

Developing a post-harvest market model for maize in South Africa

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PREFACE

We live in a globalised, specialised and highly commoditised world, on the verge of the fourth industrial revolution, in terms of which each and every product, service, thought and idea is quantifiable and subsequently tradeable as a commodity, where value is increasingly determined only by objective market factors and less by subjective opinion or ethical considerations.

The same holds true for the agricultural sector, albeit in the Republic of South Africa or the United States of America in terms of which grain is one of the oldest traded commodities in the world, pre-dating the Chicago Board of Trade, the Vereenigde Oostindische Compagnie (Dutch East India Company) between the fourth and sixth century BC Noonan (1973:232) and beyond.



Figure A: Chicago Board of Trade Stock Photo

As with all commodities, profits are marginal and optimising the sale thereof often times aggregate to a profit or loss for the producer, hence the necessity of marketing models premised on actual, real-time data and empirical data sets. South African grain circumstances are furthermore compounded by the fact that our grain is commoditised in terms of the U.S. dollar and highly influenced by North American and South American annual crop yields as well as the rand/dollar exchange rate.

The purpose of this work therefore is to develop a marketing model based on South African circumstances, yet which is bespoke to the needs, facilities and strategy of Vlakvlei Boerdery (Pty) Ltd, to enable Vlakvlei Berdery (Pty) Ltd to maximise profits by the sale of its maize, while minimising costs traditionally associated with the existing pre-harvest marketing strategies.

The author hereof is beholden to the following Latin proverb, being: '*Ex Gratia Domini Christi*', meaning 'from the grace of Christ our Lord' and the proverb of Roman Emperor Marcus Aurelius, being: '*Quod in vita facimus, in aeternum resonat*' meaning 'what we do in life echoes through eternity', and hence undertook this work to produce a lasting empirical contribution to the field of grain marketing, specifically *maize* marketing in South Africa within the Senwes white maize region, with specific reference to private grain handling and storage facilities and the effect thereof on marketing strategies and is it hypothesised that such facilities would incline the owners thereof to shift their marketing strategy from that of pre-harvest, to a post-harvest model.

ABSTRACT

This paper aims to develop a post-harvest marketing model, tailored to the bespoke requirements of Vlakvlei Boerdery (Pty) Ltd, with the earmark of utilising its private grain handling and storage facilities to the fullest.

In order to render such a post-harvest marketing model, this paper examined SAFEX data for the period of 2007 to 2020, and more specifically Spot Market- and Futures data for the period as aforementioned, and also analysed the correlation between the R/\$ exchange rate and its impact upon local prices, more specifically WM1 prices. The study also further examined base-prices applicable to the local grain industry and how it subsequently fluctuates between the twelve months of the year.

Finally, this study drew various conclusions from the data and made several recommendations, of which a proposed marketing model for Vlakvlei Boerdery (Pty) Ltd, to enable it to maximise profits by the sale of its grain during strategic periods according to the findings of this study.

Keywords: White maize, WM1, futures, hedging, post-harvest, agriculture, marketing, SAFEX.

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KEY TERMS

The following table provides terms, and concepts that will be used throughout this paper, and is the list herein *non numerata clausa*.

Table 1-1 Key terms used throughout this document

Grain futures market	A platform where buyers and sellers of term contracts meet.
Derivative instruments	An option where the value thereof is derived from a futures contract.
Ex-farm price	Farm-gate price and/or the final price the producer receives for his commodity (which is void of all deductions).
Speculation	Taking a specific predetermined risk, to attain a financial benefit.
Primal market circumstance	Supply and demand equilibrium, void of speculation.
Price spread	The difference in price between two future months, two cash months or between a cash and future month.
Carrying / carry costs	The costs associated with storing grain for a period of time.
Ceteris paribus	The assumption that all other variables remain constant.
Pre-harvest marketing model/ strategy	A marketing strategy in terms of which a producer markets his commodity 'in the future' / before harvesting the commodity by leveraging derivative instruments on SAFEX, or making use of other pre-harvest strategies.

Post-harvest marketing strategy	A marketing strategy in terms of which a producer markets and sells his commodity after harvesting it / taking physical delivery thereof by making use of SAFEX-derivatives, spot prices or other post-harvest strategies.
Silo base-price deduction	Cost associated with the physical delivery of grain at a specific silo, usually incurred as a deduction from the agreed upon SAFEX price (also known as an <i>ex-farm</i> price).
Shorting the market (selling in the market)	When a market participant sells a position in a spot and/or future month.
Going long in the market (buying in the market)	When a market participant buys a position in a spot and/or future month.
Position in the market with regard to maize	Is comprised by a one hundred-ton bought/sold position on SAFEX.
Warrants	Put warrants and call warrants give the buyer and/or seller a right, but not an obligation in the financial market.
Seasonal Price-band	The seasonal price band may be described as the spread between the lowest and highest closing dates on SAFEX for a specific future contract and/or loco contract.
Pipeline supply and/or carry-over stock	Pipeline supply and/or carry over stock is the stock of grain and oilseeds carried over from one year to the other.
Last Trade Date	The last day that any future- and/or Spot Market month is tradeable, before trading for that specific month closes and becomes deliverable.

ABBREVIATIONS

The following table provides abbreviations and acronyms used throughout this paper, and is the list herein *non numerate clausa*.

Table 1-2 Abbreviations used throughout this document

CBOT	Chicago Board of Trade
JSE	Johannesburg stock exchange
RSI	Relative-strength index
SAFEX	South African Futures Exchange, a subdivision of the JSE
SSF	Single Stock Futures
USD	United States dollar
WM1	White maize grade one
WM2	White maize grade two
WM3	White maize grade three
ZAR	South African rand

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CHAPTER 1:

NATURE AND SCOPE OF THE STUDY

1.1 INTRODUCTION

1.1.1 Background

Since the dawn of antiquity, grain and other grain-derived products had been commoditised and used to trade across countries, regions and continents (Hur, 2019). From the times of the early Greek colonisers during the 6th to 3rd centuries BC, who used trade to feed the Grecian mainland, Noonan (1973:233), to the days of emperor Augustus of the Roman Empire, who militarised the grain trade in favour of empire building (Kessler, 2007:19). Grain and subsequent trade thereof had always been an integral part of societal structure.

In terms of the modern era, with specific reference to South Africa and the commercialisation of grain and maize during the 20th century, subsequent harvests and trade thereof played a critical role in the stabilisation of the respective agricultural sectors and indeed led to the development of rural communities and economies, *in lieu* of, agricultural advancement.

With regard to South Africa, and before 1996, the South African grain industry was inwardly focused and heavily influenced by regulation and government control. Grain prices were controlled by various commodity boards, ranging from maize to wheat to meat, who fixed commodity prices for the specific production cycle (Venter M.M., 2012:4). With the deregulation of the grain industry, prices of grain products are, however, free to move according to national as well as international, supply and demand considerations, leading to production, marketing, and processing decisions based on market signals and not government intervention (Ueckermann *et al.*, 2008:222).

Pursuant to the deregulation mentioned above that occurred, grain producers in general, lost their collective bargaining power which they acquired *vis* their former agricultural co-operatives, the latter according to the change in the co-operatives' business scope and purport. This, together with decreasing producers' prices, increasing input costs and uncertainties in grain producer prices, negatively affected the producers' ability to sustain profitability over the longer term (Geyser, 2007:295; Ueckermann *et al.*, 2008:224) *In lieu*

of those mentioned above, effective marketing strategies have become of utmost importance, and is it this study's objective to develop such an effective strategy, considering the position of Vlakovlei Boerdery (Pty) Ltd, and its capital expenditure in grain handling and storage solutions.

For most modern farming endeavours, realised profits and/or losses are often a function of sales. Knowing when to sell and when not to sell have, therefore, since the deregulation of the South African grain markets, become a cardinal pillar of primary agricultural profits, alternatively losses with Vlakovlei Boerdery (Pty) Ltd being no exception thereto. Auxiliary to the aforementioned, the South African agricultural industry - and perhaps the greater portion of the private sector - had undergone numerous structural, financial and competitive changes during the past decade, ranging from globalisation to climate change, each posing unique opportunities and threats to the South African agricultural sector, including Vlakovlei Boerdery (Pty) Ltd.

1.1.2 Vlakovlei Boerdery (Pty) Ltd

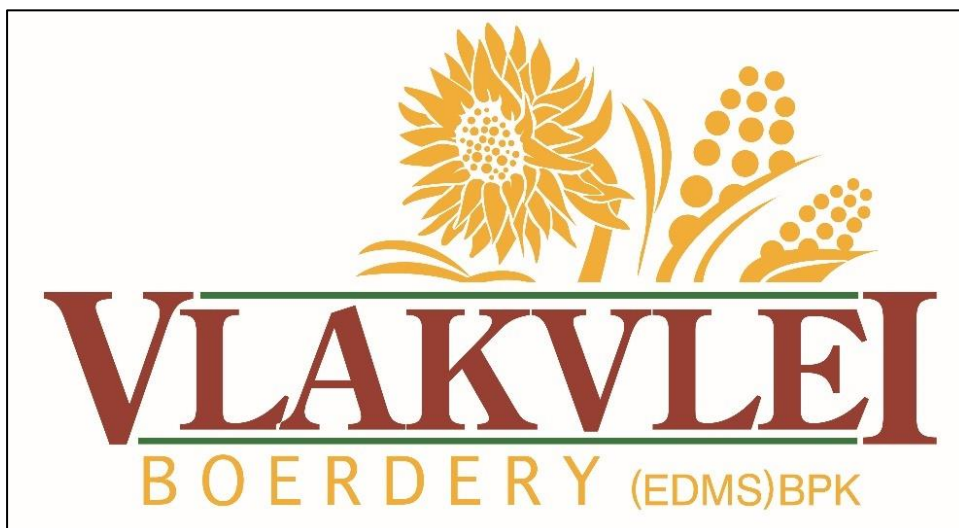


Figure 1-1: The logo of Vlakovlei Boerdery (Pty) Ltd

Vlakovlei Boerdery (Pty) Ltd, classified as a medium-size family-owned agricultural enterprise, situated within the North-Western Free State has also not been immune to the various aforementioned variables, in terms of which negative rainfall anomalies are typically associated with shortages of maize and subsequent high prices, as opposed to favourable rainfall anomalies that are usually associated with surplus supply and subsequent depressed prices. The latter state of affairs, compounded by extensive drier periods, have adversely affected producer profitability of late.

With the aforementioned borne in mind, Vlakvlei Boerdery (Pty) Ltd., therefore, undertook extensive structural and paradigm reforms to boost productivity, increase profits and diversify its cash-generating portfolio of business activities. Concerning its maize production, which accounts for most of the cash generation and profits or losses, Vlakvlei Boerdery (Pty) Ltd undertook a new value addition to its business activities by erecting its grain handling and storage facility, thereby prompting the need for a new maize marketing model with the facility mentioned above central to that. *In lieu* of the previous, the responsibility of developing such a model fell to the author hereof, being the successor to the CEO position, currently held by the author's father, Paul Jacobus Maré. The hypotheses that the author hereof, therefore, plans to test is one in which a centralised post-harvest marketing model would maximise Vlakvlei Boerdery (Pty) Ltd's long-term profits, while minimising associated marketing costs over the long- and short-term.

1.2 PROBLEM STATEMENT

In practice, very few grain producers possess their grain handling and storage facilities. More often than not, agricultural producers are dependent upon the newly transformed, old co-operatives and their grain handling and storage facilities. These facilities, pursuant to their colossal size and nature, are relatively expensive to maintain and thus also relatively expensive to make use of. Yet, for the bulk of South African grain producers, an alternative to them simply does not exist. This may very well be why most of the previously conducted marketing strategies and studies focused on the pre-harvest section of maize marketing, presumably according to the fact that the 'carrying' of grain is relatively expensive (Maré, 2019b:9).

The problem this study, therefore, aims to address is the fact that not many, if indeed any, meaningful post-harvest marketing research studies have been conducted for the benefit of South African grain producers – with specific reference to white maize marketing within the Senwes region. Furthermore, not any comparative studies have been conducted between pre- and post-harvest marketing strategies, the necessity of which is only compounded by the emergence of grain producers who also possess the infrastructure necessary to handle and store their grain. Finding a solution to the problem as mentioned above is therefore of the utmost importance to those producers who wish to 'carry' their produce and to market said produce annually and retrospectively from July to March, rather than prospectively from October to July. Data and studies about pre-harvest

marketing strategies are legion. Therefore a comparative analysis would be able to draw from numerous sources and authors - on the pre-harvest marketing side - for the author hereof to conduct a meaningful comparative study between the two marketing strategies (Maré, 2019b:9).

1.3 OBJECTIVES OF THE STUDY

1.3.1 Primary objective(s)

The primary bespoke objective of this study is to develop a post-harvest marketing model and/or strategy for the use of Vlakvlei Boerdery (Pty) Ltd, with its newly developed grain handling and storage facility central to that.

1.3.2 Secondary objective(s)

The secondary bespoke objectives of this study are to compare the aforementioned post-harvest marketing model and/or strategy with existing pre-harvest marketing models and/or strategies and to ascertain which marketing model best fits the needs of Vlakvlei Boerdery (Pty) Ltd.

