either to hedge or to speculate.

2.5. Advantages and disadvantages of futures contracts

2.5.1. Advantages of futures contracts

According to Coopers and Lybrand (1995:415-416), futures contracts have the following advantages:

- Futures contracts are traded on a recognised exchange and are standardised in nature, which promotes liquidity of futures contracts.

- The existence of an efficient and liquid market ensures that the futures positions may be valued easily and readily.

- The clearinghouse guarantees performance of contracts by the clearinghouse members. The credit risk (or the default risk) that is associated with forward contracts and dealing in a volatile market

- Futures contracts are only traded in certain commodities, currencies and instruments and are standardised, therefore a future commitment may not be matched exactly as is the case with a forward contract.

- Although the clearinghouse guarantees performance of contracts between clearinghouse members, non-members of the clearinghouse are still exposed to the default risk of their broker or clearing agent.

In Chapter 2 some of the general characteristics of futures markets and futures contracts, as well as the market participants in the futures market were discussed. Speculators use futures contracts to profit from adverse price movements. Futures contracts are used by hedgers to hedge themselves against the price risk they are exposed to when buying or selling their products on the cash market. Hedgers are able to hedge themselves against price risk due to the relationship that exists between the cash price of a specific commodity and the price of a futures contract with the same commodity as the underlying instrument.

As discussed in section 1.3. of Chapter 1, instability in the supply and demand for a commodity leads to volatility in the price of the commodity. In Chapter 3, the relationship that exists between the cash price and the futures price of a commodity will be discussed, as well as factors that influence the supply and demand for commodities in general.

CHAPTER 3: THE PRICING OF A FUTURES CONTRACT

"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, 1998:57).

3.1. Introduction

The futures price reflects the price at which buyers and sellers of a futures contract are willing to buy or sell the underlying asset of the futures contract at a future date. The futures price is based on the levels of supply and demand for the commodity. The futures price is a forecast of what the cash price of the underlying asset of the futures contract will be for a given month in future, based on the market information that is currently available. The futures price changes daily as new information becomes available on the market. The supply- and demand factors that influence the cash price of the underlying asset will influence the futures prices in a similar way. However, the relationship will never be perfect (ABSA, 2001).

In the following sections of Chapter 3 the relationship that exists between the cash price of the underlying asset of the futures contract and the futures price, will be discussed. How the price of a futures contract is determined, as well as what the relationship between the cash price and futures price is, is important in order to establish which factors should be included in the equation to be constructed in Chapter 5 of the study.

3.2. The basis

The basis can be defined as the difference between a futures price for a commodity and the current cash price of that commodity at a specific location (Strong, 2002:420). The cash price (or spot price) of a commodity is the current price of an asset, specifically an underlying asset to a futures contract (Strong, 2002:421).

The basis is an important component of futures trading and can be calculated as follows:

Basis = Current Cash Price – Futures Price (Kolb, 1998:63).

The basis of a commodity may differ from one location to the next, since the cash price of a commodity may differ from one location to the next. The difference in the cash price could be attributed to storage cost and transportation cost. A trader could profit from the difference in the cash prices of a commodity, thereby reaping an arbitrage profit, which is a sure profit with no investment. The basis usually refers to the difference between the cash price and a nearby futures contract (a futures contract near to delivery), but the basis could also be calculated for each outstanding futures contract for the following contract months (Kolb, 1998:64).

If the cash price of a commodity differs from one location to the next for reasons other than the cost of storage and transportation, the basis could become unstable and unpredictable (Kleinman, 2001:21). For example, if a certain region of the country experiences drought, but other regions receive normal rainfall, the cash price for white maize may be higher in the regions experiencing drought than in the other regions. The instability in the basis is called the basis risk. Basis risk is usually far less than the price risk involved without a hedge (Kleinman, 2001:21).

The basis can have a negative or a positive value. If the current cash price is higher than the futures price, the basis will have a positive value and if the current cash price is lower than the futures price, the basis will have a negative value (Kolb, 1998:64).

Theoretically the basis should be equal to zero on the delivery date of the futures contract, since the cash price should then be equal to the futures price (Kolb, 1998:65).

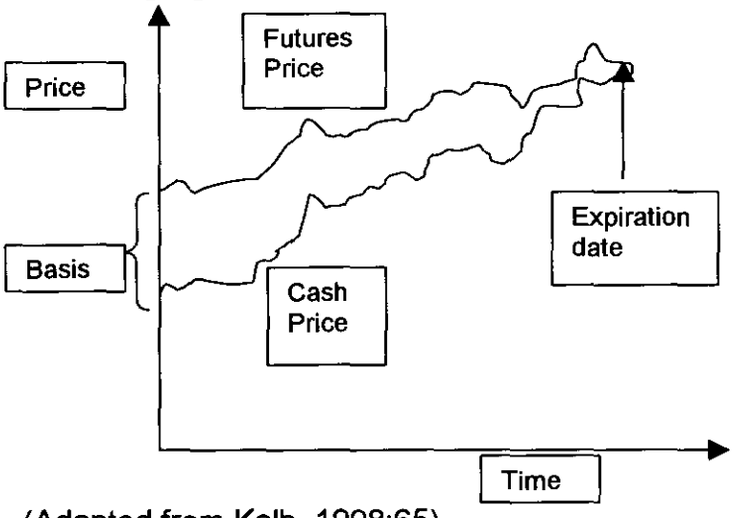
The relationship where the basis has a negative value (where the futures price exceeds the cash price) is called contango market and the relationship where the basis has a positive value (where the cash price exceeds the futures price) is called backwardation market (Strong, 2001:419, 421).

3.2.1. Contango market

Contango market (or normal market) is a situation where the prices for more distant futures are higher than for nearby futures, i.e. a situation where the futures price exceeds the cash price.

Distant futures are futures with a delivery date (expiration date) further in future and nearby futures are futures with a delivery date nearer in future. In a contango market, the basis has a negative value. Figure 3.1. will be used to illustrate the relationship between the cash and the futures price in a contango market.

Figure 3.1: Converging cash and futures prices



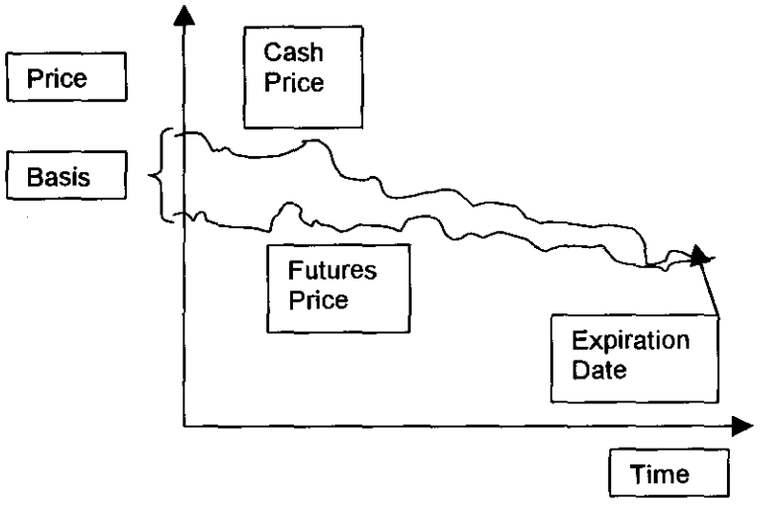
(Adapted from Kolb, 1998:65)

Figure 3.1. shows the process of convergence of the futures price and the cash price. Convergence refers to the behaviour of the basis over time: The basis increases (Figure 3.1.) or decreases (Figure 3.2.) over time until it is equal to zero (futures price = cash price). In a contango market the price of the futures contract is higher than the cash price. The basis increases from a negative value until it is equal to zero at the expiry date of the futures contract (Kolb, 1998:65)

3.2.2. Backwardation market

Backwardation market (or inverted market) is a situation where the price of nearby futures exceeds the price of more distant futures, i.e. a situation where the cash price exceeds the futures price. Figure 3.2. will be used to illustrate the relationship between the cash price and the futures price in a backwardation market.

Figure 3.2. Converging cash- and futures prices



(Adapted from Kolb, 1998:65)

Figure 3.2. shows the convergence of the cash price and futures price over time from a situation where the cash price exceeds the futures price until the cash price and futures price are equal. The basis decreases from a positive value until the basis is equal to zero on the expiration date of the futures contract (Kolb, 1998:65).

Apart from the relationship that exists between the futures price and the cash price, there are relationships between futures prices. These relationships are referred to as spreads and a distinction can be made between three different types of spreads, as examined in the following paragraphs.

3.3. Spreading with commodity futures

Futures spreading is a type of speculation that involves taking offsetting positions in two related commodities or in the same commodity.

3.3.1. Intercommodity spreads

An intercommodity spreads involves a speculator that holds a long position and a short position in two related commodities, for example beef futures and maize futures, because the maize price have an impact on the price of beef (Strong, 2002:217).

3.3.2. Intermarket spreads

With an intermarket spread a speculator takes opposite positions in two different markets, for example a speculator may buy the commodity on the cash market (if the cash price is lower than the futures price) and sell the commodity on the futures market in order to gain profit (Strong, 2002:218).

3.3.3. Intracommodity spreads

An intracommodity spread involves taking different positions in different delivery months, but in the same commodity. An intracommodity spread is also referred to as an intermonth spread. For instance, a speculator may buy a futures contract for delivery in September and sell a futures contract for delivery in December, if the December futures price is higher than the September futures price. Intracommodity spreads are rather common because of a low margin requirement on and a substantially reduced risk involved in these transactions (Strong, 2002:218).

In the next section different models of futures prices are examined.

3.4. Models of futures contracts pricing

Market forces determine the price of a futures contract. There are, however, a number of underlying factors that affect the market value of a futures contract.

These factors determine what the value of a futures contact should be, translating into a price that is called the *fair value* of the future (Alexander, 1997:41). The fair value of a futures contract is a theoretical value calculated to ascertain what the futures price should be, given the available market information (Falkena *et al.*, 1991:11). If the market is efficient, the price of the futures contract usually trades close to the fair value (Alexander, 1997:41).

According to Falkena and Kock (2000), the fair value of a futures contract consists of three main elements:

- the current spot price (or cash price) of the underlying asset;
- the financing costs for the underlying cash market asset, such as interest, storage or insurance costs; and
- income that is generated by the underlying asset (if any).

These three elements are used in pricing models as proposed by Falkena and Kock (2000) to calculate the fair value of a futures contract.