1.4 SCOPE OF THE STUDY

This study is primarily accountable to the agricultural sector. Specifically, it focuses on the marketing of maize, with a specific focus on market trends, trend breaks and price variation thereof, with due consideration given to the bespoke needs of Vlakvlei Boerdery (Pty) Ltd, *in lieu* of the entity's newly erected grain handling and storage facility, and the subsequent desire to move from a pre-harvest marketing model to a post-harvest marketing model.

The scope of this study can therefore be summarised to focus primarily on WM1 traded on SAFEX and prices, variations and trends thereof, while comparing existing pre-harvest marketing strategies with a newly developed post-harvest marketing model, while affording due cognisance to external factors that may impact local market prices of grain and volatility thereof, such as global grain supply and international currency exchange rates and is the concurrent geographical locale within which comparisons are to be conducted limited to the Senwes region, with Viljoenskroon chosen as specific locality.

1.5 RESEARCH METHODOLOGY

1.5.1 Research Design and method: A literature and theoretical study

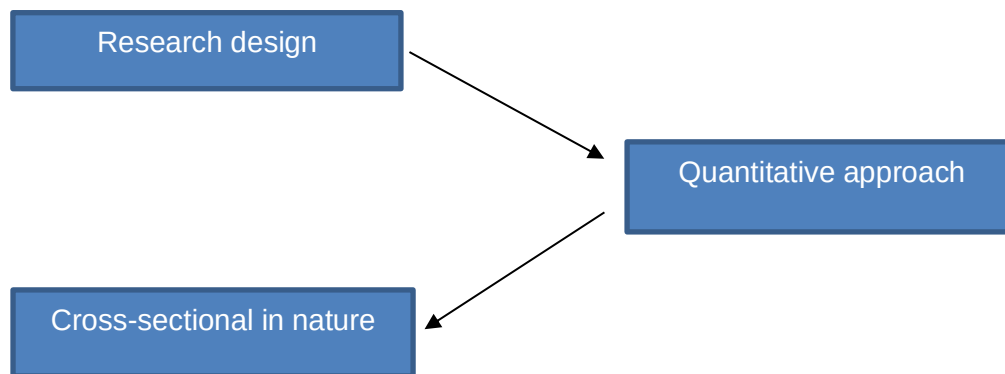


Figure 1-2: Description of overall research design

1.5.1.1 Research approach: Quantitative approach (Maré, 2019a:5-9)

This study and subsequent work would make use of a quantitative research approach, according to the following because quantitative research approaches tend to (Bryman & Bell, 2017:31):

- emphasise quantification in the collection and analysis of data;
- adopt a deductive approach to the relationship between theory and research, in which the emphasis is placed on the testing of theories;
- incorporate the practices and norms of the model of the natural sciences and of positivism in particular; and
- embody a view of social reality as an external, objective reality.'

The authors, as aforementioned and referenced, continue discussing quantitative research by recalling that: 'Quantitative research was described as a distinctive research approach that entails the collection of numerical data, regards the relationship between theory and research as deductive, prefers a natural science approach in general (and positivism in particular), and adopts an objectivist conception of social reality.'

According to the aforementioned, the author hereof intends on collecting several hundred various historical numerical data points from SAFEX and base-prices applicable to Vlakvlei Boerdery's sale of its grain and conducting a comparison thereof, together with

historical ZAR/USD exchange rate data and then processing same into usable data to apply the theory in testing the feasibility of a post-harvest marketing strategy. The author hereof also intends to analyse the July-December, July-March and July-cash month spreads (price difference) to ascertain whether said spread would reward Vlakvlei Boerdery (Pty) Ltd for 'carrying' maize from July to any particular future month. The author hereof would therefore analyse price trends to ascertain whether the spread mentioned above would discount the interest and storage costs associated with carrying grain and to what extent such costs will be discounted and if indeed a profit could be realised. The author hereof also plans on examining basis-prices, and subsequent discounts and premiums to ascertain which period of the year renders the least amount of deductions and/or premium additions to *ex-farm* and/or delivered prices which also falls within the ambit of the quantitative approach.

1.5.1.2 Research design: Cross-sectional in nature.(Maré, 2019a:5-9)

According to Bryman and Bell (2017:105), the cross-sectional design is primarily associated with social surveys but may include other research methods, such as structured observation, content analysis, official statistics and diaries.

Bryman and Bell (2017:107) define cross-sectional research design as a research design that involves the collection of data on more than one facet and at a single point in time, which is then replicated pursuant to different time-points. This can be illustrated at the hand of a SAFEX July future that is traded for a year. Hence before physical delivery occurs. Therefore, using the example of the July future, a market participant can trade the July 2020 future in August 2019 and said the future price would fluctuate daily during the months of August 2019 to July 2020, therefore delivering a unique variable during the *legion* points in time. Bryman and Bell (2017:107) furthermore state that cross-sectional research design is usually harnessed to collect quantitative and/or quantifiable data concerning specific categories of variables and may it also include the collection of qualitative data which is then examined and analysed to detect certain patterns (The July to December spread serves here as an example).

Bryman and Bell (2017:108) noted that cross-sectional research design is premised on the following characteristics:

- **More than one case:** Researchers using a cross-sectional design is interested in a variation, which occurs only when more than one facet is being examined.
- **At a single point in time:** Data on the variables are collected more or less simultaneously.

Quantitative and/or quantifiable data: To establish variation between facets and data points, and to examine associations between variables, it is necessary to have a systemic and standardised method for gauging and comparing variation.

Patterns of association: It can be stated that a cross-sectional research design only enables a researcher to examine relationships between variables, and not causality in as much, pursuant to the fact that the researcher cannot manipulate any of the variables collected at the various data points in time.

These authors, therefore, conclude that, *in lieu* of the aforementioned, this study will make use of a cross-sectional research design pursuant to the fact that the author hereof shall make use of raw variables or facets, collected various points in time, which is quantitative in nature, and hence also quantifiable, and which would produce patterns of association between different facets and variables. These authors also noted the characteristics of longitudinal research design, and further notes the comments of (Bryman & Bell, 2017:109) and agrees that according to the nature of this study and the purpose thereof, that the aforementioned research design would not be best suited herein.

1.5.1.3 Study population / Unit of analysis

One of the essential ideas in a research project is the unit of analysis (William, 2006). Unit of analysis is furthermore defined as the central entity that you are analysing in your study.

The Unit of analysis is furthermore defined as the “who” or the “what” the study is analysing. This could be an individual student, a group or even an entire program (The Pell Institute for the Study of Opportunity in Higher Education, 2019).

It can furthermore be said that: ‘all researchers must deal with questions related to their unit of analysis and the related idea of the unit of observation’. Unit of analysis helps the researcher define what is being studied as well as what aspects are being studied (Harris,

2018). In terms of a dissertation, the unit of analysis provides a guardrail to ascertain what data falls within the confines of the study, and that which is *ultra vires* thereof. More specifically, the unit of analysis describes the level at which you are conducting your study.

Typical units of analysis include, but are not limited to (Harris, 2018):

- Individuals;
- Groups;
- Organisations;
- Social phenomena;
- Policies;
- Values; and
- Principles.

This study focuses on the subsequent unit of analysis and observation on organisational data, policies concerning SAFEX trading and marketing of maize, value of certain futures and spot market prices throughout a period and principles associated with basis-link price differentials and screenings subtraction and waiver thereof.

Unit of observation, on the other hand, refers to the level at which you are collecting data. The importance to differentiate between the unit of analysis and unit of observation is that they provide important boundaries for the study, particularly for data analysis (Harris, 2018). The unit of observation can be defined further as an object on which information is collected (Lavrakas, 2008).

Unit of analysis and unit of observation can furthermore be differentiated according to the undermentioned theory (DeCarlo, 2018:45):

- **Unit of Analysis:** The unit of analysis is the entity that you wish to be able to say something about at the end of your study, and would probably be the main focus of your study. Usually, a study's unit of analysis would be predetermined by the researcher's research question. It is also the most basic element of a scientific research project and forms the subject of a study about which the researcher and/or analyst may generalise and/or theorise (Long, 2004:1157).

- **Unit of Observation:** The unit of observation, on the other hand, is the item and/or items that are actually observed, measured, or collected in the course of attempting to gather information about the unit of analysis. In contrast to the unit of analysis, the unit of observation is primarily determined by the method of data collection used by the researcher, and not by the research question.

In lieu of the aforementioned, the author hereof intends on focusing on numerous units of analysis and - observation in this study, and may subsequent hereto add, remove or vary the units of analysis and observation as he may deem necessary to conduct this research document to achieve the best possible outcome. In the premise, the author hereto therefore intends on focusing on the following units of analysis and observation, respectively:

- **Unit of analysis:** Senwes and/or Unigrain
- **Units of observation:**
 - o Historical basis-link premiums and discounts at mills and other areas since, together with monthly fluctuations thereof, annualised.
- **Unit of analysis:** SAFEX
- **Units of observation:**
 - o Daily March futures prices for the past ten years from opening thereof until contract expiry day.
 - o Daily May futures prices for the past ten years from opening thereof until contract expiry day.
 - o Daily July futures prices for the past ten years from opening thereof until contract expiry day.
 - o Daily September futures prices for the past ten years from opening thereof until contract expiry day.
 - o Daily December futures prices for the past ten years from opening thereof until contract expiry day.

- o Daily Subsequent spot market prices for the past ten years for all non-future months.
- **Unit of analysis:** Pre-harvest marketing strategies.
- **Units of observation:**
 - o Pre-harvest option marketing strategies (Puts, calls, three-way and swops).
 - o Pre-harvest fixed price marketing strategies.
 - o Pre-harvest futures strategy.
 - o Spot price marketing strategy.

1.5.1.4 Number of units of analysis and/or observation included in the study (Maré, 2019a:8)

The preliminary number units of analysis and observations stand respectively as three units of analysis and 11 units of observation.

1.5.1.5 Sampling strategy (Maré, 2019a:12)

- **Theoretical sampling and saturation.** This study uses theoretical sampling and theoretical saturation in testing the study's theory and hypotheses. Theoretical sampling is defined by Bryman and Bell (2017:187) as the process of data collection for generating theory whereby the analyst jointly collects, codes, and analyses his data and decide what data to collect and where to find said data. It is, furthermore, driven by concepts derived from evolving theory and based on comparative analysis.

Purposive sampling: The study also makes use of purposive sampling, which is defined by (Bryman & Bell, 2017:186) as: "Purposive sampling is a non-probability form of sampling. The earmark of purposive sampling is to sample cases and/or participants in a strategic way, as to enable the sample to be relevant to the research question. In terms of quantitative research, quota sampling is a form of purposive sampling."

Quota sampling: In addition to the aforementioned methods of sampling, the study also uses quota sampling. Quota sampling is defined as: “A sampling method of gathering representative data from a group.” (Web Finance Incorporated, 2019). Quota sampling is used frequently by commercial researchers in market research. The aim of quota sampling is, therefore, to produce a sample that reflects a population that is specifically sought by the researcher, hence its connection to purposive sampling methods.

In lieu of the aforementioned theory, this study aims to use a combination of theoretical sampling and quota sampling as a category of purposive sampling.

1.6 DELIMITATIONS AND ASSUMPTIONS OF THE STUDY:

1.6.1 Delimitations

1.6.1.1 Included

The purpose of this study is to develop a marketing strategy to market maize *post-harvest*. This study specifically includes the following variables:

- Annual and historic SAFEX white maize prices.
- Annual and historic R/\$ exchange rate.
- Annual and historic basis-link and base-prices (premium and/or discount at base) of various milling endeavours (for instance, IMEX) (Tiger Milling Randfontein).
- Existing pre-harvest marketing strategies that include, but may not be limited to pre-harvest option marketing strategies that include puts, calls, three-way and swaps and pre-harvest fixed price marketing strategies, pre-harvest futures strategies and spot price marketing strategies.
- The depth of the historical analysis is dependent on the extent of research that is necessary to develop the marketing model.

1.6.1.2 Excluded

The study specifically excludes the following items from this study:

- Any commodity other than white maize grade 1(WM1).

- Any grain handling and storage costs that fall outside the geographical area of Senwes, specifically Viljoenskroon.
- Any basis- and differential subtractions that fall outside the delivery area of Vlakvlei Boerdery (Pty) Ltd.
- Any information, data, prices and costs that are standard to grain trading in Southern Africa, but that does not apply to Vlakvlei Boerdery' and its subsequent needs.

1.6.2 Assumptions

- It is assumed that this study and subsequent findings only pertain to grain producers who possess their grain handling and storage facilities.
- It is furthermore assumed that such a facility consists of a weighbridge, silo and/or silos, and a vertical gravitational sieve and that such a facilities owner adhered to the SAFEX requirements for certification and accreditation of the sieves and weighbridge.
- It is not assumed that such a facility, with specific reference to the silo(s), have been registered as a SAFEX accredited site, and as such listed on the SAFEX-JSE bourse, as such accreditation is cumbersome and expensive and subject to certain pre-requisites and quarterly audits and is generally considered *ultra vires* of normal commercial farming endeavours, such as that of *Vlakvlei Boerdery (Pty) Ltd.*
- It is furthermore assumed that - in general - WM1 prices are highest between November and March, and lowest between April and October based on historical trends. This assumption, however, shall later herein be proved, and/or disproved and/or partially proved and/or partially disproved.