Different models are used to calculate the futures price of the different underlying assets to a futures contract. For instance, the model used to calculate the futures price of futures contracts with commodities as the underlying asset, is called the carry-cost futures pricing model. The implied-forward-rate futures pricing model is used for futures contracts with financial instruments as the underlying asset (Falkena and Kock, 2000). The futures price that is calculated by using these models is the fair value of the futures contract. Since white maize

futures are categorised as futures with a commodity as the underlying asset, only the carry-cost futures pricing model will be discussed in this section.

3.4.1. The carry-cost (or cost-of-carry) futures pricing model

The carry-cost (or the carrying charge) is the total cost involved in carrying a commodity forward in time (Kolb, 1998:69). For example, the carry-cost for white maize is the total costs involved in storing the maize from, for instance, June until December.

According to Kolb, (1998:70), cost-of-carry can be divided into four basic categories: Storage costs, insurance costs, financing costs and transportation costs. Storage costs include the cost of storing or warehousing the commodity in the appropriate facility. If a commodity is kept in storage, insurance is also necessary. For instance, maize might be insured against water damage. Transportation charges are applicable where the commodity is transported from one location to the next: Maize produced on a farm, should be transported to the nearest silo for storage.

Most participants in the futures markets also face a financing charge. The carry-cost futures pricing model proposed by Falkena and Kock (2000), uses the prime interest rate as the financing charge to calculate the fair value of a futures contract. In South Africa the prime interest rate is derived from the repo rate and changes in the repo rate would therefore lead to changes in the prime interest rate. Falkena and Kock (2000) do not include storage cost, insurance cost and transportation cost, as proposed by Kolb (1998:7), in the calculation of the fair value of a futures contract.

Falkena and Kock (2000) and Falkena *et al.* (1991:11) use the following two equations to calculate the fair value of a futures contract with a commodity as the underlying instrument:

$$\mathbf{FVFC = P(1 + r)^{t/365}} \qquad [1]$$

Where

FVFC is the fair value of a futures contract expiring in ***t*** days, calculated by making use of compound interest;
P is the current cash price of the underlying asset;
r is the financing charge; and
t is the days to settlement.

or

$$\mathbf{FVFS = P + (P \times r \times t/365)} \qquad [2]$$

Where
FVFS is the fair value of a futures contract expiring in t days, calculated by making use of single interest;
P is the current cash price of the underlying asset;
r is the financing charge; and
t is the days to settlement.

For equation [1], compound interest is used in the calculation of the fair value, while simple interest is used for equation [2]. For the calculation of the white maize futures price, compound interest is used, although some markets do make use of simple interest (Falkena and Kock, 2000).

Example

Suppose a South African farmer wants to sell white maize futures contracts to hedge himself against a decline in the maize price. On 9 July 2000 the following information was applicable:

White maize futures price (per ton): R790
Futures trading date: 9 July 2000
Date of expiry of the futures contract: 1 September 2000
Prime interest rate on 9 July 2000: 16% per annum

By making use of the formula for compound interest, the fair value (**FVFC**) of one white maize futures contract consequently is:

$\mathbf{FVFC} = R790(1 + 0.16)^{52/365}$

$= R806.88$

The change in the futures price is caused by changes in the supply and demand of the underlying commodity. When a futures contract trader analyses the market, his analysis takes place in two parts: The fundamental analysis and the technical analysis.

3.5. Market analysis

3.5.1. The fundamental analysis

The fundamental analysis focuses on economically based indicators, which may influence the price of the underlying instrument (the cash price) to the futures contract. Some of the indicators that might be included in the fundamental analysis are the crop size, weather conditions, supply and demand statistics, economic forecasts and interest rate trends. Other factors that could also be included in the fundamental analysis are government policy, export statistics, plantings, consumption and government programmes. Government programmes might include price support programmes, loans to farmers, direct cash incentive

plans, programs to dispose of surplus crops and re-allocation of land (Kleinman, 2001:114).

The purpose of fundamental analysis is to determine the balance of supply and demand in order to forecast how that balance might affect futures prices (Bernstein, 2002:122). Fundamental analysis is not simply an analysis of the economy and markets in general, but the analysis of the economy and markets with a specific commodity in mind.

3.5.1.1. Supply and demand

Fundamental analysis focuses on the factors that influence the supply and demand for the underlying asset (or commodity). The assumption is made that any increase in the supply for the underlying commodity will decrease the price of a futures contract and any increase in the demand will increase the price of a futures contract, *ceteris paribus*. The opposite is also true: Any decrease in the supply of the underlying commodity will increase the price of the futures contract and any decrease in the demand for the underlying commodity will decrease the price of the futures contract (Bernstein, 2002;148).

For the white maize price an analysis of the supply and demand would mean that ending stocks at the end of the crop year would have to be calculated. If the ending stocks relative to demand, are too low, there will be upward pressure on the price of white maize. Higher ending stocks imply that the price of white maize will decrease. The following information could, as an example, be included in the calculation of ending stocks (Kleinman, 2001:113):

To calculate the total supply of the commodity:

- Total supply: The beginning stocks, production and imports equal the total supply.

- The beginning stocks: The beginning stocks refer to stocks carried over from the previous production year.

- Production: The total production of the commodity at the end of the production season.

- Imports: Since South Africa is mainly an exporter of maize, imports will generally be a small amount.

To calculate the total demand for the commodity:

- Total demand: The demand by millers and the export, seed and residual equal the total demand.

- Demand by millers: The demand by millers refer to the domestic demand by maize millers, who buy the raw maize, which is then milled in order to make it suitable for human consumption.

- Export, seed and residual: A part of the total crop will be exported and a part will be held back for next year's seed use. The foreign exchange rate has an impact on the levels of export: A weaker domestic currency might increase exports and a stronger domestic currency might decrease exports.

To calculate the ending carry-over stocks:

- Ending carry-over stocks: Ending carry-over stocks = Total supply - total demand. The ending carry-over stocks could also be referred to as the inventory levels. Changes in the ending carry-over stocks will influence the price of the underlying commodity to the futures contract.

(Kleinman, 2001:113).

To calculate the estimated total supply of the commodity before the end of the production season the beginning stocks, the estimated production and the estimated imports could be used. The estimated production for white maize in South Africa is the monthly crop estimates as published by the South African Grain Information Service (SAGIS) on their web page (www.sagis.org.za).

Apart from inventory or ending carryover stock levels, other factors could also influence the supply and demand of a commodity. The factors discussed in the following paragraphs are general factors that could influence the supply and demand for a commodity.

Although the factors discussed in the following paragraphs are general factors that could influence the supply and the demand for a commodity, these factors are also applicable to the supply and demand of white maize in South Africa. White maize can be categorised as a commodity, and therefore the general factors that influence the supply and demand for a commodity will also be applicable to white maize.

3.5.1.2. The impact of weather

The weather remains one of the most important factors that influence the price of agricultural commodities (Kleinman, 2001:114). Weather patterns have an impact on the supply of a commodity. Through the impact weather patterns have

on the supply of a commodity, it impacts on the price of a commodity. Weather patterns cause prices to vary during the production season.

Prices may even vary from one location to the next due to varying weather conditions from one location to the next. The weather primarily affects commodity prices during the growing season. However, because of the openness of the world economy, the growing season of the world seems to be stretching year-round and weather conditions anywhere in the world can have an effect on the price of one commodity or another (Bernstein, 2002:151).

3.5.1.3. Secular trends

Secular trends refer to any long-term changes in the supply or the demand of a particular commodity. Secular trends may include demographic changes, long-term weather changes, changes in customs and tastes, government policy, the discovery of new uses for a commodity and large-scale changes in consumer purchasing power. Other factors that might also have a long-term effect on the supply or demand are crop substitution and the availability of new technology. Such long-term changes in the supply or demand for a particular commodity must be taken into account in long-run price predictions (Bernstein, 2002:159).

3.5.1.4. Government programmes and government policy

In section 3.5.1. a list of possible actions that might be viewed as government programmes, were given. Government programmes might expand or restrict the available supply of a specific crop and the re-allocation of land might have a long-term effect on the supply of agricultural commodities. Price support programmes might increase the supply of agricultural commodities and programmes to enhance exports, might increase the total exports of a specific crop (Kleinman, 2001:114).

Government intervention in the market for commodities has, for a variety of reasons, been proven to be unsuccessful and unsustainable over the long run. Trade agreements for the liberalisation of the commodities market will further decrease the success rate of price stabilisation schemes (Lence, 2002). Government intervention may also all too often be a reaction to political issues and the response may almost always be too late. Nonetheless, government programs might have a significant influence on the prices of commodities (Bernstein, 2002:158).

3.5.1.5. Government reports

Economic reports published by the government, such as reports on wholesale prices, consumer prices, trade deficits, unemployment and money supply, all have a more or less direct and significant effect on all prices in the economy (Bernstein, 2002:159).

3.5.1.6. Political influences

Political decisions taken anywhere in the world may have an effect on commodity prices. For example, a decision of a government to support the price of a particular commodity in order to enhance its value on the world market, may lead to other countries adopting protectionist attitudes. These protectionist attitudes might result in tariffs and other trade barriers being introduced (Bernstein, 2002:159). As discussed in section 1.3. of Chapter 1, the recent Conference of the WTO, held in Cancun from 10-14 September 2003, has placed renewed emphasis on the existence of protectionist attitudes toward agricultural markets, especially in some of the industrialised countries.

3.5.1.7. International news

Commodities that have an international source are vulnerable to news of war or international tensions. News of war might result into hoarding and stockpiling. The possibility also exists of imports being cut off or major export markets might be lost (Bernstein, 2002:161).

3.5.1.8. Currency fluctuations

The exchange rate is an important factor in the profitability of business operations. If the rand is strong against other foreign currencies, exports from South Africa are more expensive and less competitive in the international market. If the value of the rand declines, South African goods become more competitive in the world market and exports tend to increase (Bernstein, 2002:161).

3.5.1.9. General business conditions

Consumers are more willing to spend if the economy is healthy, unemployment is low and business is expanding. If economic predictions are positive, the demand for commodities tends to be high. If the economic predictions are not positive, consumers become less willing to spend and demand falls.

3.5.2. Technical analysis

It is important to note that traders could use a combination of fundamental analysis and technical analysis when deciding the position they are going to take in the market. If a trader decides to use one method to analyse the market, it does not imply that the trader could not use the other method at some stage.