1.7 LAYOUT OF THE STUDY

This study consists of four chapters (see Figure 1.3)

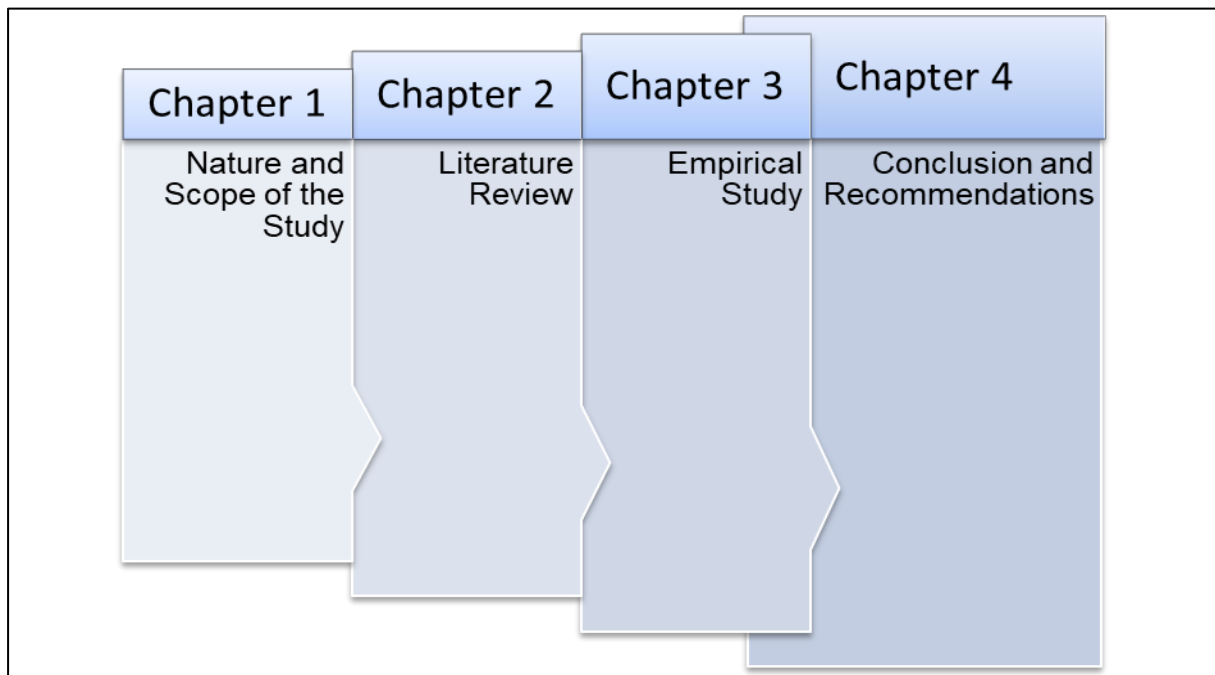


Figure 1-3: Layout of the study

In Chapter 1 the reader is introduced to Vlakovlei Boerdery (Pty) Ltd, the problem statement of the study pertaining to Vlakovlei Boerdery's need for a comprehensive post-harvest marketing model, as well as the research methodology used, the limitations and delimitations of the study and the various units of analysis and subsequent units of observation.

Chapter 2 is the theoretical underpinning of the study. This chapter deals with the literature applicable to this study, ranging from the founding and workings of the JSE, to futures contracts and forward contracts and differentiation between the two forms of contracts, as well as their definitions. The agricultural value chain is also examined, with specific reference to agri-businesses such as Senwes, Unigrain and the like. The reader is also introduced to pre-harvest and post-harvest marketing strategies, and the various factors that influence said marketing strategies, such as exchange rate movements, the location differential, screening deductions and base-price indices.

Chapter 3 entails the study's empirical research and subsequent analysis. It examines spot market- and futures prices from the past decade, as well as base-price comparisons. It draws on an abundance of Safex data, locational differential data from Senwes and base-price indices from Unigrain, SAGIS historical data and compiles these data points into discernible infographics for the sake of trend analysis. This chapter examines data, in some instances, from the past decade. It firstly looks at *loco* prices, whereafter future prices are examined.

Chapter 4 is the final chapter. It draws conclusions and renders recommendations based on empirical analysis. The chapter also identifies possible areas for future study and provides a summary of the study.

1.8 SUMMARY

Vlakovlei Boerdery is in need of a comprehensive and robust post-harvest marketing model, premised upon empirical evidence and analysis that stems from Safex market data, Senwes and Unigrain historical fees and base-prices as well as exchange rate data, to enable the organisation to effectively market its grain in a post-harvest manner, without incurring unnecessary risks associated with pre-harvest marketing models. The second chapter shall introduce the reader to the applicable literature, enabling the reader to discern between the different theoretical concepts that are central to the concepts of either pre-harvest or post-harvest marketing models as well as the positive and negative attributes associated in addition to that.

CHAPTER 2:

LITERATURE REVIEW FOR DEVELOPING A MODEL TO MARKET MAIZE POST-HARVEST

2.1 INTRODUCTION

In the South African context, a derivative market was developed within the JSE which became a fully accredited and established market during 1987. Option contracts followed in 1992, followed by the introduction of agricultural products in 1995 (Roux, 2018:16). After the demise of the maize board in 1997, the percentage of respondents using SAFEX increased from 27% during 1997-1998, to 49% after 2000 (Bown *et al.*, 1999:275), and to 37% in 2014 (Van Der Vyfer, 2014:80).

Generally, the supply and demand of maize are relatively inelastic, thereby compounding the price risk faced by producers and consumers alike. In years of oversupply, producers tend to 'lose' while consumers 'gain' with the opposite true in years of undersupply (Bown *et al.*, 1999:278).

In addition to the derivative instruments tradeable on the South African Futures Exchange (SAFEX) (a subdivision of the JSE), grain producers, buyers and speculators may also partake in the grain futures markets. Geyser (2013:4) defines futures markets as a gathering- and/or auction place where buyers and sellers meet to trade futures contracts with specified delivery dates. Roux (2018:2) purports that futures contracts entail the exchange of contracts between suppliers, consumers, brokers and/or speculators who do not necessarily need or want to obtain delivery of the commodity. In forward contracts, the price and delivery are predetermined and fixed. This 'market platform is in the form of an electronic trading platform (known as SAFEX), where futures prices are determined based on a continuous worldwide flow of information regarding current and future supply and demand expectations (Geyser (2013:5-12).

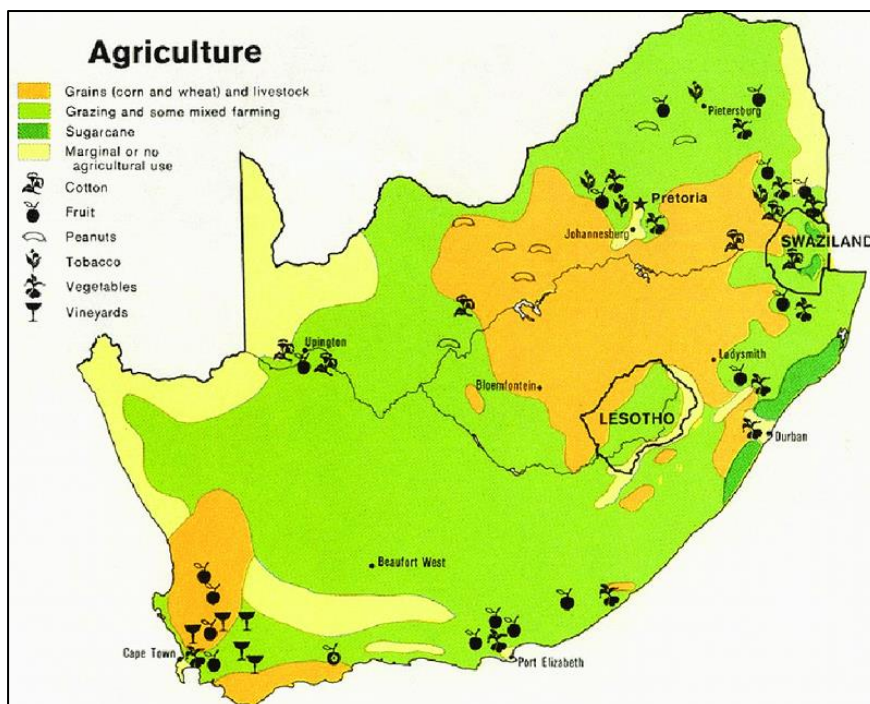
The primary purpose of futures markets is to render buyers and sellers with an effective mechanism to manage price risk relating to the commercial activity (Geyser, 2013:iv). Futures markets serve two primary functions in agricultural marketing. *Firstly* the function of a price discovery role, and *secondly*, a price risk management role (Venter M.M., 2012:2). Market prices, and variance therein, poses a significant risk to local and

international producers because the variance in prices correlates directly with variance in profits. Several authors concur that the deregulation of the market increased the variability of grain commodity prices (Jordaan *et al.*, 2007; Traub & Jayne, 2008; Venter *et al.*, 2012). Some of these authors have even gone as far as warning that although the importance of futures markets is well established, the increased use of these derivatives has promoted comment on the possible negative effects of futures trade, such as excessive speculation (Traub & Jayne, 2008; Venter *et al.*, 2012). The key characteristic which differentiates futures contracts from forward contracts is that with futures contracts, trade may occur without the sellers or buyers having any intention of taking physical delivery or acceptance of the maize.



Figure 2-1: SAFEX, a subdivision of the JSE

The Johannesburg Stock Exchange Emblem, of which the South African Futures Exchange is a subsidiary. Extensive reference is made to SAFEX and the JSE throughout this document.



Source: University of Texas (2020)

Figure 2-2: Agricultural map of South Africa, in respect of production and activity zones

For interest's sake, an agricultural map of South Africa, depicting the various regions of primary agricultural production

As referred to by Roux (2018:15), South Africa is unique about the various agricultural activities undertaken within the country, and multiple cultures used for subsequent commercial production.

2.2 CURRENT STATUS QUO WITHIN THE SOUTH AFRICAN GRAIN HANDLING AND STORAGE MARKET, VALUE ADDITION, AND CONSUMPTION

In South African context - agricultural organisations - such as Senwes, Afgri, Suidwes, Unigrain and the like play an integral role in the South African agricultural value chain, which includes the transport, storage and brokering of grain and oilseeds futures and derivatives. The majority of these organisations own, manage and control plants which process grains and oilseeds to add value to these input products. As such, these organisations unlock economic activity and subsequent financial remuneration. The primary source of income for these organisations is the handling, storage and brokering of grain and oilseed commodities as well as the transport thereof (Roux, 2018:12).

These organisations and/or entities act as storage facilitators, and as clearing and brokerage houses on SAFEX for futures contracts and derivatives. They also facilitate futures and derivatives trading between different brokers (usually grain trading- and co-operative entities), participants who speculate (speculators), and primary producers (farmers).

Traditionally, as had been alluded to by Roux (2018:18), the window for maize cultivation ranges from October the preceding year, to January of the following year, with the window for harvesting ranging from April to September of the same year. *In lieu* of the aforementioned, producers, therefore, chose to mitigate potential price risk by making use of pre-harvest marketing strategies such as futures contracts, derivatives and forward contracts or a combination thereof.

2.2.1 Status quo with the handling and storage of grain

After the deregulation of the market during 1995 and the subsequent abolition of the so-called maize board, most co-operatives privatised. These organisations owned and

operated – in terms of 2011 data – nearly 85% of the total South African storage capacity of 20 million tonnes.

According to The Department of Agriculture (2011:26) a total of 432, known, silo and storage facilities were located nationwide of which 260 were commercial silo's owned by 17 entities, with the balance of 172 silos being *ex-farm* and owned by private organisations for private use. According to Roux (2018:18) agricultural organisations such as Senwes, Afgri and NWK own and operate approximately 73% of commercial grain handling and storage facilities in the South African agricultural market. In recent years, various other role players have also entered the grain handling and storage market with new, innovative and cheaper storage solutions such as silo-bags and grain bunkers.

It is a ventured guess that private grain handling and storage facilities are set to increase as producers pursue economies of scale. It is also true that storage costs for private facilities, expressed as per unit cost, also decreases with an increase in storage capacity, therefore compensating farmers for investing in additional storage capacity.

2.2.2 Human and animal consumption.

Since the abolition of the maize board, and subsequent deregulation of the market – as aforementioned – the total number of milling entities and/or organisations increased substantially from 111 such entities to nearly 300, prompting severe competition and differentiation within the sector (Roux, 2018:18). Subsequently, some entities stagnated, while others flourished. White maize is mainly used for human consumption, while yellow maize is traditionally used for animal feed.

Participants within the animal feed industry consist of approximately 150 processors which produce around 60% of annual animal feed consumption within the country (The Department of Agriculture 2011:28).

2.2.3 Traders, brokers and speculators.

The brokerage provides a large part of SAFEX's liquidity within day-to-day trading. The broker's purpose is to bring the producer and end-consumer together and act as a third-party intermediary facilitating and underwriting the transaction.

Traders, on the contrary, seek to bring the producer and end-consumer together with the express purpose of facilitating delivery between the two contracting parties; usually, the trader and broker work in conjunction with one another.

Speculators, on the contrary, do not seek any physical delivery of produce but rather seek to use and exploit any price movements within the market to their sole benefit. Speculators, although loathed by many, provide necessary liquidity and volatility for futures and spot markets, that are needed to enable producers and consumers to use price movements and mitigate their price risks albeit pre- or post-harvest.