Technical analysis differs from fundamental analysis on the grounds that technical analysis makes judgments based on purely mechanical or mathematical rules, which are applied on data. Technical analysis does not

concern itself with the economy, supply, demand, crop size or the weather. Specific chart formations, mathematical indicators, moving average signals and so forth are studied during the process of technical analysis (Bernstein, 2002:123). The point of departure of technical analysis is that the price of a commodity reflects all the changes that took place in the supply and demand of the commodity, therefore only the changes in the price should be studied.

When analysing the market by making use of technical analysis, traders often develop different systems and methods. These systems and methods vary in complexity. Systems and methods could be run on a computer or they could be determined manually. The decision whether to use a computerised or manual technique is entirely up to the trader. Traders could choose from hundreds of possible trading systems. The purpose of these trading systems is to interpret market signals in order to determine the best time to buy or sell a financial instrument (Bernstein, 2002:121).

Making use of trading systems has the advantage of keeping the trader objective and focused on the market. The trader will have a specific set of rules to follow. However, making use of trading systems that are rigid and inflexible might have the disadvantage that the trader might not react to changes in the market timely (Bernstein, 2002: 121).

According to Bernstein (2002:122) trading systems can be divided into several categories:

- Trend following systems;
- breakout systems;
- market pattern systems;
- support and resistance systems;
- swing trading systems;
- artificial intelligence systems and
- market structure systems.

Each system has a specific theory, a set of rules and trading methods that should be followed. Within each of the general categories above, many different systems could be identified (Bernstein, 2002:122). Traders may use different categories or combinations of the categories listed above. However, discussing each of these trading systems goes beyond the scope of this study.

In Chapter 3 the relationship that exists between the cash price and the futures price of a commodity was discussed. The factors included in the calculation of the fair value of a futures contract were also discussed. Some of the factors included in the calculation of the fair value of a futures contract, are also included in the calculation of the import- and export parity price. The calculation of the import- and export parity price will be discussed in section 4.4.2. of Chapter 4.

Some of the factors that influence the supply and the demand for commodities in general were also discussed in section 3.5.1. of Chapter 3. Fundamental analysis might be used to establish the balance of supply and demand for a specific commodity. After a fundamental analysis for the commodity has been done, technical analysis might be used in order to interpret the price signals of the market for the commodity.

Some of the factors discussed in section 3.5.1. of Chapter 3 will be included in the equation to be constructed in Chapter 5. In Chapter 4 the history of the South African maize market will be discussed, as well as certain specific factors that influence the price of white maize futures contracts in South Africa, over and above the factors discussed in section 3.5.1. of Chapter 3.

CHAPTER 4: THE MAIZE MARKET IN SOUTH AFRICA

4.1. Introduction

The South African economy is highly dependent on agriculture as a part of the economy due to its contribution towards domestic consumption, employment and exports (Department of Agriculture, 2003). Historically South African agriculture (including the maize market) has been a heavily regulated sector of the economy. Prices of agricultural commodities have been significantly influenced by the statutory boards (Minister of Agriculture and Forestry, 2003). The Maize Board controlled the marketing of maize.

Maize production in South Africa varies from one year to the next, due to low and variable rainfall. Over ten years up to 2001, the coefficient of variation in South Africa's maize production is 32%, compared to the 19% of the US (United States) (Le Clus, 2001). The variation of the maize production as well as the changes in stock, from a surplus in the one year to a deficit in the next, causes domestic price fluctuations over and above the fluctuating world market prices (Le Clus, 2001).

The rest of Chapter 4 is a discussion of the history and deregulation of agricultural markets in South Africa, the development of SAFEX, the market for white maize in South Africa and the unique factors that influence the price of white maize in South Africa.

4.2. The history of the maize market in South Africa

4.2.1. Introduction

As the case is in other developing countries, the government also controlled the markets for maize, wheat, sorghum and oilseeds in South Africa. Prices were determined by government control boards and producers were only able to sell

their products to government control boards. Buyers bought their products by simply placing an order with the relevant board. This type of market control has lead to a risk free environment for both the buyers and the sellers.

After the total deregulation of the agricultural market in early 1998, measures of price control and the single marketing channel that was available through the government control boards, no longer existed. Producers and consumers had to adapt to these changes and the process was not without problems for those involved. Producers were faced with prices that vary from day to day and consumers had to accept that their opposition was able to buy at a cheaper price than they did (Le Clus, 2001). During this time of uncertainty, farmers had to develop new marketing methods for their products.

4.2.2. Deregulation analysis

Since the early 1900's, government measurements were imposed to try and curb the problem of fluctuating maize prices. World War II worsened the problem due to transportation problems and local hoarding. After various schemes proved to be unsuccessful, a single channel marketing system was instituted in 1944/1945. During the 1960's and 1970's statutory regulation of retail and wholesale prices were abolished, but the single channel marketing system was maintained (Le Clus, 2001). The South African Maize Board administered the single channel marketing system of maize.

The changed Agricultural Products Marketing Act, No. 47 of 1996, changed the marketing methods used for maize marketing in South Africa (Van Rooyen, 1999:659).

The reforms of 1996 came about as the result of domestic and international pressure. The South African government has agreed to support a free market system and therefore took steps to deregulate agricultural markets. South Africa

was also under pressure from its trade partners to liberalise the agricultural markets in the country (Minister of Agriculture and Forestry, 2003).

South African trade has been associated with distortions. As a result of the distortions in South African trade, an inquiry was conducted into the process of agricultural marketing and the pricing system of agricultural products. The Kassier report of 1992 (Report of the Committee of Inquiry into the Marketing Act, December 1992) promoted the removal of regulatory boards to facilitate the process of freeing up trade to and from South Africa (Minister of Agriculture and Forestry, 2003).

4.2.3. The development of the SAFEX APD division

One of the marketing methods used currently are futures contracts. Futures contracts are traded on the South African Futures Exchange (SAFEX). The history of futures markets in South Africa dates back to an informal market started by a local merchant bank, Rand Merchant Bank, in April 1987. The exchange became independent in September 1988, when it was decided to broaden the market and since then the trading of futures contracts are managed by the South African Futures Exchange (SAFEX) (Gravelet-Blondin, 2001:15). As discussed in section 1.1., SAFEX is now a part of the JSE.

The agricultural division of SAFEX was established in 1995 and beef futures contracts were the first contracts to be traded. In February 1996, trading in yellow and white maize futures commenced (ABSA, 2001).

Futures contracts are not only a marketing method for farmers, but also an instrument used to manage their price risk. Surveys conducted show that the percentage of commercial maize producers making use of futures contracts, has increased markedly from 27% in 1998 to 49% in 1999/2000 (Brown *et al.*, 1999:275). As discussed in section 1.3., a survey conducted by Krugel in 2003,

shows that the number of farmers currently making use of futures contracts on a regular basis is approximately 60%.

The average number of contracts traded monthly on the APD of SAFEX also increased from 1800 in 1996 to above 33 000 in 2000 (Gravelet-Blondin, 2001:2).

4.2.4. Problems South African farmers are still facing

Although there has been a dramatic increase in the volumes of futures contracts traded on the APD of SAFEX, there are still certain problems that maize producers (farmers) need to overcome before enjoying the full benefits of futures contracts. The first two contracts introduced by SAFEX APD were not successful and were subsequently delisted (ABSA, 2002:166). A brief discussion will follow, explaining some of the difficulties South African farmers still have to face in the marketing process of their products.

4.2.4.1. Price transparency and price discovery

SAFEX prices only reflect the prices of maize delivered to Randfontein. The price of maize in other localities differs from the price quoted for Randfontein and farmers are not always able to require the information needed to establish the price of their product at different locations throughout the country.

4.2.4.2. Accessibility of the market

Before the deregulation of the market, buyers and sellers only had to call the Board in order to buy or sell maize. In the current, deregulated market system, it is up to buyers and sellers to find one another. For producers and consumers located in remote areas, access to the market may be limited and might come at a high price (Le Clus, 2001).

4.2.4.3. Resistance to change

As is the case in South Africa, the establishment of the futures market coincided with the change in the existing market system. In order for market participants to fully accept and adopt the futures market, a balance should be struck between confronting them with the changes and getting them to co-operate (Gravelet-Blondin, 2001:14).

4.2.4.4. Lack of information

Prices vary from one location to the next and from day to day. Data regarding the supply and demand may not be readily available to all players in the market (Le Clus, 2001). Ehlers (2000) is of the opinion that the supply of agricultural data actually decreased since the deregulation of the markets and that the Section 21 companies and producer organisations that replaced the data collection and dissemination functions of the former marketing boards, often act in their own interest and with a particular goal in mind.

The lack of information is not only a barrier for production but also for trade. In a market system where a country is changing from a government-controlled marketing system to a system of private enterprise, the availability of information is of utmost importance. Through information, farmers and traders become aware of opportunities in the market. The information supplied by the Provincial Departments of Agriculture is inadequate, due to incomprehensive systems and insufficient budgetary allowances (NAMC, 1999).

The lack of information also leads to a lack of knowledge among market participants. Although SAFEX has committed time and effort to the training of market participants this initial training was more focused on marketing the product and less focused on providing the market participants with the skills to fully understand the futures market (Gravelet-Blondin, 2001:13).

4.2.4.5. A changing market environment

According to Van Rooyen (1999:668), globalisation, technology and consumer behaviour may change the current position of maize farmers and they should not only focus on hedging themselves against price risk and channelling their products through the spot market, but should also develop business relationships with the buyers themselves.

4.2.4.6. Differences between futures markets in developing countries and in developed countries

The tendency to apply the traditional methods of hedging used by futures markets in developed countries may not always prove to be successful under the unique circumstances of futures markets in a developing country (Lence, 2002). Research might be conducted to establish whether or not the South African futures market is an efficient market.

4.2.4.7. Constraints that small scale farmers experience

In addition to the above-mentioned, small scale farmers also face other unique problems when trying to market their goods:

- The unavailability of transport;
- storage facilities that are located in centralised areas, leading to crops that have to be transported over long distances, or storage facilities that are non-existent;
- poor road infrastructure, especially in the rural areas of some provinces and

- a centralised market infrastructure, causing products to be transported over long distances, at high costs and sometimes resulting in a loss of quality (NAMC, 1999).

Differences between transportation costs and storage costs also exists between the different maize production regions in South Africa, which in turn might lead to differences in the basis, as discussed in section 3.2 of Chapter 3.