2.3 MARKETING STRATEGIES AND THE MITIGATION OF PRICE RISK FOR MAIZE PRODUCERS IN SOUTH AFRICA

Price risk management and its subsequent mitigation strategies are as diverse as the farmers who make use of them. Each grain producer approaches price risk factors in their unique way, implementing their unique mitigating solutions, which usually entails a marketing strategy in the centre thereof (Dorfman, 2008:796; Maré, 2019b:6-12). In his article, dated 4 April 2007, Coetzee (2007) warns that, since the abolition of the maize board, South African farmers were responsible and accountable to themselves to ensure that they make the correct marketing decisions, and thus need to take time to understand SAFEX.

Marketing strategies can be divided into two categories, being the pre- and post-harvesting strategies (Gabriel & Hundie, 2006:9-10; Venter M.M., 2012:64-86).

2.3.1 Pre-harvest marketing strategies and,

2.3.1.1 Different pre-harvest marketing strategies include:

2.3.1.1.1 Sequential and flexible marketing strategies(Bown *et al.*, 1999:279)

According to (Bown *et al.*, 1999:279), seasonal variations and volatility in commodity prices may be managed, and mitigated by spreading sales out over the length of the season, in terms whereof 'single sale events' are avoided, *inter alia* referred to as a *sequential marketing strategy*. In terms of this sequential strategy, the producer's price would thus be determined by weighting each sale as a proportion of the total sales multiplied by the *ex-farm* price. The principal purport of the sequential marketing strategy

is, therefore, to spread the total tonnage of the specific commodity out over a period or term. Thus, the main focus of this strategy is on the spread of the sales of the commodity over a period without allowing price fluctuations to impact on the sale spread. This marketing strategy, therefore, does not seek to maximise 'high' prices relative to 'low' prices and therefore aims to sell from quartile one to four, without any exceptions.

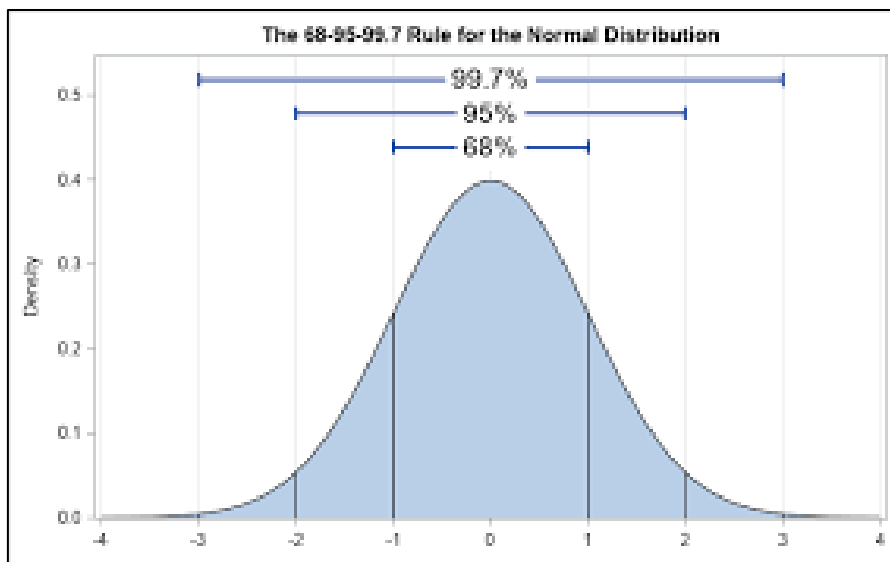


Figure 2-3: Normal Distribution: The 68-95-99.7 rule

Flexible marketing strategies differ from sequential marketing strategies in that it does take price movements into account, and continuously analyses real-time market information and data to determine if sales should be undertaken, and the volume thereof. Here, the producer actively works to sell less of his produce in quartiles one and two, and more in quartiles three and four. It is noteworthy that sequential and flexible marketing strategies are not only applicable to pre-harvest marketing strategies but may also be used post-harvest.

2.3.1.1.2 Derivative trading

The South African Future's exchange grew out of an informal market in 1987 (Olatundun, 2009:4-7). Historically, Rand Merchant Bank, being a local merchant bank, started an informal financial market in April of 1987. Several years later, in October of 1992, options contracts were introduced, followed by agricultural commodity futures in 1995, and a fully automated trading system in 1996.

Derivatives in the agricultural market are usually grouped into two categories, being either *Futures contracts* or *Options*.

1. *Options* are contracts and/or instruments that are derived from futures contracts, and hence the term derivative. Options can be grouped into *put-and-call options*, in terms of which a buyer and/or seller, though either the put or call option, buys the right to either sell at a specific minimum price (put) or buy at a specific maximum price (call). All of these 'rights' are hence priced out of a certain futures month, depending on the date of proposed delivery of the produce.
2. *Futures contracts*, however, are legal agreements in terms of which a specific commodity or group of commodities are either bought or sold at a predetermined price, time and location (Chen, 2020). Futures contracts, therefore, can be defined as being:
 - i. A derivative that obliges the buyer to purchase some underlying asset, and inversely obliges the seller to sell an underlying asset at a pre-determined future price, location and date.
 - ii. A futures contract allows an investor to speculate on the direction of a security, commodity, or a financial instrument through selling or buying in the market.
 - iii. Futures contracts are also often used to hedge the price movement of the underlying commodity to help prevent losses from unfavourable price changes.
 - iv. Futures contracts may be freely bought and sold on/before the date of the option expiration.

In the South African context, futures contracts of WM1 are traded annually in March, May, July, September, and December.

2.3.1.1.3 Forward contracts:

Forward contracts are agreements between the buyer and seller in terms whereof, as with futures contracts, the commodity, price, location and date of delivery/acceptance are predetermined by virtue of the aforesaid agreement. In general, these agreements cannot be rescinded or altered without severe repercussions or costs for either one of the parties to the contract.

According to Van der Merwe (1998:21-23), forward contracts allows prices to be set before planting. However, no formal market for forward contracts exists within South Africa. Three general types of forward contracts have arisen since 1997, being:

1. Fixed price contracts, in terms whereof prices are fixed at levels stipulated in the agreement;
2. Minimum price contracts, in terms whereof a 'floor price' for the commodity, is set, with an upside for the producer of being able to achieve higher prices;
3. Production finance contracts, which is negotiated between the producer and his/her financiers.

Typically, within the South African agricultural market, forward contracts generally entail a producer (farmer), in this instance, marketing his WM1 to a consumer (miller/agricultural co-op) pre-harvest. The producer agrees to supply WM1 to the consumer at a specific date, location and most importantly, at a specific price. These agreements are concluded – often – without the producer knowing whether:

1. His crops would realise a harvest.
2. There would be an under-, or oversupply of the specific commodity in the market.
3. The price contracted for, directly equates to profits or losses.
4. His crop would indeed be graded to be WM1.

In terms of the aforementioned, it is evident that there are substantial risks involved for the producer in marketing by way of forward contracting, being:

5. A price risk in the event of crop failure and subsequent under-supply his WM1 would be worth more. On the other hand, in the event of oversupply, the balance of unpriced tonnes may not be priced at favourable prices;
6. In the event of a crop failure, the producer would still be obligated to deliver the WM1 at the agreed-upon price. In the event of total crop failure, the producer may be forced to 'buy' the agreed-upon tonnages 'out' at premium prices and selling it at the forward contract price which, in these circumstances, be significantly lower than the equilibrium prices in the event of crop failure, in which instance the producer would realise significant losses;
7. If the grain produced by the producer does not meet the minimum requirements for WM1, the producer may lose a substantial margin on the contracted tonnage, as he would be penalised for delivering sub-standard produce.

This figure illustrates the growth of futures contracts relative to options contracts traded on the JSE while illustrating a net decrease in overall futures contract relative to equity, as referred to by (Olatundun, 2009)

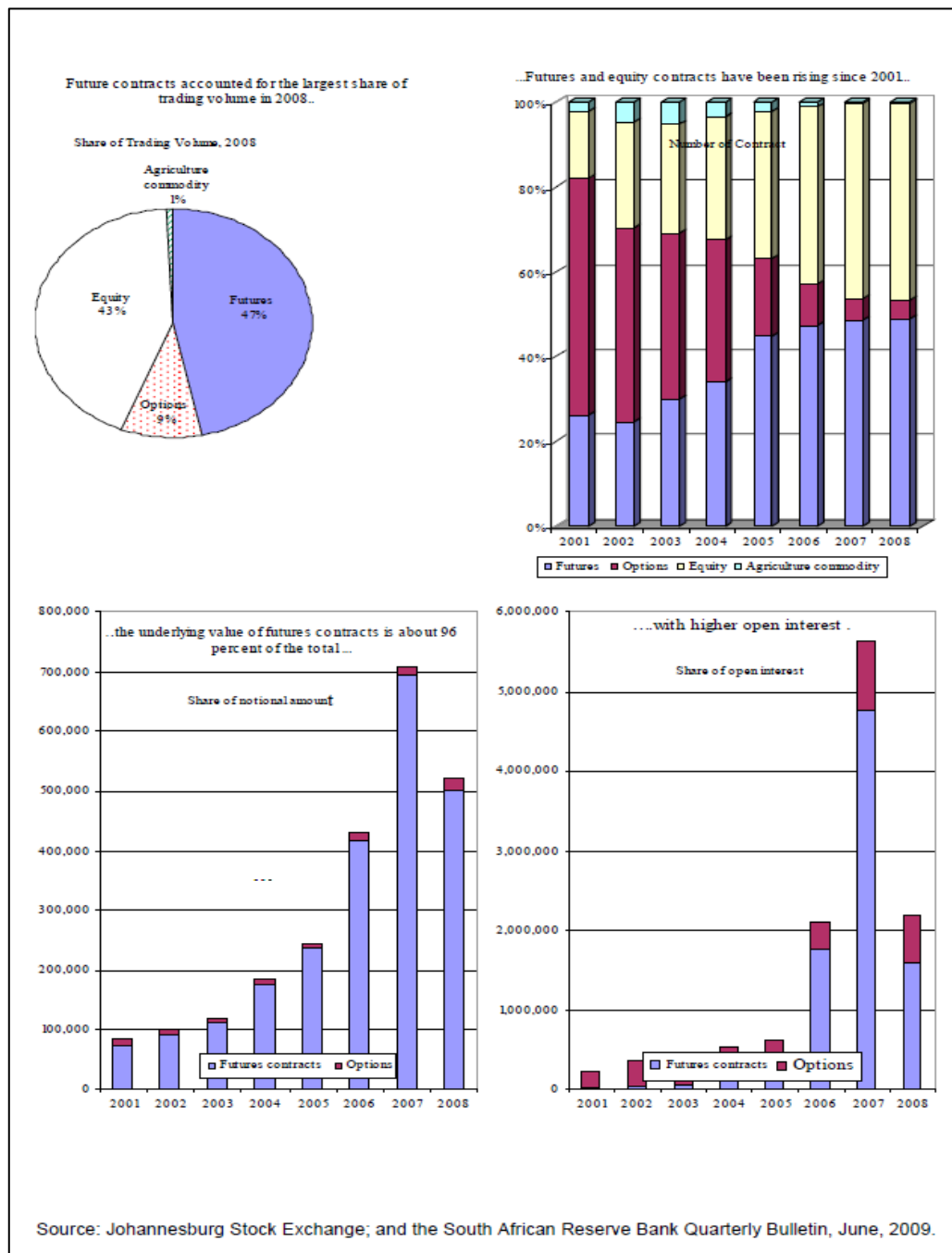


Figure 2-4: South Africa: Exchange-based traded derivatives

2.3.2 Post-harvest marketing strategies.

Post-harvest marketing strategies pertain to strategies the producer seeks to market all of, or a portion of, his produce only after the harvesting cycle. Although the producer may yet choose to make use of derivatives, forward contracts, sequential-, or flexible marketing strategies in marketing his produce post-harvest, the producer can do so fully aware of the exact amount of maize that needs to be sold. He, therefore, does not incur any risk(s) regarding the actualised crop size (as opposed to pre-harvest marketing).

Bown *et al.* (1999:296) averred that access to storage facilities, albeit privately owned (on-farm) or owned by agricultural organisations (such as co-operatives and subsequent entities) would affect the marketing strategies of producers, especially those producers who own and manage their facilities. He furthermore noted that the use of some price mitigation tools and/or measures, such as sequential marketing relies heavily on access to storage facilities, albeit silo's, bunkers, silo-bags or other facilities. Producers are expected to pay a premium fee per ton to make use of storage facilities owned and operated by third parties. Producers who do not own storage facilities, tend to focus more heavily on pre-harvest marketing strategies, rather than post-harvest marketing strategies because of the costs involved to have their produce stored.

2.3.3 Current status quo regarding marketing strategies

The majority of maize marketing strategies have been developed over the years within the ambit of pre-harvest strategies. Forward contracting, by way of futures and/or derivative trading have become effective and relatively widely used as a form of risk management for farmers, the most common being the contract for the sale of a crop (Maré, 2019b:13).

The proponents of pre-harvest derivatives and futures marketing purport that, based on economic theory, producers will always prefer to participate in the derivatives market if it maximises their utility and thus their profit. Accordingly, a producer's profit function is represented as follows (Ueckermann *et al.*, 2008:222-239):

$$\pi_i = f\lambda q_i + r(1 - \lambda)q_i - [\gamma_i + \alpha q_i + \rho\lambda q_i + \delta_i]$$

Equation 2-1: Producer's profit function equation

Where:

- πi represents producer's profit;
- f represents the price received with a derivative or futures contract;
- r is the spot price;
- qi is the output of the grain crop;
- $\lambda(1 - \lambda)(0 \leq \lambda \leq 1)$ is the proportion of the grain sold in the derivatives market, with the balance sold in the spot market;
- γ is the total fixed production cost;
- αqi is the variable cost component;
- δ and pqi are the fixed cost and variable cost components associated with derivative contracts and spot transactions.

As aforementioned, most marketing strategies fall within the ambit of pre-harvest strategies, meaning that the producers market their products before harvesting it, through futures and derivatives trading, forward contracts and to a lesser extent via sequential and flexible marketing strategies. This is mainly done by hedging against price risk factors. Another often overlooked reason is that the grain handling and storage costs, the economic opportunity cost, and/or interest cost associated with 'carrying' the produce post-harvest.

Accordingly, a basic compound interest formula, which is expressed as (Brigham *et al.*, 2016:111; The Calculator site, 2019):

$$FV = PV(1 + i)^n$$

Equation 2-2: Basic compound interest formula / Compound opportunity cost formula

Where:

- FV represents the future value compounded amount;
- PV represents the principal amount;
- i represents the interest rate;
- n represents the number of years, alternatively n/t when the composition is for specific months;

This formula is refined by the author hereof into a post-harvest real spot price equation which makes the necessary provision for the opportunity and/or interest costs and handling and storage costs, expressed per ton, being:

$$FV = PV(1 + i)^n + \beta + (\theta \times \mu) + \rho$$

Equation 2-3: Post-harvest, nominal profit equation

Where:

- FV is the nominal-July or any other future spot price in the appropriate month;
- PV is the average July spot price, or some other variable used (other future or cash month);
- i is the interest rate that the producer pays, alternatively the opportunity cost incurred, expressed as a numerical fraction (10% = 0.1);
- n represents the number of years, alternatively n/t when the composition is for specific months;
- β represents grain handling costs;
- θ represents the daily storage costs and where μ represents the number of days stored; and
- ρ represents 'term-storage' fees, if applicable.

The abovementioned equation provides the producer with a post-harvest nominal profit equation. It determines the additional cost of 'carrying' produce and equates to an equilibrium selling price. A lower price would result in economic losses. The formula is a mathematical instrument that enables comparative analysis of the different marketing structures and different futures prices (Ueckermann *et al.*, 2008:226).

2.4 SEASONAL PRICE TRENDS ON SAFEX FOR FUTURES AND CASH MONTHS AND VOLATILITY THEREOF.

According to Roux (2018:2) futures exchanges (such as SAFEX) do not set prices, but are rather free markets where the forces of supply and demand are transparently brought together. The logic in terms thereof entails that the price of WM1 maize on the SAFEX

exchange and subsequent futures contracts should, in certain harvest seasons, be trading at higher levels and closer to import parity. This usually happens when the volume of the national crop yield exceeds local consumption. In these circumstances, prices usually decrease to export parity. The inverse is also true.

Individual farmers could use the futures exchange platform as a price determinant and risk management platform (Roux, 2018; Auret & Schmitt, 2008). The aforementioned, circumstances, however, did not hold true during the 2007 season when the national crop was significantly lower than the previous year and below local consumption. More recently, in the pre-season of 2018/2019, the price of WM1 in the December 2018 cash month decreased between 16 December 2018 to January 2019. This still happened although the first summer rains started to fall during the middle of January 2019. Similarly, in the season of 2007, prices continued to decline irrespective of a significantly smaller national crop estimate. It has become evident that supply and demand are not only determinants of seasonal prices, but also the individual and cumulative actions of speculative persons and/or entities on the SAFEX-JSE bourse.

The 'free-market' notion, therefore, specifically regarding the SAFEX bourse, is not necessarily 'free' to timeously and duly reflect the balance between supply and demand within the South African maize market. According to the JSE, various other challenges exist. Some of these challenges are biased competition, one-sidedness and not creating a 'link' between inputs and outputs which results in over- or undertrading in a market that is being overbought and/or oversold (Roux, 2018).

The South African SAFEX futures market does not necessarily provide a true reflection of supply and demand *in lieu* of the fact that speculative positions may disrupt the balance of supply and demand. Only in the absence of speculative positions, would a true reflection of supply and demand emerge, which is not disrupted by said speculative positions on the bourse, thus reflecting the primal market circumstance.

Several technical analysts in the SAFEX-derivatives and futures field, namely Kobus Retief and Wilbie Venter of Unigrain, aver that the annual South African harvest is traded on SAFEX more than 20 times. However, none can concisely determine an exact value according to a lack of critical and complete end-user data. However, it is assumed that an annual harvest of ten million tonnes of white and yellow maize, and one multiplies the

harvest by a variable of 20, it means that the calculation includes 200 mil. tonnes. In terms thereof, an assumption of a variable of 20 entails that the actual annual maize harvest is traded 2000% above actual production, and the same subsequent value above approximate annual consumption. Hence it can therefore be postulated that 190 mil. tonnes are in speculative trading positions on SAFEX. None of these tonnes of maize is bought or sold with the intention of either taking delivery or delivering produce against such market positions. Although the assumption above is evidently overly simplified, it is used to emphasise the effect of potential speculative volatility on the market.

The SAFEX futures market does have a crucial role in fulfilling in terms of price discovery (Roux, 2018; Venter et al., 2012). These authors concluded that the fundamental advantage thereof lies with the relatively high liquidity in the market and the market's ability to find a willing buyer and/or seller. In contrast, cash and/or spot market months may fail in the effective and speedy allocation of buyers to sellers and vice versa.

Roux (2018) also noted that a positive correlation and/or association between spot and futures prices. During years when the national harvest is more than consumption, futures prices determine spot market prices, whereas, during deficit years, the spot market prices determine the futures prices. In terms of the aforementioned, it can thus be stated that in years of relative abundance, the spot market price months tend to be derived from futures prices. This entails that cash month prices would be determined by the applicable futures prices less carrying costs whereas, during deficit years, futures prices would be determined by adding carry costs to the specific spot market prices (McCullough & Strydom, 2013).

Seasonal price trends in the grain is a well-known phenomenon within the grain industry. Generally, grain prices tend to be lower during the harvest months, and conversely higher during the summer planting months and are usually expressed in a spread format which is premised upon the July-December futures price difference (spread) (Geyser, 2013:161).

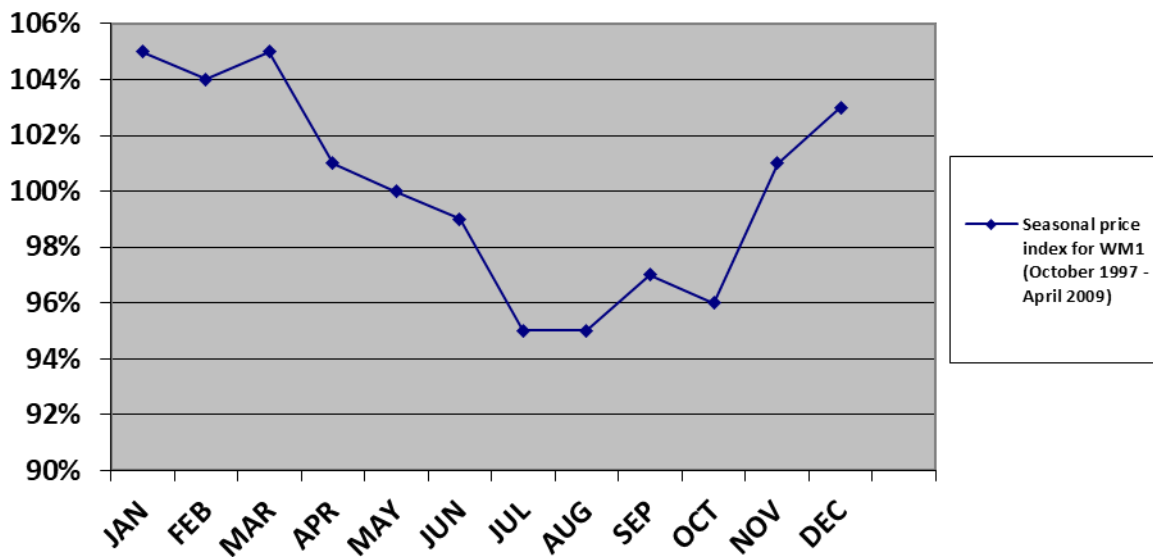


Figure 2-5: Seasonal price trend (index) for WM1

Figure 2-5 shows that the index value of January, February, March, November and December is substantially higher than May, June, July, August September and October (Geyser, 2013:162). The reason is that the general white maize price trend tends to be lower during the harvest months - when supply is at its highest - and conversely tend to be higher during the summer planting months - when supply tends to be lower. As is evident from the figure, January, February and March's index value is on average five percentage points higher than the basis of one hundred and subsequently on average ten percentage points higher than July, August and September's index values. This entails an average price difference (spread) of ten percentage points between pre-harvest and post-harvest prices if no pre-harvest marketing strategies had been used, and the produce had been sold during the spot price months, alternatively post-harvest by virtue of futures contracts. The figure also shows that the producer who wishes to 'carry' its stock from July to the December - March period, would on average, see a net price increase of ten percentage points in the July and December spread. He would thus be 'rewarded' by the market for carrying its produce post-harvest. However, the costs associated with carrying grain will decrease the final net benefit, as a net-off of benefits and subsequent costs need to be conducted.

2.5 BASIS-PRICE AND THE EFFECT THEREOF ON A POST-HARVEST MARKETING MODEL.

Basis and the base-price concept accrued thereto can be defined as the difference between the spot market price of a commodity and the related futures contract price. The

aforementioned basis-price difference is premised on the difference of locality and the time-difference between the subsequent periods and make most locations trade at negative basis-prices compared to futures contracts, save in periods of national and/or regional harvest deficits (Geyser, 2013:59).

According to paragraph 2.3 *supra*, Roux (2018) therefore determined that basis-link provides a transparent platform for buyers and sellers of grain to be able to trade produce without speculative disturbance.

According to Roux (2018), the basis-link platform uses the same basic characteristics as a futures contract platform to represent supply and demand with the exception that speculative positions are excluded from said platform. Those mentioned above essentially entails that a buyer or seller can only partake in the platform if said persons and/or entity have the intention of buying and/or selling physical grain without the option of taking a speculative position.

The purpose of the basis-link platform is explained below:

- The purpose of the basis-link platform is to create a market that is ‘truly’ representative of the actual supply and demand in the market, by only offering the platform to persons and/or entities who are in the market to buy or sell produce.
- Futures and spot market prices remain in use to fulfil a price discovery function. Yet, each consumption entity (albeit millers, feedlots or another secondary processing facility) and every production entity with the necessary grain handling and storage facility may freely list their enterprise and/or organisation on the basis-link platform in terms of which a base is allocated to each enterprise and/or organisation. In terms thereof, each of the organisations and/or enterprises in question may then list supply and/or demand of a specific commodity subject to certain pre-conditions. The aforementioned therefore entails that Vlakvlei Boerdery (Pty) Ltd may list its facilities as a ‘base’ on the platform, and may in terms thereof, list and advertise any tonnages that it is willing to sell subject to any premiums and/or discounts that the organisation wishes to attain and/or willing to incur, or may be said that the organisation simply advertises the produce on the platform and allow consumers to bid thereon. Similarly, a miller or any other consumer of the product may list a specific demand on the said platform subject to a specific

discount or premium. For instance, many millers would advertise slots of a particular number of tonnes, and subject to a certain base-price, which may be subject to SAFEX price less discount (when national stock is high), alternatively a premium (when national stock is low). In terms of the aforementioned Roux (2018) found that processing organisations such as millers tend to have a negative basis-prices during the harvest period and higher or positive basis-prices during the summer months, which essentially entail that producers who carry their grain post-harvest may stand to gain by receiving premium prices during the summer months when the supply of the market becomes segmented.

The basis-price platform offers 'real' producers and sellers the opportunity to find and transact with one another, using a price and premiums and/or discounts that are disconnected from speculative trading practices and which provides a holistic approach to the determination of segmented supply and demand.

Furthermore, the SAFEX futures- and spot prices provide price discovery in absolute and/or cumulative terms. Hence SAFEX futures and spot prices do not provide accurate pricing in terms of South Africa's segmented regions. The aforementioned entails that a white maize producer who operates within the Viljoenskroon and Bothaville region and its surrounding areas would find it difficult to obtain a premium on its produce during the harvest period. However, a white maize producer in the Bainsvlei area would more easily attain a premium considering the SAFEX differential deduction and subsequent distance from Randfontein. A buyer who is located within the Bainsvlei area, however, would be more willing to pay a premium for white maize in that specific area according to the relatively small scale of white maize production within that area as compared to the Viljoenskroon and Bothaville areas.

2.6 EXPLAINING THE EFFECT OF THE R/\$ EXCHANGE RATE ON SOUTH AFRICAN MAIZE FUTURES AND CASH MONTH PRICES

2.6.1 R/\$ exchange rate

Like most other commodities, the rand/dollar exchange rate plays a significant role in day-to-day parity price movements, which may have a substantial effect on daily futures- and spot market prices and subsequent fluctuations.