4.3. The market for white maize in South Africa

4.3.1. The production of maize

Maize is South Africa's most important field crop and the staple food of the population. Areas in South Africa where maize can be produced are areas where the rainfall exceeds 350mm per year. The production of maize depends on an even distribution of rain throughout the growing season. Medium and high potential soils are preferable for maize production (NDA, 2001).

Maize is planted during October, November and December. The planting season for maize varies from one area to the next, due to variation in rainfall, temperature and the duration of the growing season (NDA, 2001). The marketing season of maize in South Africa commences on 1 May each year and ends on 30 April the following year (NDA–Trends, 2000).

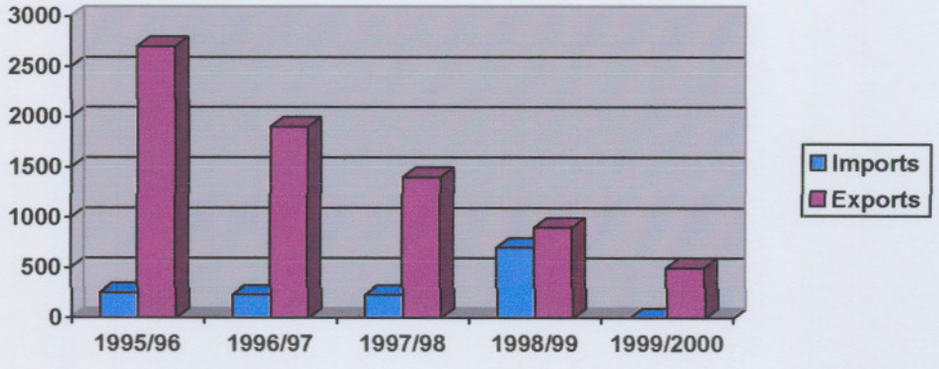
Maize is produced in most parts of South Africa. The major areas of production are, however, situated in the Free State, North West and Mpumalanga. All maize producers (and other grain producers) receive specialist services from the Grain Producers Organisation (GPO). The GPO was formed in June 1999 from the previous four grain commodity organizations namely NAMPO (National Maize Producers Organisation), the WPO (Wheat Producers Organisation) and the NOPO (National Oil Producers Organisation) (NDA -Trends, 2000).

During the past 10 years the average annual production of maize was 8.2 million tons (4.3 million white maize and 3.9 million yellow maize). An average of 500 000 tons of white maize, mainly for household consumption, are produced yearly by subsistence farmers. In 2001 it was estimated that approximately 7.5 million tons of maize are required for domestic consumption yearly. It was also estimated in 2001 that the consumption requirements for white maize, mainly for human consumption, are 4.4 million tons yearly and that the average yearly requirement for yellow maize is 3.1 million tons, mainly for animal consumption (NDA, 2001).

However, during times of shortages, yellow maize is sometimes mixed with white maize for human consumption (NDA – Trends, 2000). The surplus production of maize is exported to Japan, Iran, Kenya and Venezuela (NDA, 2001).

Figure 4.1. shows the imports and exports of maize from the 1995/1996 production season until the 1999/2000 production season. The graph shows a decline in the exports of maize during the period under consideration and an increase in the imports of maize in 1998/1999. However, during 1999/2000 the imports of maize decreased again.

Figure 4.1: Maize imports and exports: 1995/1996 – 1999/2000 ('000 tons)



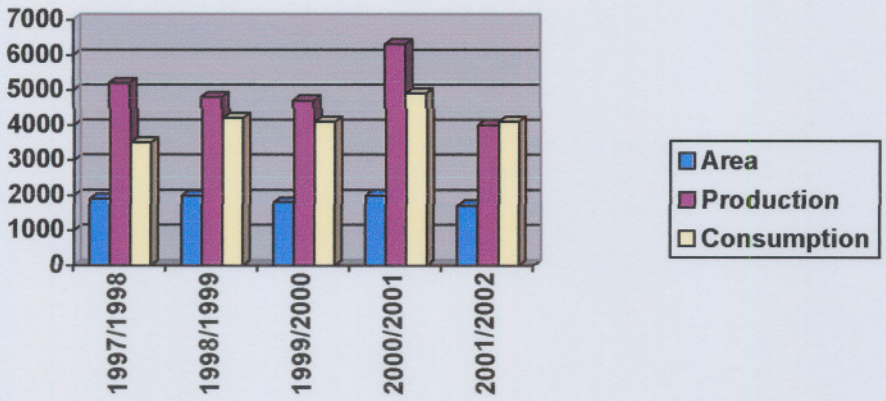
Source: NDA-Trends, 2000

4.3.2. The focus on white maize

In the long run, price variations within the white maize industry will be larger than price variations within the yellow maize industry. The reason for bigger price variations within the white maize industry could be ascribed to the strategic importance of white maize for milling companies: Milling companies should acquire enough stock to be able to supply in the demand of the market, as domestic shortages cannot easily be supplemented from the international market. A company could therefore lose its total market share to a competitor if it has to mix white maize meal and yellow maize meal, as consumers prefer the white maize meal. The price of white maize therefore becomes inelastic during periods of shortages (Proagri, 2001).

Figure 4.2. shows the area planted, the total production and the consumption of white maize from the 1997/1998 until the 2001/2002 production year.

Figure 4.2: Area ('000 ha), production ('000 tons) and consumption ('000 tons) of white maize



Source: NDA, 2001

Figure 4.2. shows that there has been an increase in the consumption and production of white maize during the 2000/2001 production season, but in

2001/2002 both the consumption and the production of white maize decreased again.

4.4. The impact of the international market on domestic maize prices

4.4.1. The impact of the US-market

In 2000 the US was the world's biggest producer and exporter of maize. The US produced around 40% of the total maize crop of the world and was responsible of supplying around 67% of the total exports of maize. World price trends are therefore normally derived from the US-market. Changes of stock levels in the US will also have an impact on the world market: An increase of the stock levels in the US will lead to downward pressure on world prices and a decrease of the stock levels in the US will have upward pressure on world prices (Proagri, 2001). In Chapter 5, where the equation to be tested is constructed, the prices of the CBOT is included in the equation as a proxy for the US-maize prices. The CBOT is the largest futures market for maize in the US (CBOT, 2003).

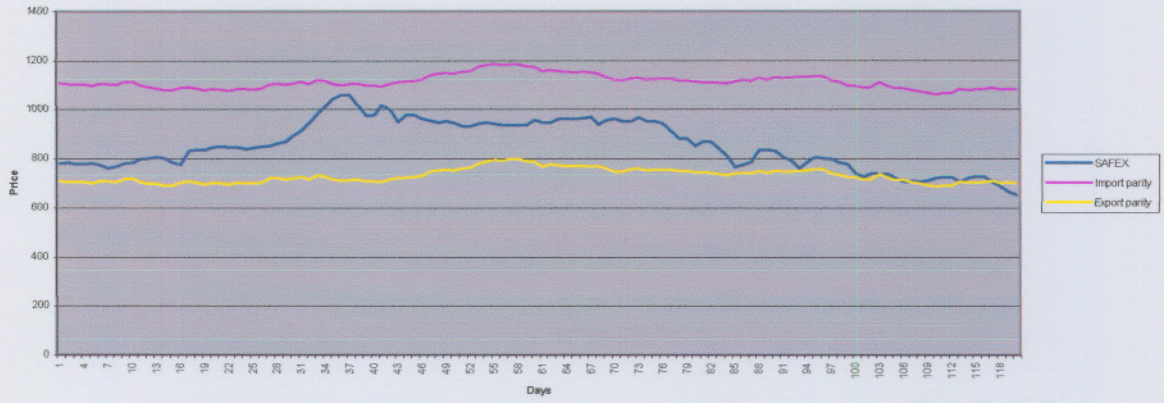
4.4.2. Import- and export parity prices

The maize market in South Africa operates within a free market environment. The changes in the world market therefore have a direct effect on the domestic market prices in South Africa. The calculated export- and import parity prices act as a floor price and a ceiling price for domestic maize prices.

The world prices determine a band within which domestic prices in South Africa vary, depending on the domestic stock levels. In a period where the domestic stock levels are in a surplus, maize prices will tend to move downwards towards export parity. If the domestic stock levels are in short supply, maize prices will tend to move upwards towards import parity (NDA -Trends, 2000).

Figure 4.3. shows how the price of white maize futures contracts varies between import and export parity levels.

Figure 4.3: SAFEX-price, export parity and import parity



Sources: SAFEX and SAGIS.

Table 4.1. and Table 4.2. is an indication of how the import- and export parity prices of white maize could be calculated. The precise detail included in the calculation of the import- and export parity prices may differ from one futures trader to the next. The different components that are included in the calculation are discussed below the tables.

The method used in Table 4.1. and 4.2. for the calculation of import parity prices and export parity prices is the method suggested by SAGIS (South African Grain Information Service). The values used in the calculations of Table 4.1. and Table 4.2., are the values used by SAGIS for the calculation of the import- and export parity price of white maize on 18/07/2003. The calculations are done for the costs involved in exporting or importing one ton of maize.

Table 4.1: The calculation of the import parity price of white maize

Futures prices (CBOT)	US No. 3 Maize (Gulf) 18/07/2003 Delivery: 09/2003
FOB Gulf value ($/t)	94.78
Freight rate ($/t)	23.00
Insurance ($/t)	0.28
Cost, insurance and freight ($/t)	118.06
Converted to R/t	910.95
Exchange rate (1$=) (18/07/2003)	7.7160
Financing costs (R/t) (15.5%)	11.61
Discharging costs: Durban (R/t)	65.24
Import tariff (24/10/2002) (R/t)	0.00
FOR at Durban harbour (R/t)	987.80
Transport costs to Randfontein (R/t)	135.00
Delivered price (R/t)	1122.80

Source: SAGIS, 2003.

4.4.2.1. Components included in the calculation of import parity

A brief discussion will now be given of the components as included in the calculation of import parity in Table 4.1.

- Futures prices (CBOT): Refers to the futures price for maize as quoted by the Chicago Board of Trade.
- US No. 3 Maize (Gulf)18/07/203: The price quoted is the price of US No. 3 Maize, referring to the US-system used for the grading of maize for futures trading.
- Delivery: 09/2003: The futures price quoted is the futures price of maize for delivery in September 2003.
- FOB Gulf value ($/t): Free on Board. A term which describes the price or value of a commodity, which is calculated on the basis of the process of

manufacture and does not include the transport costs of the commodity to the consumer (Macmillan, 2003:158).

- Insurance ($/t): Insurance costs involved in transporting the maize.
- Cost, insurance and freight ($/t): Total costs involved in transporting the maize from the Gulf to Durban.
- Exchange rate (1$=) (18/07/2003): The exchange rate as quoted for the specific trading day. The exchange rate is used to convert the price from dollar value to rand value.
- Converted to R/t: Making use of the exchange rate, the price is converted from dollar into rand.
- Financing costs (R/t) (15.5%): Calculated by making use of the prime interest rate.
- Discharging costs: Durban (R/t): Costs involved in order for maize to be discharged at Durban harbour.
- Import tariff (2/10/2002) (R/t): A tax imposed on a good imported into a country (Macmillan, 2003:412).
- FOR at Durban harbour (R/t): Free on Rail. The same applies as is the case for FOB.
- Transport costs to Randfontein (R/t): Transport costs from Durban harbour to Randfontein.
- Delivered price (R/t): The price of white maize imported form the US and delivered at Randfontein.

Table 4.2: The calculation of the export parity price of white maize

Futures prices (CBOT)	US No. 3 Maize (Gulf) 18/07/2003 Delivery: 09/2003
FOB Gulf Value ($/t)	94.78
+ US$10($/t)	10.00
SA FOB price (R/t)	104.78
Exchange rate (1$=) (18/07/2003)	7.7160
USA No.3 Maize FOB (Gulf) (R/t)	808.48
Marketing costs:	
Financing costs (15.5%) (R/t)	10.30
Transport costs: Randfontein to Durban (R/t)	135.00
Loading costs: Durban harbour (R/t)	59.03
Export Realisation (R/t)	604.15

Source: SAGIS, 2003.

4.4.2.2. Components included in the calculation of export parity

A brief discussion will now be given of the components included in the calculation of export parity as included in the calculation of export parity in Table 4.2.

- Futures prices (CBOT): Refers to the futures price for maize as quoted by the Chicago Board of Trade.
- US No. 3 Maize (Gulf) 18/07/2003: The price quoted is the price of US No. 3 Maize, referring to the US-system used for the grading of maize for futures trading.
- Delivery: 09/2003: The futures price quoted is the futures price of maize for delivery in September 2003.
- FOB Gulf Value ($/t): See definition given for FOB, table 4.1.

- + US$10($/t): Add on to take into account the difference in quality and location (SAGIS, 2003).
- SA FOB price (R/t): See definition given for FOB, table 4.1.
- Exchange rate (1$=) (2003/07/18): The exchange rate as quoted for the specific trading day. The exchange rate is used to convert the price from dollar value to rand value.
- USA No.3 Maize FOB (Gulf) (R/t): See definition given for FOB, table 4.1.
- Marketing costs: Finanacing costs, transport costs and loading costs.
- Financing costs (15.5%) (R/t): Calculated by making use of the prime interest rate.
- Transport costs: Randfontein to Durban (R/t): Transport costs from Randfontein to Durban harbour.
- Loading costs: Durban harbour (R/t)
- Export Realisation (R/t): The costs involved in exporting white maize to the US.

As indicated by Table 4.1. and Table 4.2. the import- and export parity prices include some of the factors discussed in section 3.4. and 3.5 of Chapter 3. In section 3.4. of Chapter 3 the factors that might be included in the calculation of the fair value of a futures contract were discussed. In section 3.5. of Chapter 3 some general factors that might have an impact on the price of commodities were discussed.

These factors are factors that might have an impact on the price of a futures contract with an agricultural commodity as the underlying instrument, therefore these factors could also have an impact on the futures price of white maize futures contracts.

Two of the factors that should, according to Kolb (1998:70) be included in the calculation of the fair value, are included in the calculation of the import- and export parity price. The factors suggested by Kolb (1998:70), as discussed in

section 3.4.1.of Chapter 3 and included in the calculation of the import- and export parity price are financing costs (the interest rate) and transportation costs.

In section 3.5.1.8. of Chapter 3 the exchange rate as a possible factor that could influence the price of commodities, was discussed. The exchange rate is also included in the calculation of the import- and export parity price.

The price of maize on the CBOT, a proxy for the maize price in the US, is also included in the calculation of the import- and export parity price. See section 4.4.1. of Chapter 4 for a discussion on how the US-maize price impacts on the maize price in South Africa.

By including import- and export parity prices in the equation to be constructed in Chapter 5, the effect of transportation costs, the interest rate, the exchange rate and the US-maize prices are already included in the equation.

Apart from the impact that international market prices have on the price of white maize futures contracts in South Africa, other factors such as HIV/AIDS and the increased production of genetically modified organisms (GMO's), might also influence the supply– and demand levels of maize in South Africa.

4.5. The possible impact of HIV/AIDS

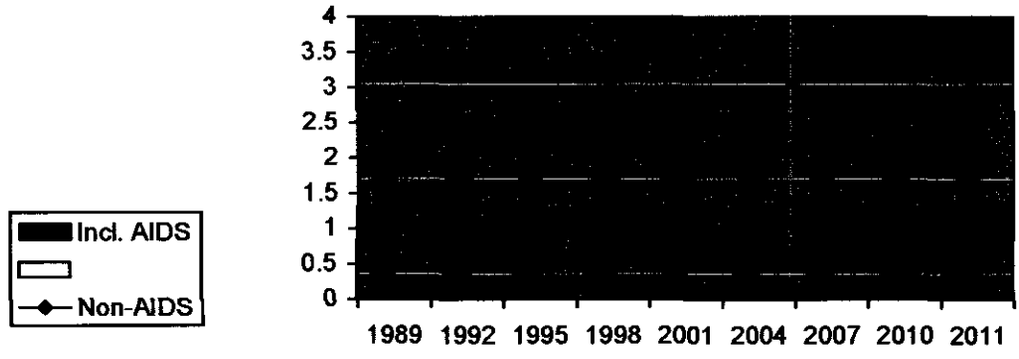
The Bureau of Economic Research (BER) at the University of Stellenbosch has been commissioned by the National Chamber of Milling to undertake an investigation into the impact of HIV/AIDS on the consumption of maize meal and wheat flour in South Africa.

The key findings of this investigation were that in the year 2006 the impact of HIV/AIDS in South Africa might reduce the projected sales of maize meal by 143 000 tons per annum or 180 000 tons of maize. In the year 2011 the sales will be

429 000 tons less maize meal or 536 000 tons less maize than what might have been the consumption levels of maize meal without the HIV/AIDS disease.

The studies conducted by the BER also indicate that the maize milling industry should reconsider its medium and long-term investment decisions and evaluate the current surplus capacity of the maize milling industry. Figure 4.4. is an illustration of how maize meal sales volumes could be affected by HIV/AIDS (De Villiers, 2001: 42,45). The bar graph is the expected sales of maize meal with the expected impact of HIV/AIDS taken into account. The line graph is the expected sales of maize meal should HIV/AIDS not be taken into account.

Figure 4.4: Maize meal sales volumes



Source: De Villiers, 2001.

4.6. The possible influence of GMO's

According to the Food Advisory Consumer Service (FACS, 2002), a GMO is any living organism that contains genes not normally found in it. These alien genes are genetic material that was transferred into the organism using genetic modification technology.

Since the mid 1970's biotechnology has enabled scientists to copy or delete genes from one organism and insert them into another organism, which could be

unrelated to the original organism from which the genes were extracted. The targeted transfer of genetic information from one organism to the next is known as gene technology, genetic engineering or genetic modification (FACS, 2002). As with many new scientific innovations, genetic modification has lead to many debates and has been subject to media coverage (Department of Health, 2003).

The GMO Act (No. 15 of 1997), the Agricultural Pests Act (No. 36 of 1983) and the Foodstuff, Cosmetics and Disinfectants Act (No. 54 of 1972) regulate the introduction of GMO's in South Africa.

In South Africa the South African Department of Agriculture has given approval for the planting of three GM crops: Cotton, maize and soybeans, which may be insect and/or herbicide resistant. There is no fresh GM fruit and vegetables on sale in South Africa (FACS, 2003).

According to the FACS (2003), the planting of these three insect and/or herbicide resistant crops might have the following benefits for farmers in South Africa:

- Fewer insecticides could be used, which, in turn might benefit farm workers, farmers, consumers and the environment.

- The quality of food could improve, as there is less fungal infection, less insect damage and less residual insecticide.

- Better safety for farm workers and those living near the fields.

- Less impact on the birds and beneficial insects around the fields, as only very specific insect pests are controlled by insect resistant crops.

- Less time and energy could be spent by farmers in producing the crop.

- GMO's could contribute to more efficient, sustainable food production.

The GM maize planted in South Africa has been genetically modified to be resistant to the stem borer. Stem borers are prevalent in southern and eastern Africa, where maize is a staple food.

However, according to De Grassi (2003), stem borders are a relatively insignificant contributing factor to poverty in Southern and Eastern Africa. Of greater importance are other agronomic, socio-economic and political constraints, such as droughts, poor transport, HIV/AIDS and political repression. De Grassi (2003) is also of the opinion that GMO's are not necessarily a cost effective method to reduce the occurrence of stem borers. Conventional crop breeders and farmers have already (as long as two decades ago) been working on techniques to improve borer-resistant varieties and also made use of other techniques to combat stem borers.

The debate is still going on whether or not GMO's could help to alleviate poverty and aid in the food security crises currently faced by much of Southern and Eastern Africa (South Bulletin, 2002).

In Chapter 4 the history and deregulation of the maize market in South Africa, as well as the development of the APD of SAFEX were discussed. Chapter 4 also focused on the difficulties South African farmers have to face when trying to market their produce. The position of white maize in the maize market in South Africa, the impact of international markets and import- and export parity prices as well as the possible impact of GMO's and HIV/AIDS on maize prices, were also discussed in Chapter 4.

Maize is an important staple food in southern Africa (NDA, 2003), therefore volatility in the market price of maize might have an adverse effect on both the producers and the consumers of maize. Being able to estimate changes in the price of maize could therefore have important benefits for the market. Chapter 5 will therefore be devoted to the constructing and testing an equation that could

explain the impact of some of the factors that influence the price of white maize futures contracts in South Africa.

CHAPTER 5: THE EMPIRICAL STUDY

5.1. Introduction

As stated in section 1.2. of Chapter 1, producers of commodities are vulnerable to price risk, due to the volatility of the prices of commodities. Farmers in developing countries are especially influenced by changes in the price of the commodities they produce. The price of white maize futures contracts in South Africa is also subject to volatility.