To understand the possible effect of any exchange rate movements, one needs to understand that in South Africa, the metric system of measuring is used, while the United States uses the imperial measurement system. In this calculation, yields in bushels are converted into tons (using official U.S. federal web sources) (U.S. Grains Council, 2019)

One metric tonne of maize is equal to 39.368 bushels. Hence, a parity calculation would entail the following, being:

$$(\alpha \times \beta) \times 39.368 = \theta,$$

where:

- α is the U.S. dollar price variance per bushel.
- β is the value of the rand (R/\$ exchange rate)
- θ is the expected parity price movement of one tonne of grain in South Africa according to U.S. price movements per bushel.

It is therefore evident that the R/\$ exchange rate may have a significant leverage effect on South African futures- and spot market prices. The researcher, in collaboration with Marius Van Wyk, created an interactive figure which tracks these movements after a rolling average indicator. (Van Wyk, 2019) in terms of which green dots represent buy notifications in terms of which the ZAR had appreciated against the USD below the rolling average indicator, which indicates that ZAR should return to the rolling average indicator and thus depreciate and vice versa for the red dots.

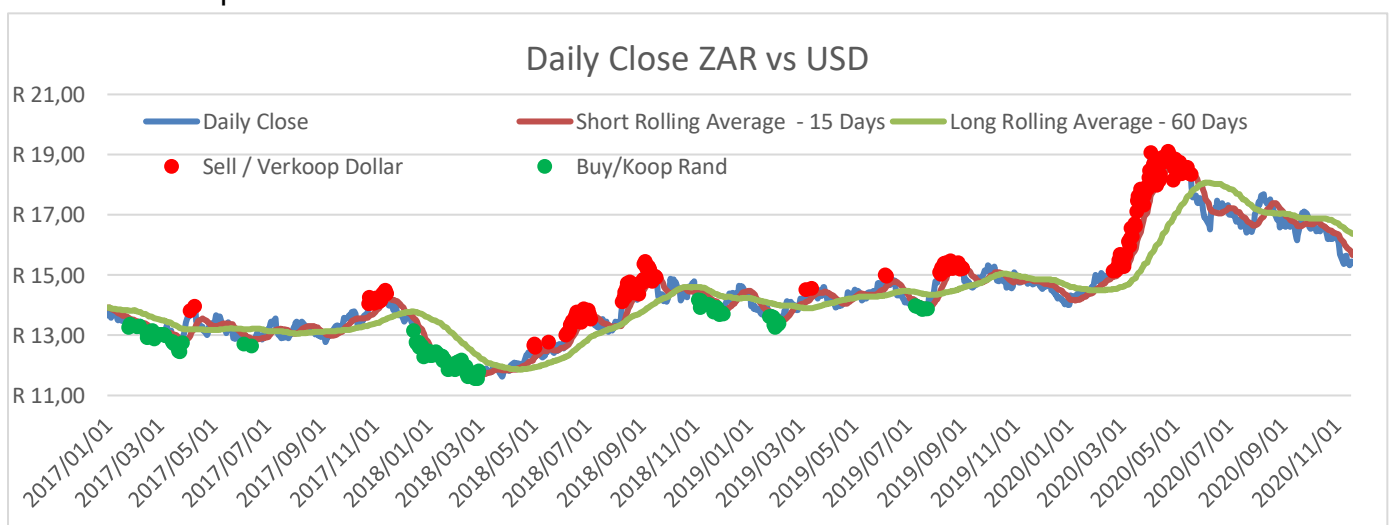


Figure 2-6: Historical R/\$ exchange rate

2.6.2 Relative security index

In addition to the exchange rate measure that can be used, the producer may also make use of a relative strength index (RSI). According to Geyser (2013) the purpose of the RSI is to serve as a comparison between the days in which a security (in this example grain as a commodity) closed at a higher or lower level on the bourse. It calculated as follows:

$$RSI = 100 - 100/(1 + RS)$$

Where: $RS = \text{Average of } n - \text{days higher close prices} / \text{Average of } n - \text{days lower close prices}$

Equation 2-4: Relative Security Index (RSI) equation

Geyser (2013:162) further purports that the RSI would, oscillate between the values of 0 and 100. Once the RSI moves to the uppermost levels (closer to 100), the security is deemed to be overbought. Conversely, if the RSI moves closer to the lowermost levels (closer to 0), the security is deemed to be oversold.

It is noteworthy that the RSI and the R/\$ exchange rate movements can be used in conjunction to one another to determine whether these two 'forces' are working in a related manner to drive prices in either one direction, or whether they are working inversely to one another, as this may compound and/or dampen price movements in certain commodities.

2.7 EXPLAINING THE REASONING BEHIND THE SAFEX LOCATION DIFFERENTIAL AND SCREENING DEDUCTIONS.

Futures contracts need to be standardised to enable prospective buyers and sellers the opportunity to engage in commercial activity with one another (Geyser, 2013:8). These areas of standardisation are:

- Quality (WM1, WM2 and/or WM3).
- Quantity (bulk quantification such as tonnes or an alternative pre-agreed form).
- Delivery date (July future's last trading date, for example).

- Locality (the location of delivery and subsequent acceptance).

Usually, in practice, the quality, quantity and delivery date is set to certain standards and norms and are easily ascertained. Yet, the determination of the latter point, being locality, is usually problematic as a result of the various localities of both suppliers and consumers.

In practice, the locality is standardised in terms of two methods, being a single reference point system, alternatively a 'traded at par' system in terms of which it is considered that all products traded on the platform of the specific future are standardised.(Geyser, 2013:8) In the South African context, however, the JSE-SAFEX bourse opted for the single reference point system, being Randfontein Gauteng. The logic, therefore, arises from Randfontein being more or less centrally located within the maize production region and it being relatively dense in terms of milling activities and presides over a complex and integrated rail and road network infrastructure. The effect of the aforementioned in general commerce is that all futures contracts need to be delivered and accepted at Randfontein, Gauteng in terms of which producers know that their produce needs to be delivered to Randfontein and that buyers know that they need to collect their produce from Randfontein (Geyser, 2013:8).

2.7.1 Location differential

The purpose of the SAFEX differential is therefore to hedge producers and suppliers against volatility in transport costs, by instituting a differential which is calculated based on the distance from the specific base of delivery and/or acceptance to the Randfontein base. The aforementioned entails that, in theory, a supplier in Viljoenskroon must receive a futures price of SAFEX less the specific Viljoenskroon differential, whereby the specific ton of maize is then considered FOB en route to Randfontein. If the buyer of the grain, however, is not located in Randfontein, but rather Pretoria, then said the buyer would be liable for transport costs from Randfontein to Pretoria, for which the seller cannot be held liable.

The topic of differentials, however, is generally a contentious and controversial one and shall the author hereof not delve into the said invidious topic of whether said differentials are inherently fair or not. It should, however, be noted that the reader hereof should distinguish between the SAFEX location differential and basis-link and base-prices. The latter system is completely removed from the SAFEX location differential calculation and

is based upon supply and demand and is not institutionally fixed, but rather determined by individual actors therein. However, the SAFEX location differential is taken into account when bidding and/or advertising on said basis-platform.

Geyser (2013:124) furthermore argued that the current single point reference system, being Randfontein, also provides producers with a minimum price (floor price). If the cash month price were to be discounted below futures prices (spot price in August, as opposed to a September future price) the producer would always have the option of discovering what the price(s) in coming months maybe. Auxiliary to the aforementioned, a single reference point system also makes trading of South African agricultural commodities much easier, as producers and consumers know exactly what the incurred transport costs should be, as opposed to a 'traded at par' system with different transport and basis differentials.

2.7.2 Screening deductions

The South African Maize Board controlled South African grain industry before deregulation. The board derived certain quality criteria in terms of which grain - specifically maize - had to adhere to and subsequently created three different 'tiers'. They were grade one white maize (WM1) grade two white maize (WM2) and grade three white maize (WM3) with subsequent criteria for each and an allowance of one percentage point of foreign material for every tier. Irrespective thereof, millers cannot process foreign material into maize meal, and screens said foreign material out of the batch. Resultantly, losing one percent of the mass of the delivered produce. The aforementioned entails that producers relinquish one percent of their total annual harvest to foreign material screenings deductions which equate to losing one percentage point of the 'farm-gate' price. Producers like Vlakvlei Boerdery (Pty) Ltd who possess their own grain handling and storage facilities, however, may have their vertical gravitational sieves certified in terms of which said producers can apply for and insist on a waiver of said screening deductions based on the fact that the said foreign material is removed from the produce ex-farm.

Producers may therefore incur significant savings by owning and operating their vertical gravitational sieves, and more so when the data of figure 2-2 *supra* is taken into account.

2.8 CONCLUSION

This chapter concludes with the view that producers who own their own grain handling and storage facilities are in a privileged and beneficial position to 'carry' their produce post-harvest. This is because they do not need to pay premiums for the use of storage facilities at third parties.

These producers have the benefit of not having to transport their produce to one of the large agricultural co-operatives who have come to dominate the grain handling and storage industry, whereby grain handling-, storage- and transport costs are saved, whereby these producers can carry their grain post-harvest, enabling them to benefit from the positive average index of price movements and enabling them to save the one percentage point screening deduction, and whereby they keep their screenings, allowing them to convert same into feed for livestock. Carrying grain from the winter harvest months to the summer production months also enable them to benefit from positive base-price increases and may they even attain premiums under certain circumstances.

Carrying grain post-harvest also enables these producers to defer from using pre-harvest marketing strategies, whereby significant margin costs, commission fees and VAT thereon is saved, not to mention the risk associated with open futures positions and the so-called 'margin calls' that most producers dread to receive from their brokers.

What is also of utmost importance is the general price trend that can be observed from the positive average index of price movements in Figure 2-5, is that index prices of white maize specifically follow a cyclical and seasonal trend - *ceteris paribus*. This entails that a producer can market his produce either using a pre-harvest strategy whereby estimated produce is marketed prospectively from November to March, alternatively by marketing retrospectively from November to March after the harvest period. The difference being that with pre-harvest marketing, the producer incurs significant risks in marketing unrealised grain, wherewith post-harvest marketing the number of goods to be sold had indeed been quantified and can the producer merely sell its produce at favourable price levels, and tend the costs of 'carrying' the produce post-harvest to be equal to and/or less than the cost that would have been paid to an agricultural co-operative for the use of its grain handling and storage facilities.

Hence, in terms of the aforementioned, the literature study conducted herein indicate the viability and feasibility of a post-harvest marketing strategy, which shall henceforth in the following two chapters be explored and developed.

The next chapter deals with the research methodology and empirical results of the study.

CHAPTER 3:

EMPIRICAL ANALYSIS

3.1 SAFEX SPOT (*LOCO*) DATA ANALYSIS

Spot market months, also known as cash and/or *loco* months, are months in which grain may be traded on SAFEX, and which months were not forerun by any other dates, save for the dates within the specific month. For example, future months usually open several months in advance of the final trading and/or last trade date, whereas cash months may only be traded from the first trading day to the last trading day of the specific month, with the first trading day, in these instances, usually being the first workday of the month.

In SAFEX's terms, the following months are considered spot market months, being: January, February, April, June, August, October and November. It should, however, be noted that all futures market months, being: March, May, July, September and December become spot market months in the months of their final trading date.

In lieu of the aforementioned, our spot market analysis would, therefore consist of all twelve months of a specific year.

The purpose of the spot market analysis is, therefore, to ascertain which spot market months *usually* produce the highest prices within a year, to determine the frequency thereof and to infer any long-term trends from this data. The effect of the exchange rate on spot market prices will also be examined, and correlations, if any, would be discerned from the data. Reference will also be made to SAGIS data. More specifically, the crop size of every year will be examined.

Spot market selling usually occurs when the producer did not make use of pre-harvest hedging and/or marketing as had been alluded to in Chapter 2 *supra*, or when the producer has 'carried' stock from previous seasons that he/she wishes to sell.

The methodology used herein is one in which the daily close prices are examined, whereafter an average price for the year is determined and whereafter the third quartile for the year is determined. The seasonal 'price-band' may be divided into three quartiles. For purposes hereof, it is assumed that the producer wishes to sell his/her produce within

the third quartile of the seasonal 'price-band' meaning that only the top 25% highest prices are considered as possible 'selling-levels'.

For purposes hereof, spot market data from 2007 to 2020 shall be examined, and should it be noted that all prices referred to herein, shall only be applicable to white maize grade 1 (WM1).

All prices indicated are per ton prices.