Farmers can hedge themselves against changes in the price of a commodity for which a futures market exists, by making use of futures contracts. As stated in section 3.1. of Chapter 3, the futures price is a forecast of what the cash price of a commodity will be at a given time in future. Factors that influence the cash price of a commodity will also impact on the futures price of the commodity, but not necessarily to the exact same extent (ABSA, 2001).

Changes in the price of commodities (including white maize) are the result of changes in the supply and demand for that commodity (see section 3.5.1.1. of Chapter 3). Section 3.5. of Chapter 3 gave an overview of all the factors influencing the supply and demand for commodity futures in general. These factors include the impact of the weather, government reports, political influences, international news, currency fluctuations and general business conditions. Also discussed in Chapter 3, section 3.4.1., are the factors that could be used to calculate the fair value price of a commodity. These factors include the transportation costs, financing costs, insurance costs and storage costs.

In Chapter 4 the specific factors that could influence the price of white maize futures contracts in South Africa were discussed. These factors include the impact of the US-maize market, import- and export parity prices, HIV/AIDS and GMO's. The aim of the empirical study is to consider some of the factors that

could have an impact on the price of white maize futures contracts in South Africa in order to construct an equation that could explain some of the variation in the white maize futures price.

5.2. Empirical methodology

5.2.1. Variables not included in the final regression equation

The following factors were considered but not included in the final regression equation. The reasons for not including these factors as independent variables (Ramanathan, 2002:4) in the final regression equation will be discussed separately in sections 5.2.1.1 to 5.2.1.7.

5.2.1.1. Factors included in the calculation of the fair value of a futures contract

In section 3.4.1. of Chapter 3 the carry-cost futures pricing model was introduced as a method to calculate the fair value price of a futures contract with a commodity as the underlying instrument. Kolb (1998:70) proposes a carry-cost futures pricing model that included the insurance costs, financing costs, transportation costs and storage costs as components of the fair value price of a futures contract. However, Falkena and Kock (2000), referring to the South African situation, makes use of only the financing costs in the carry-cost model they propose for the calculation of the fair value of a futures contract with a commodity as the underlying instrument. As a proxy for the financing costs in South Africa, Falkena and Kock (2000) make use of the prime interest rate.

The components included in the calculation of the import- and export parity prices were discussed in Table 4.1. and Table 4.2. of Chapter 4. By including import- and export parity prices as independent variables in the regression equation, as will be discussed in section 5.2.2. of Chapter 5, certain components of the carry-cost models as proposed by Kolb, will be included, namely the

transportation costs and the financing costs. The financing cost, the only component in the carry-cost model as proposed by Falkena and Kock (2000), will also be included in regression model if import- and export parity prices are included as independent variables in the regression equation.

5.2.1.2. Weather Conditions

Both rainfall estimates and realised rainfall may have an impact on the price of white maize (Kleinman, 2002:114). Higher levels of rainfall are mostly associated with a bigger supply of the commodity and therefore lower price levels, *ceteris paribus*. The opposite is also true.

Because of a difference between the areas used in the reporting of rainfall patterns in South Africa and the areas of maize production, the Southern Oscillation Index (SOI) were considered as a proxy for the long run weather patterns in South Africa. The SOI is calculated from the monthly or seasonal fluctuations in the air pressure difference between Tahiti and Darwin (Commonwealth Bureau of Meteorology, 2003). If the index shows sustained negative values, this is an indication of the so-called *El Niño* effect. The *El Niño* effect is associated with low rainfall patterns.

Positive values of the SOI are associated with higher rainfall patterns, popularly known as the *La Niña* effect (Commonwealth Bureau of Meteorology, 2003).

However, the SOI are not included as an independent variable in the regression equation, since the values of the index are only available on a monthly basis, while futures market prices are quoted on a daily basis. If the monthly averages of the futures price were to be included in the regression equation, the variation of the price could be smoothed out. While a regression equation might still be constructed if monthly averages of the futures price were to be included, the variation in the futures price could be smaller and information that might have been included if daily data were used, might be omitted.

The estimated rainfall patterns were also considered as an independent variable, in order to establish how the futures market for white maize reacts on the possibility of rainfall, but once again the areas used in the reporting of the estimated rainfall patterns differed from the areas of maize production. Data regarding the estimated rainfall patterns were also not available for the period included in the analysis.

Regional data regarding rainfall in South Africa is available. However, to make use of regional rainfall data and national data for white maize futures contract prices might lead to other complexities that go beyond the scope of the study.

5.2.1.3. Crop estimates

The crop estimates for white maize is published by SAGIS on a monthly basis, from the beginning of the production season until after the harvesting process has been completed. The crop estimates were considered as a proxy for the possible supply of white maize, since changes in the supply of white maize may lead to changes in the price, *ceteris paribus*.

The crop estimates were included in the regression equation as a dummy variable. The implications of including a dummy variable in a regression analysis are discussed by Kennedy, (1999:56). When the coefficient of the dummy variable was estimated, it was insignificant on a 5% level. The availability of market information might cause a situation where the crop estimates might already be taken into account before the actual publication of the data. Dragging the crop estimates forward for one month tested for this scenario. Making use of this "one month forward" crop estimates in the regression equation, showed its coefficient to be insignificant at a 5% level.

5.2.1.4. Currency fluctuations

As discussed in section 3.5.1.8. of Chapter 3, currency fluctuations or changes in the exchange rate might also have an impact on commodity prices. By including import- and export parity prices as an independent variable in the regression equation, the effect of currency fluctuations are also taken into account. The exchange rate is one of the components of the calculation of import- and export parity prices as discussed in Table 4.1. and Table 4.2 of Chapter 2.

5.2.1.5. The impact of US-maize prices

As discussed in section 4.4.1. of Chapter 4, fluctuations in the maize price on the US-maize market might lead to fluctuations in the maize price in South Africa. The futures price of maize on the CBOT might be used as a proxy for prices on the US-maize market, since the CBOT is the largest futures market for maize in the US (CBOT, 2003). Once again, by including import- and export parity prices as an independent variable in the regression equation, the effect of US-maize prices could also be included in the regression equation. The maize price on the CBOT is also included as a component of the import- and export parity prices, as discussed in Table 4.1. and Table 4.2 of Chapter 4.

5.2.1.6. HIV/AIDS and GMO's

As discussed in section 4.5. and section 4.6. of Chapter 4, HIV/AIDS and GMO's might possibly have an impact on the supply and demand of white maize in South Africa. However, the data currently available regarding HIV/AIDS and GMO's are not of such a quality and availability that it might be included in a regression analysis. As more data become available on HIV/AIDS and GMO's, these two variables might also be considered as independent variables in the regression equation.

5.2.1.7. Factors that might lead to structural changes in the maize market

In South Africa the deregulation of the maize market is an example of how changes in government policy might lead to structural changes in the maize market. For example, the price control by the government control boards were abolished in 1996. Since then the price of maize is determined by market forces. No significant changes took place in the government policy regarding maize markets in South Africa during the period used in the regression model. However, suppose there have been changes in the government policy during that period of time, the effect on the market could have been captured by including a dummy variable.

Other factors such as political influences, international news, and general business conditions are also factors that might influence the price of a commodity such as white maize. However, factors such as these are not easily quantifiable. In the period under consideration in the regression analysis, there were no important political changes or international news that could have had a significant impact on the maize market, such as Gulf War II or the Zimbabwean crises. Should events like these have an impact on the market, the effect could once again be captured by including a dummy variable.

5.2.2. Variables included in the final regression analysis

The dependent variable

For a description of the term dependent variable, refer to Ramanathan (2002:4).

5.2.2.1. The futures price

The futures price reflects the price at which buyers and sellers of a futures contract are willing to buy or sell the underlying asset of the futures contract at a future date. The futures price is based on market consensus (the levels of supply and demand for the commodity). The futures price is a forecast of what the cash price of the underlying asset of the futures contract will be for a given month in future, based on the market information that is currently available (see

section 5.1. of Chapter 5). The supply and demand factors that influence the cash price of the underlying asset will influence futures prices in a similar way, but the relationship of the changes are not always perfect (ABSA, 2001). The difference between the cash price of maize and the futures price is due to differences in the financing cost (such as interest payments) and storage or insurance cost for the underlying cash market asset (see section 3.4.1. of Chapter 3).

The independent variables

For a discussion of the term independent variable refer to Ramanathan (2002:4).

5.2.2.2. Import- and export parity prices

The relationship between the calculated import- and export parity prices and the futures price of white maize, where discussed in section 4.4.2. of Chapter 4.

The data (SAFEX, 2002) used for the regression analysis are the futures price and the calculated import and export parity prices for a period of 100 trading days, stretching from May 2002 to September 2002. The import and export parity prices used are calculated according to the method described in Table 4.1. and 4.2. of Chapter 4.

A longer time series was tested (680 trading days), but including data from more than one production season presented some problems: The factors influencing the price of maize differ from one production season to the next, for example, a severe drought might occur during the one production season, but not during the next. The factors that influenced the price during the previous production season might no longer have an impact on the price during the next production season. The longer the time series to be tested, the greater the possibility that factors that might no longer have an impact on the futures price, might be included in the regression

When analysing the market, hedgers might also have a short-term view regarding the price of maize because the contracts traded on the futures market at any given time are contracts for delivery in a nearby month and contracts for delivery in the following two delivery months. For example during November 2003 the white maize futures contracts for delivery in December 2003, March 2004 and July 2004 could be traded on the futures market.

Another factor that might play a role in determining the price of a futures contract is the limits that are placed on daily price movements by the futures exchange.

5.2.2.3. Limits on daily price movements

The impact of limits on the daily price movements of futures contracts is discussed in section 2.2.2.5. of Chapter 2.

Price limits are used to counter excessive speculative movements in the market, but controversy exists surrounding the use of price limits for futures contracts. For example, some market participants are of the opinion that the use of price limits might impose unnecessary restrictions on the market (Sutcliffe, 1993:39 and Hull, 1997:20).

The use of price limits indicate that today's futures price could be

$$(P_{t-1}) - PL \leq P_t \leq (P_{t-1}) + PL$$

where

(P_{t-1}) is the futures price on period back;
PL is the limit placed on the daily price movements and
P_t is the futures price at period t.

In the dataset used for the regression analysis in this study, the limit on the price movement for white maize futures remains constant and therefore has no impact on the variation of the price. Price limits remain constant for a relatively long

period of time and will only be changed if the market shows signs of extreme volatility (Hull, 1997:20).