3.1.1 Historic 2007 Spot Prices and subsequent graphs and data

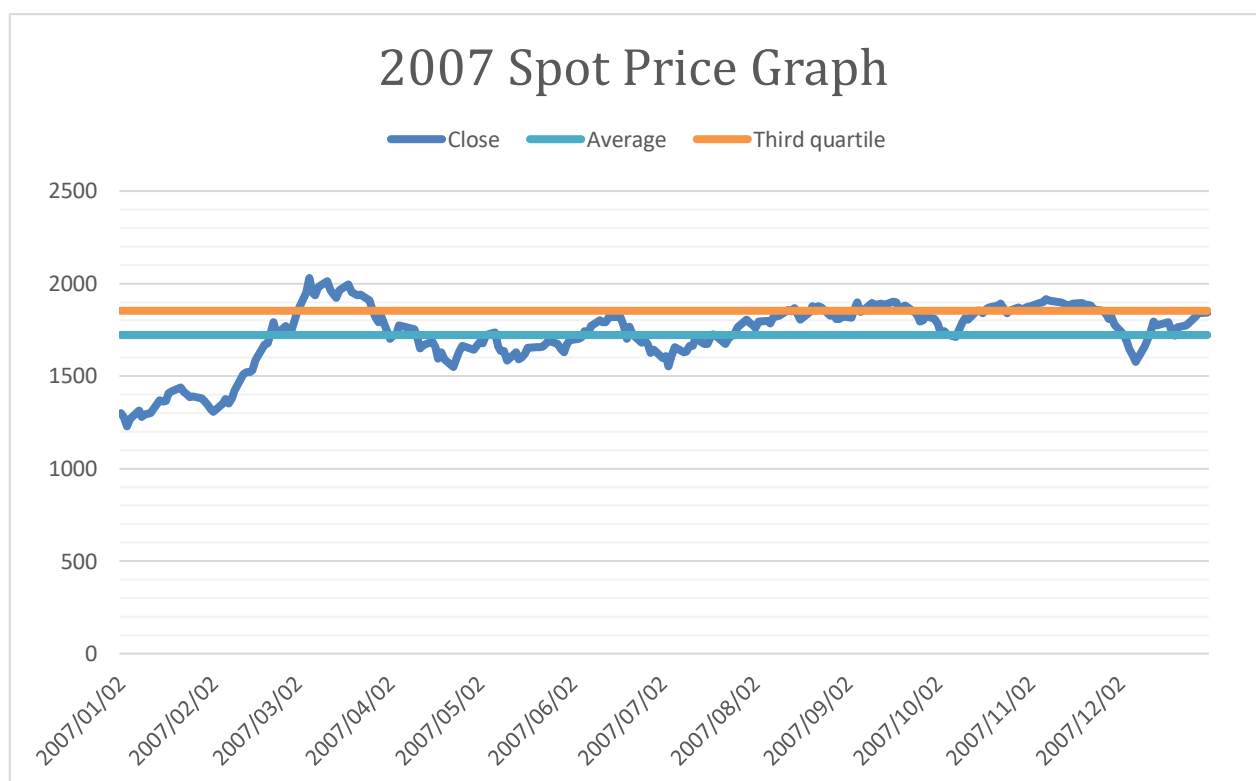


Figure 3-1: Historic 2007 Spot Market price graph

In terms of the aforementioned figure, the average price had been calculated as R1722.00 with the third quartile level being R1853.00. Therefore, in terms of the aforementioned, the third quartile level, or the highest 25% of the seasonal price-band is above the R1853.00 level. In terms thereof, it is evident that the seasonal prices for the year ending December 2007, increased above the third quartile level, during March to April, whilst trading near said level during July, August to September, and November.

The highest average monthly price for the previous year, was for March, as can be ascertained from the graph, at a level of R1920.00.

YEAR	MONTH	WHITE	\$/R	WHITE/YEAR	Max Check
2007	January	1345,68	7,19	1722,46	0
2007	February	1550,20	7,17	1722,46	0
2007	March	1920,48	7,35	1722,46	1
2007	April	1663,22	7,12	1722,46	0
2007	May	1653,50	7,01	1722,46	0
2007	June	1736,43	7,17	1722,46	0
2007	July	1681,55	6,97	1722,46	0
2007	August	1828,45	7,23	1722,46	0
2007	September	1862,26	7,13	1722,46	0
2007	October	1819,83	6,77	1722,46	0
2007	November	1874,23	6,70	1722,46	0
2007	December	1733,67	6,83	1722,46	0

Table 3-1: 2007 Spot Market data table

3.1.1.1 SAGIS/BFAP data

In terms of the Bureau for Food and Agricultural Policy (2014), the total white maize harvest for the year ending 2007 was estimated to be approximately 4,5 million tonnes.

3.1.1.2 Statistical analysis: Exchange rate and price movement correlation

2007	Spearman's rho	WHITE	Correlation Coefficient	1,000	-0,025
			Sig. (2-tailed)		0,940
			N	12	12
		EXCHANGE	Correlation Coefficient	-0,025	1,000
			Sig. (2-tailed)	0,940	
			N	12	12

Figure 3-2: Correlation between 2007 White maize price movement and the R/\$ exchange rate.

In terms of the aforementioned figure, it can be ascertained that for the year ended 2007, no correlation existed between the exchange rate and subsequent price movements, as is highlighted by the Spearman's rho correlation coefficient of -0.025. For purposes hereof, it should be stated that any coefficient values close to zero, indicates no

correlation, whilst positive values denote positive correlations, and negative values denote negative correlations ($-1 < 0 < 1$).

It should, however, be noted that – in terms of paragraph 2.6 *supra*, parity price movements are calculated as a function of the R/\$ exchange rate, and the daily CBOT price movements. Our analysis of the R/\$ exchange rate on local price movements does not take CBOT price movements into account, and should it therefore only be used auxiliary to the other data and not as a leading indicator of sorts.

3.1.2 Historic 2008 Spot Prices and subsequent graphs and data

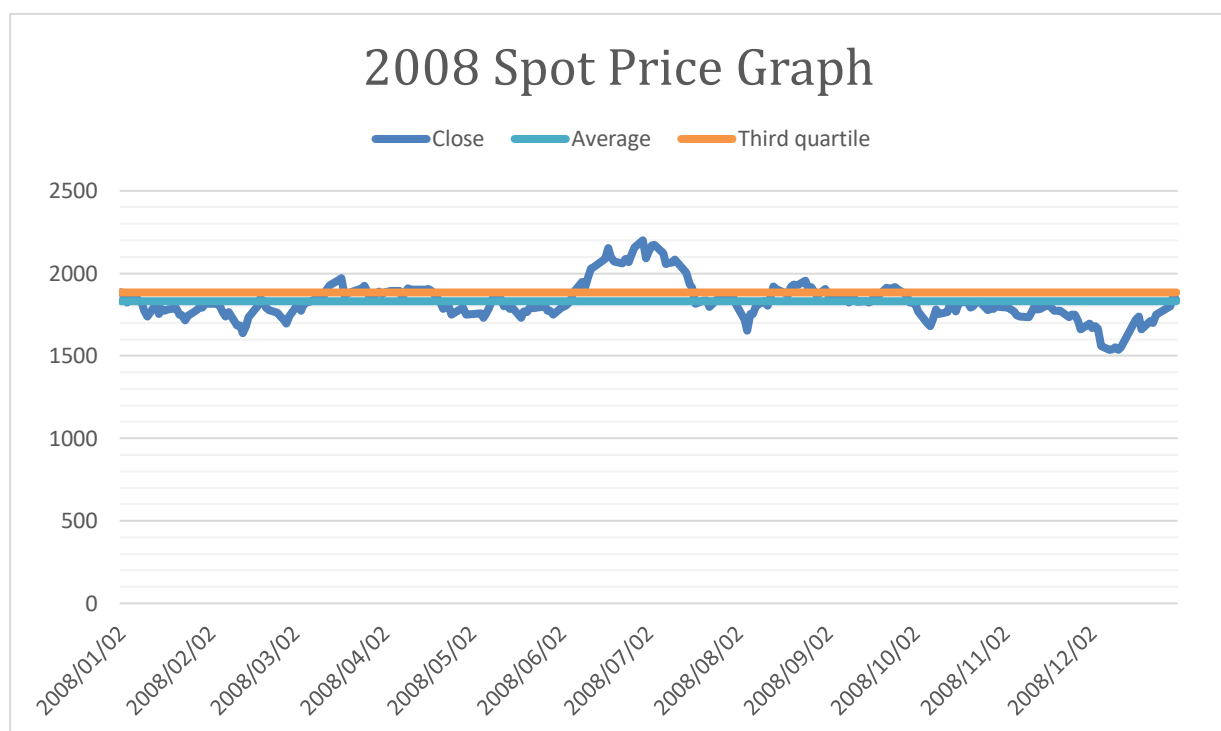


Figure 3-3: Historic 2008 Spot Market price graph

In terms of the aforementioned figure, the average price had been calculated as R1831.00 with the third quartile level being R1884.00. Therefore, in terms of the aforementioned, the third quartile level, or the highest 25% of the seasonal price-band is above the R1884.00 level. In terms thereof, it is evident that the seasonal prices for the year ending December 2008, increased above the third quartile level, during June to August, whilst trading below said level during November to December.

The highest average monthly price for the aforementioned year, was for June, as can be ascertained from the graph, at a level of R2005.75. It should be noted that it is peculiar to

find that the price for white maize was the highest during the harvest months, which is a function of the lower than average harvest for the 2007 period.

YEAR	MONTH	WHITE	\$/R	WHITE/YEAR	Max Check
2008	January	1792,82	7,00	1830,25	0
2008	February	1754,14	7,64	1830,25	0
2008	March	1873,05	7,99	1830,25	0
2008	April	1856,62	7,80	1830,25	0
2008	May	1783,85	7,63	1830,25	0
2008	June	2005,75	7,93	1830,25	1
2008	July	1964,87	7,63	1830,25	0
2008	August	1851,81	7,67	1830,25	0
2008	September	1863,14	8,05	1830,25	0
2008	October	1784,43	9,73	1830,25	0
2008	November	1761,35	10,12	1830,25	0
2008	December	1671,20	9,98	1830,25	0

Table 3-2: 2008 Spot Market data table

3.1.2.1 SAGIS/BFAP data

In terms of the Bureau for Food and Agricultural Policy (2014), the total white maize harvest for the year ending 2008 was estimated to be in excess of 7 million tonnes. This is approximately 2.5 million tonnes more than the 2007 harvest. The supply of maize is usually the highest during the harvest months (July to August), and usually coincides with lower than average producer and/or ex-farm prices as can be seen in Figure 3-1: Historic 2007 Spot Market price graph, due to excess supply. Therefore, having the highest annual average price per month in June of 2008 is an anomaly and is influenced by the fact that the 'pipeline' supply of maize in terms of carry-over stock from 2007 to 2008 was lower than average.

3.1.2.2 Statistical analysis: Exchange rate and price movement correlation

2008	Spearman's rho	WHITE	Correlation Coefficient	1,000	-0,214
			Sig. (2-tailed)		0,505
			N	12	12
		EXCHANGE	Correlation Coefficient	-0,214	1,000
			Sig. (2-tailed)	0,505	
			N	12	12

Figure 3-4: Correlation between 2008 White maize price movement and the R/\$ exchange rate.

In terms of the aforementioned figure, it can be ascertained that for the year ended 2008, a stronger negative correlation existed between the exchange rate and subsequent price movements, than in the previous year of 2007 as is highlighted by the Spearman's rho correlation coefficient of -0.214. For purposes hereof, it should be stated that any coefficient values close to zero, indicates no correlation, whilst positive values denote positive correlations, and negative values denote negative correlations ($-1 < 0 < 1$).

3.1.3 Historic 2009 Spot Prices and subsequent graphs and data

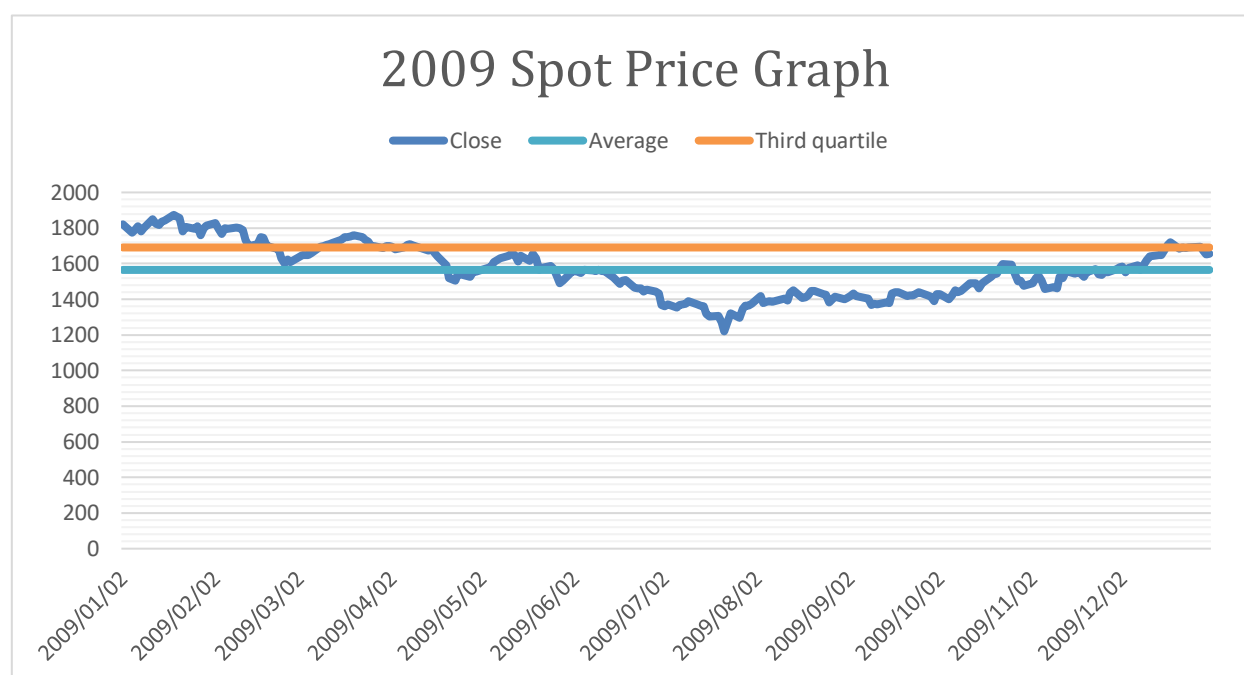


Figure 3-5: Historic 2009 Spot Market price graph

In terms of the aforementioned figure, the average price had been calculated as R1565.00 with the third quartile level being R1691.00. Therefore, in terms of the previous, the third quartile level, or the highest 25% of the seasonal price-band is above the R1691.00 level. In terms thereof, it is evident that the seasonal prices for the year ending December 2009, increased above the third quartile level, during the months of January to March, and for a brief period during April, whilst trading below said level during the months of June to December.