As long as the daily price limits do not change continuously, a change in the daily price limits could be dealt with as a structural break by including a dummy variable. The reason for including a dummy variable is that a constant price limit has no effect on the variation in the white maize futures price. A regression analysis is based, amongst others, on the variation of the variables, therefore daily price limits might be excluded.

5.3. The regression estimation

The data to be used in the estimation of the regression equation was tested for structural breaks by making use of the CUSUM-test. No structural breaks occurred in the data for the period used in the regression analysis.

All the variables included in the regression equation to be estimated, were tested for stationarity by making use of the Augmented Dickey Fuller (ADF)-test (Ramanathan, 2002:473). If non-stationary variables were to be included in the regression analysis, the estimation results might be spurious (Phillips, 1986:311-340). Non-stationary variables could be converted into log-growth rates in order to ensure stationarity of the data. Converting the data into log-growth rates also overcomes the problem of heteroscedasticity (Ramanathan, 2002:133,344) of the data (Carlson, 1978:17).

A disadvantage of a model consisting of converted log-growth rates is that long-term information is omitted from the estimation model. To rectify the problem and to include long term information into the estimation model, an error correction model (Seddighi et al, 2000:2520 could be constructed:

$$GFP_t = \alpha_0 + \beta_0 DGIPGEP_t + \gamma_0 \varepsilon_{t-1} + f_t \quad \textbf{(1)}$$

where

$$\gamma_0 \varepsilon_t = \gamma_0 (FP_t - \chi_0 - \phi_0 DIPEP_t - \eta_0 FP_{t-1})_{t-1} \quad \text{(2)}$$

For **(1)**

$GFP_t = log(FP_t / FP_{t-1}) * 100$ or the log-growth rate in the futures price;

$DGIPGEP_t = GIP_t - GEP_t$ with

$GIP = log(IP_t / IP_{t-1}) * 100$ and $GEP_t = log(EP_t / EP_{t-1}) * 100$ and

ε_{t-1} is the stationary error term and

f_t is the AR-error term (see section 5.3.1. of Chapter 5).

$DGIPGEP_t$ is used as an instrumental variable (Ramanathan, 2002:552) for import parity and export parity due to the multicollinearity (Ramanathan, 2002:214-225) that exists between import– and export parity.

For **(2)**

FP_t is the price of the futures contract;

$DIPEP_t$ is the difference between import parity and export parity [Import parity (IP_t) – Export parity (EP_t)];

FP_{t-1} is the autoregressive (Ramanathan, 2002:243) or dynamic variable that describe the relationship of the futures price with the futures price of the previous day, due to the existence of price limits.

$DIPEP_t$ is used as an instrumental variable for import parity and export parity due to the multicollinearity that exists between import parity and export parity variables.

The error term, ε_{t-1}, should be tested to ensure that the error terms are not serially correlated (or autocorrelated). If the assumption of independent error terms is violated (when the error terms are serially correlated), an OLS regression would produced biased estimates of the standard errors of the regression coefficients. A biased estimation of the standard errors could lead to incorrect hypothesis tests and incorrect conclusions (Choudhury *et al* 1999:342).

Different regression methods could be used to estimate autocorrelated observations, for example the autoregressive (AR) model, the moving average (MA) model and a mixed autoregressive-moving average (ARMA) model. An autoregressive model refers to a model where the explanatory variables include one or more lagged values of the dependent variable, or if the error terms are autocorrelated, one or more lagged values of the error terms (Seddighi *et al*, 2000:118).

The estimation was attempted by using both an AR-error process and an MA-error process. The AR(2)-error process captures the structure of ε_{t-1}. A brief description of the AR-error process will now be given.

5.3.1. The AR(p)-error process

An AR(p)-error process can be written as an infinite sum of past random shocks. Each shock persists indefinitely, although the importance of the shock diminishes over time (Choudhury *et al*, 1999:342). p refers to the number of lagged error terms included in the process.

An AR(1)-error process could therefore be written as

$$Y_t = \pi_0 + \omega_0 X_t + \tau_0 Z_t + w_t$$

where

$$w_t = \rho w_{t-1} + s_t \text{ with } -1<\rho<1.$$

ρ is the autoregressive parameter and ε_t is another random error term that is assumed to have zero mean, be homoskedastic and is serially uncorrelated. s_t satisfies the assumptions of the least squares estimators (LSE) (Seddighi *et al*, 2000:146).

If the AR-error terms are included the equation will have the following format:

$$GFP_t = \alpha_0 + \beta_0 DGIPGEP_t + \gamma_0 \varepsilon_{t-1} + f_t$$

where

$$f_t = \delta_0 v_t + \theta_0 v_{t-1} + r_t$$

v_t and v_{t-1} is the autoregressive error terms and r_t satisfies the assumptions of LSE.

5.4. The estimation results.

The results of the estimation is given in Table 5.1.

Table 5.1.: The results of the final equation

Dependent variable GFP_t	**Results**
Constant (α_0)	0.000102 [0.942]
$DGIPGEP_t$	0.24062 [0.122]
Long run residual (ε)	-0.0006399 [0.002]
AR(1) (v_t)	0.049576 [0.001]
AR(2) (v_{t-1})	-0.004119 [0.000]
R-Squared	0.22
R-Bar-Squared	0.18
DW – statistic	2.0172
The terms in parentheses are the P values.	

The coefficients have the expected sign and all but one (*DGIPGEP*) is statistically significant on at least a 0.2% level. *DGIPGEP* is statistically significant at a 12,2% level. This suggests that changes in import– and export parity prices are not as important over the short run as it is over the long run. For the long run estimation import-and export parity prices are significant at less than a 0.1% level of significance.

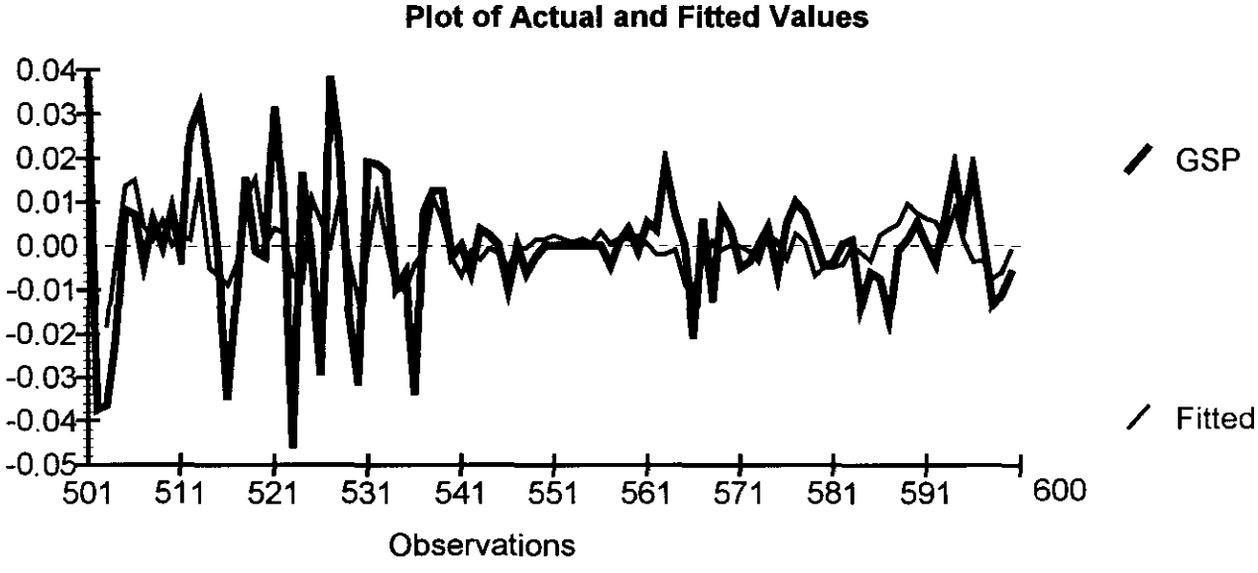
Since the import– and parity prices form a band between which the futures price fluctuates, long run structural changes in this band might have a more significant

effect on the level of futures prices than short run changes. The Durbin–Watson test (Ramanathan, 2002:385-388) shows the absence of serial correlation.

As indicated by the F-value, the regression estimation is statistically significant at at least a 1% level. Although the R-Squared is not very high, it should be kept in mind that the values are in log-growth rate form.

Figure 5.1. is a graphic illustration of the actual and fitted values of the dependent variable.

Figure 5.1: Plot of actual and fitted values of the estimation



5.5. Comments and recommendations regarding the estimated equation

The results of the estimation show that changes in the import- and export parity prices of white maize have a more significant effect over the long run as is the case over the short run. The AR(2) regression estimation delivers a significant coefficient for v_t and v_{t-1}. If there were structural breaks in the data (see section 5.3. of Chapter 5), some of the short run structural breaks could have been accounted for by including "The-day-of-the-week-effect" as proposed by Bhattacharya *et al* (2003:553) for Mondays and Fridays. According to

Bhattacharya *et al* (2003:553), Mondays and Fridays could lead to seasonality in the volatility of futures prices.

The variables included in the calculation of import– and export parity prices could also be estimated separately (for example the effect of the exchange rate or the CBOT–prices for maize) in order to asses the impact of changes in these individual variables on the white maize futures price in South Africa.

CHAPTER 6: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1. Introduction

South African farmers are exposed to price risk when marketing their produce. The purpose of this study was to focus on the market for white maize in South Africa, in particular the futures price for white maize, in order to construct and test an equation that could explain some of the volatility in the futures price of white maize in South Africa. A background had first to be provided regarding futures contracts and futures markets in general, the pricing of futures contracts and the market for white maize in South Africa.

Section 6.2. of Chapter 6 provides a brief summary of what was discussed in the different chapters of the study. In section 6.3. of Chapter 6 concluding remarks regarding the literature study and the empirical study will be given. Section 6.3. of Chapter 6 contains recommendations pertaining to the white maize futures market in South Africa and the possibilities for further research.

6.2. Summary

Chapter 1 gave an introduction of the aspects surrounding the maize market in South Africa. Certain introductory aspects regarding the deregulation of the agricultural markets in South Africa, including the maize market, were discussed. The development of the South African Futures Exchange (SAFEX) and the increased volumes of futures contract trading were also discussed.

A motivation to substantiate the undertaking of the study was also given in Chapter 1. The hypothesis to be tested by the empirical study (in Chapter 5) was described, as well as the research methodology to be followed during the

rest of the study. Chapter 1 also gave a broad overview of how the different chapters in the study are linked to each other.

Chapter 2 was a discussion of the certain aspects pertaining to futures markets and futures contracts in general. The futures contract, the specifications of the futures market, the differences and similarities between futures contracts, option contracts and forward contracts, the characteristics of the futures market, futures market participants, the role of the clearinghouse, the process of margining, the role of the exchange, the process of hedging and the advantages and disadvantages of futures contracts were discussed.

The topic of Chapter 3 was the pricing of a futures contract. The relationship between the cash price and the futures price of a commodity was discussed, as well as the calculation of the fair value of a futures contract with a commodity as the underlying instrument.

The use of fundamental and technical analysis when analysing the futures market for a particular commodity, was also discussed in Chapter 3. Fundamental market analysis may be used to establish how certain factors, as discussed in section 3.5.1. of Chapter 3, might influence the balance of supply or demand for a particular commodity. The different factors that might have an impact on the levels of the supply and demand for commodities in general were discussed in section 3.5.1. of Chapter 3. Some of these factors were considered for inclusion in the equation to be constructed in Chapter 5.

In Chapter 4 a brief history of the development of the maize market in South Africa was given. The deregulation of the maize market in South Africa and the development of the APD division of SAFEX were discussed. The problems that South African farmers are still facing when marketing their products, were also discussed. The rest of Chapter 4 focused on the supply and demand for white maize in South Africa, as well as the unique factors in

the South African maize market that could possibly have an impact on the supply and demand of white maize. Some of the factors discussed in Chapter 4 were also considered for inclusion in the equation to be constructed in Chapter 5.

6.3. Conclusion

Chapter 2 provided a background regarding the futures markets and futures contracts. Futures markets developed through the centuries to a market system that is well-established worldwide. Futures contracts are traded on a variety of commodities, financial instruments and indices on exchanges worldwide. Futures markets provide investors with the opportunity to hedge themselves against the price risk they are exposed to on the cash market. The standardised nature of futures contracts provides participants on the futures market with the opportunity to trade futures contracts on the secondary market. The clearinghouse guarantees the fulfilment of the futures contract, and therefore reduces the risk of default for members of the clearinghouse.

In Chapter 3 the pricing of futures contracts was discussed. The carry-cost futures pricing model is a model that is used to calculate the fair value price of a futures contract with a commodity as the underlying instrument. According to Kolb (1998:70) storage costs, insurance costs, financing costs and transportation costs should be included in the calculation of the fair value price of a futures contract. However, in the method of calculation of the fair value price of a futures contract as suggested by Falkena and Kock (2000), referring to the South African situation, only the financing costs are included, by means of the prime interest rate. Falkena and Kock (2000) use the prime interest rate as a proxy for the financing costs.

Also discussed in Chapter 3 are the factors that might influence the supply and demand for a commodity. Changes in the supply and/or demand for a particular commodity might influence the price of that commodity. By

analysing the factors influencing the balance of supply and demand for a particular commodity, the futures trader is conducting fundamental. Fundamental analysis is usually conducted with a particular commodity in mind.

In conjunction with fundamental analysis, the futures trader could also conduct a technical analysis of the market. When making use of technical analysis, a futures trader could use one or a combination of various analytical techniques to analyse the market. The point of departure of technical analysis is that the price of the commodity is a reflection of all the changes that took place in the supply and demand for that particular commodity and therefore the price of the commodity should be studied.

As discussed in Chapter 4, the deregulation of the agricultural market in South Africa is the result of pressures, both domestic and international. The deregulation of the agricultural market in South Africa led to various changes in the pricing system of agricultural commodities, including white maize. Prices of agricultural commodities, previously determined by government control boards, are now the result of market forces. The more open South African economy exposes South African farmers to the impact of global market forces and the management of price risk has become an important determinant of profitability in the agricultural market.

Although agricultural markets in South Africa have developed over the past few years, South African farmers still have to face problems such as price transparency (section 4.2.4.1. of Chapter 4) and price discovery (section 4.2.4.4. of Chapter 4), the accessibility of markets, a resistance to change, the lack of information and a changing market environment when marketing their products. Also, differences between markets in developed countries and developing countries do still exist, as discussed in section 4.2.4.6. of Chapter 4. Small-scale farmers in South Africa are also faced with unique problems, such as poor infrastructure and the costs of storage and transportation.

White maize is the staple food for large parts of Southern Africa and the ability of maize millers to provide in the demand for white maize in South Africa is of strategic importance (see section 4.3.2. of Chapter 4). White maize is mainly used for human consumption and consumers prefer white maize meal to yellow maize meal. The management of price risk are therefore not only of importance to the producers of white maize (the farmers) but also to the suppliers of white maize to the consumers (the maize millers).

From the discussion of the unique factors in the South African maize market that might influence the price of white maize, the influence of global markets on the South African maize market are apparent. The calculated import- and export parity form a band between which the futures price of white maize in South Africa fluctuates. The import- and export parity are derived from the futures price of maize on the CBOT and other factors, such as transportation costs, financing costs and the exchange rate.

By making use of the calculated import- and export parity in testing the empirical validity of the regression equation constructed in Chapter 5, some of the factors described in Chapter 3 and Chapter 4 are taken into account, such as the maize price on the US-markets, transportation costs, financing costs and the exchange rate. The empirical validity of the equation constructed in Chapter 5 are tested with the F-statistic (for the equation) and the t-statistics (for the coefficients).

Transportation costs and financing costs are two of the factors included in the calculation of the fair value price of a futures contract (Kolb, 1998:70), as discussed in section 3.4.1. of Chapter 3. The exchange rate is one of the factors mentioned in section 3.5.1. of Chapter 3, as a factor that could possibly have an impact on the supply and demand of a commodity. The maize price on the US-markets are mentioned in Chapter 4 as being one of the specific factors that could influence the price of maize in South Africa.

The import- and export parity price is relatively successful in explaining a percentage of the variation in the price of white maize futures contracts in South Africa, as described in Chapter 5.

6.4. Recommendations

In the calculation of the fair value price of a futures contract, as proposed by Falkena and Kock (2000) and as discussed in section 3.4.1. of Chapter 3, consideration might be given to the inclusion of other factors such as the transportation costs, storage costs and insurance costs, as proposed by Kolb (1998:70). The method proposed by Falkena and Kock (2000) only includes the financing costs. The relationship (if any) between the fair value price of a futures contract and the daily futures price could also be tested empirically.

The factors included in the calculation of the import- and export parity prices could be tested separately in a regression equation in order to establish the impact of each of these factors on the price of white maize futures contracts in South Africa.

The differentials between transportation costs and storage costs in the different maize production regions in South Africa might be investigated, in order to establish how the basis of a futures contract might differ from one region to the next, as discussed in section 4.2.4.7. of Chapter 4.

The impact of rainfall on the white maize price might also be tested on regional basis, since the rainfall data for the different municipal districts in South Africa are available (section 5.2.1.2 of Chapter 5). To make use of the regional rainfall data to test the impact of rainfall on the national maize price, as reflected by the futures price, might be more complex.

An investigation might also be launched into the efficiency of the futures market in South Africa (section 4.2.4.6. of Chapter 4).

Regarding white maize and white maize futures contracts in South Africa, possibilities for further research do still exist and might be explored in future research.

GLOSSARY OF TERMS

Arbitrage Arbitrage refers to the simultaneous purchase and sale of the same asset in different markets.

Cash price The cash price of a commodity can be defined as a price quotation obtained or a price actually received in a cash market or the price of a commodity if it was to be delivered immediately.

Close out A futures contract may be closed out by an offsetting transaction (or opposite transaction) before the expiry date. A futures contract could be closed out by buying a futures contract of the same size if a contract was sold or selling a futures contract of the same size if a contract was bought.

Credit risk Credit risk (or default risk) refers to the risk that an obligation will not be honoured by the counterparty to the transaction.

Commodity A commodity may be defined as any object that is produced for the purpose of consumption or for the purpose of being traded in the market. The term is also used in a more narrow definition to denote those foodstuffs and raw materials that are widely traded internationally in organised markets, for example wheat, white maize, yellow maize, cotton and oil.

Daily price limit The daily price limit refers to the maximum amount the price of a futures contract can move upward or downward from the settlement price of the previous day. If the price of a futures contract moves upward by the amount equal to the daily price limit, the contract is said to be *limit up* and if the price of a futures contract moves downward by the amount equal to the daily price limit, it is said that the contract is *limit down.*

Default risk See *credit risk.*

Forward contract / forward A forward contract may be defined as a non-marketable agreement between two parties to exchange certain assets at a set date in future.

Future A futures contract (future) is a contract between two parties, for the delivery of a standardised quantity of a specified commodity, at a price and delivery date that is predetermined. A formal exchange exists for the trading of futures contracts.

Hedging Hedging refers to an action taken by a buyer or seller of a commodity to protect his income against adverse price movements in future.

Hedger Hedgers face some type of economic risk and they choose to eliminate or reduce that risk by some type of offsetting transaction.

Initial margin The initial margin is the amount payable before a trade can take place. The initial margin is based on the historical price volatility of the futures contract price. The initial margin is set at a level sufficient to protect the clearinghouse against the maximum price movement that could take place in one day (according to historical data) in the particular futures contract.

Limit up See *daily price limit.*

Limit down See *daily price limit.*

Long position / Long The long position refers to the ownership of a financial instrument, i.e. the person who is in the possession of the financial instrument or buying the financial instrument.

Maintenance margin The maintenance margin is the amount that must be available in the account of the clearinghouse member as long as the futures position is active. A futures position is still active if a futures contract was bought or sold but not closed out by an offsetting transaction.

Margin call A margin call is the requirement to pay an amount into a margin account at the clearinghouse because of adverse price movements or new transactions.

Mark-to-market Marking-to-market refers to the practice in the futures market of transferring funds from one account to another account at the end of each trading day. The transferring of funds takes place because of price movements in the specific futures contract. The amount to be transferred depends on the size of the profit or loss.

Option contract / Option An option contract gives the holder of the option contract the right, but not the obligation, to buy or sell a certain asset at a set price, on or before a given date.

Offsetting transaction See *close out.*

Price limit See *daily price limit.*

Short position / Short The short position, on the other hand, refers to the person who is not in the possession of the financial instrument or the person who is selling the financial instrument.

Speculator In the futures markets a speculator is a person who, for a price, is willing to bear the risk that the hedger does not want.

Spot price See *cash price.*

Variation margin The extra funds deposited into the margin account to maintain the maintenance margin, is called the variation margin.

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