The highest average monthly price for the aforementioned year, was for January, as can be ascertained from the graph, at a level of R1814,00. The trend for 2009 is one that is to be expected considering the above-average white maize harvest for the previous year of 2008.

YEAR	MONTH	WHITE	\$/R	WHITE/YEAR	Max Check
2009	January	1814,33	9,93	1567,43	1
2009	February	1727,80	10,03	1567,43	0
2009	March	1704,55	9,97	1567,43	0
2009	April	1630,22	9,02	1567,43	0
2009	May	1597,70	8,38	1567,43	0
2009	June	1512,43	8,06	1567,43	0
2009	July	1339,48	7,96	1567,43	0
2009	August	1411,65	7,94	1567,43	0
2009	September	1410,14	7,53	1567,43	0
2009	October	1492,82	7,47	1567,43	0
2009	November	1527,86	7,52	1567,43	0
2009	December	1640,24	7,49	1567,43	0

Table 3-3: 2009 Spot Market data table

3.1.3.1 SAGIS/BFAP data

In terms of the Bureau for Food and Agricultural Policy (2014), the total white maize harvest for the year ending 2009 was estimated to be approximately 7 million tonnes. This is approximately 0.5 million tonnes less than the 2008 harvest, which suggests ample 'pipeline' carry-over stock.

3.1.3.2 Statistical analysis: Exchange rate and price movement correlation

2009	Spearman's rho	WHITE	Correlation Coefficient	1,000	.608*
			Sig. (2-tailed)		0,036
			N	12	12
		EXCHANGE	Correlation Coefficient	.608*	1,000
			Sig. (2-tailed)	0,036	
			N	12	12

Figure 3-6: Correlation between 2009 White maize price movement and the R/\$ exchange rate.

For the year ended 2009, a positive and statistically significant correlation existed between white maize price movement and the subsequent R/\$ exchange rate. This is the first positive and first statistically relevant correlation for this analysis. Statistical significance entails the existence of a positive and/or negative correlation coefficient that cannot be classified as a coincidence. Thus the positive correlation coefficient ascertained herein did not happen by chance. This is, therefore, the first year in which a positive statistically significant correlation coefficient existed between maize price movements and the exchange rate as aforementioned. For purposes hereof, it should be stated that any coefficient values close to zero, indicates no correlation, whilst positive values denote positive correlations, and negative values denote negative correlations ($-1 < 0 < 1$).

3.1.4 Historic 2010 Spot Prices and subsequent graphs and data

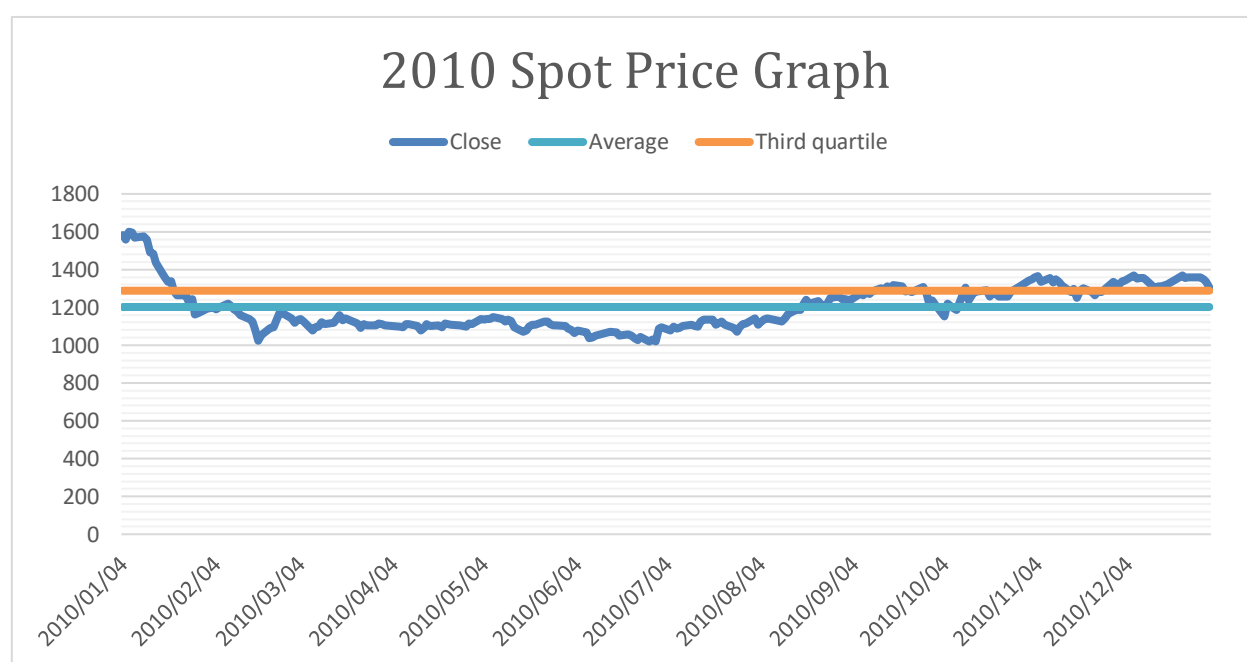


Figure 3-7: Historic 2010 Spot Market price graph

In terms of the aforementioned figure, the average price had been calculated as R1202.00 with the third quartile level being R1288.00. Therefore, in terms of the aforementioned, the third quartile level, or the highest 25% of the seasonal price-band is above the R1288.00 level. In terms thereof, it is evident that the seasonal prices for the year ending December 2010, increased above the third quartile level, during the months of January to February, and between November and December, whilst trading below said level during the months of March to September. It should be noted that this seasonal trend resembles that of the 2009 seasonal trend, with the highest price also attained in January.

The highest average monthly price for the previous year, was for January, as can be ascertained from the graph, at a level of R1404.00. The trend for 2010 is one that is to be expected considering the average white maize harvest for the previous year of 2009.

YEAR	MONTH	WHITE	\$/R	WHITE/YEAR	Max Check
2010	January	1404,90	7,46	1201,75	1
2010	February	1150,50	7,66	1201,75	0
2010	March	1117,86	7,43	1201,75	0
2010	April	1103,26	7,35	1201,75	0
2010	May	1117,14	7,65	1201,75	0
2010	June	1052,48	7,65	1201,75	0
2010	July	1103,50	7,55	1201,75	0
2010	August	1184,76	7,30	1201,75	0
2010	September	1276,71	7,14	1201,75	0
2010	October	1254,90	6,92	1201,75	0
2010	November	1314,18	6,97	1201,75	0
2010	December	1340,76	6,83	1201,75	0

Table 3-4: 2010 Spot Market data table

3.1.4.1 SAGIS/BFAP data

In terms of the Bureau for Food and Agricultural Policy (2014), the total white maize harvest for the year ending 2010 was estimated to be approximately 8 million tonnes. This is approximately 1 million tonnes more than the 2009 harvest, which suggests ample 'pipeline' carry-over stock.

3.1.4.2 Statistical analysis: Exchange rate and price movement correlation

2010	Spearman's rho	WHITE	Correlation Coefficient	1,000	-.592*
			Sig. (2-tailed)		0,043
			N	12	12
		EXCHANGE	Correlation Coefficient	-.592*	1,000
			Sig. (2-tailed)	0,043	
			N	12	12

Figure 3-8: Correlation between 2010 White maize price movement and the R/\$ exchange rate.

For the year ended 2010, a negative and statistically significant correlation existed between white maize price movement and the subsequent R/\$ exchange rate. This is the first negative and second statistically relevant correlation for this analysis. Statistical significance entails the existence of a positive and/or negative correlation coefficient that cannot be classified as a coincidence. Thus, the positive correlation coefficient ascertained herein did not happen by chance. This is, therefore, the first year in which a negative statistically significant correlation coefficient existed between maize price movements and the exchange rate as aforementioned. For purposes hereof, it should be stated that any coefficient values close to zero, indicates no correlation, whilst positive values denote positive correlations, and negative values denote negative correlations ($-1 < 0 < 1$).

3.1.5 Historic 2011 Spot Prices and subsequent graphs and data

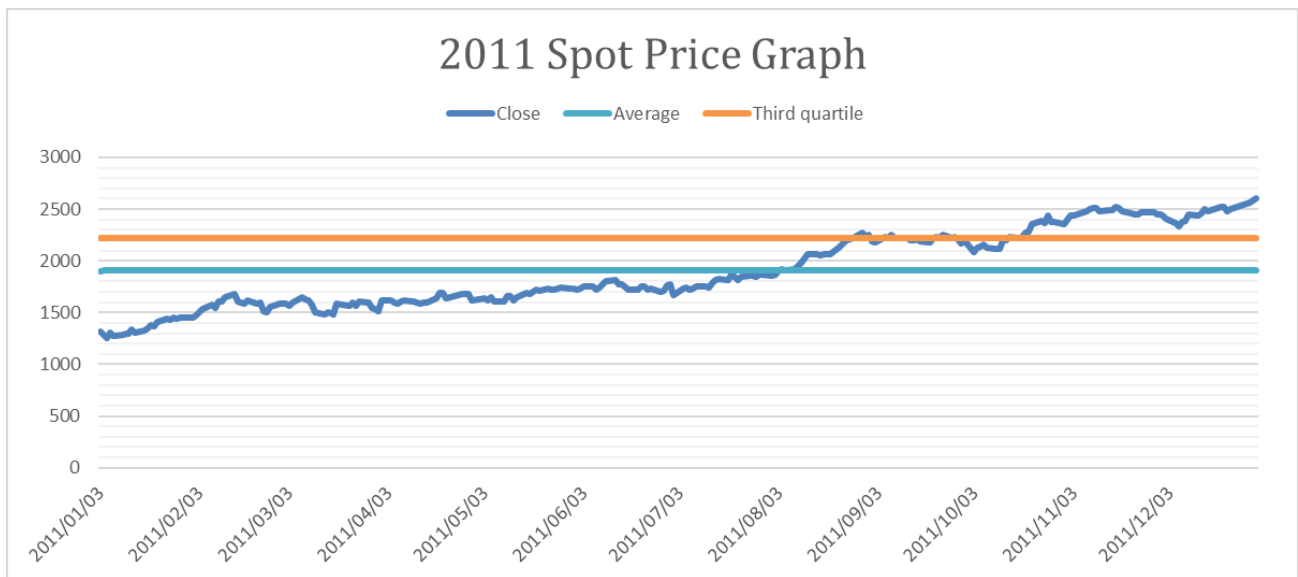


Figure 3-9: Historic 2011 Spot Market price graph

In terms of the aforementioned figure, the average price had been calculated as R1904.00 with the third quartile level being R2221.00. Therefore, in terms of the aforementioned, the third quartile level, or the highest 25% of the seasonal price-band is above the R2221.00 level. In terms thereof, it is evident that the seasonal prices for the year ending December 2011, increased above the third quartile level, during the months of November to December, whilst trading below said level during the months of January to September.

The highest average monthly price for the aforementioned year, was for November, as can be ascertained from the graph, at a level of R2470.00.

YEAR	MONTH	WHITE	\$/R	WHITE/YEAR	Max Check
2011	January	1354,43	6,92	1900,06	0
2011	February	1567,00	7,20	1900,06	0
2011	March	1563,59	6,92	1900,06	0
2011	April	1625,06	6,74	1900,06	0
2011	May	1682,25	6,86	1900,06	0
2011	June	1748,14	6,80	1900,06	0
2011	July	1797,57	6,80	1900,06	0
2011	August	2066,77	7,07	1900,06	0
2011	September	2210,95	7,54	1900,06	0
2011	October	2245,10	7,96	1900,06	0
2011	November	2470,73	8,16	1900,06	1
2011	December	2469,11	8,18	1900,06	0

Table 3-5: 2011 Spot Market data table

3.1.5.1 SAGIS/BFAP data

In terms of the Bureau for Food and Agricultural Policy (2014), the total white maize harvest for the year ending 2011 was estimated to be approximately 6 million tonnes. This is approximately 2 million tonnes less than the 2010 harvest. This would still have equated to sufficient carry-over stock.

3.1.5.2 Statistical analysis: Exchange rate and price movement correlation

2011	Spearman's rho	WHITE	Correlation Coefficient	1,000	.639*
			Sig. (2-tailed)		0,025
			N	12	12
		EXCHANGE	Correlation Coefficient	.639*	1,000
			Sig. (2-tailed)	0,025	
			N	12	12

Figure 3-10: Correlation between 2011 White maize price movement and the R/\$ exchange rate.

For the year ended 2011, a positive and statistically significant correlation existed between white maize price movement and the subsequent R/\$ exchange rate, with a correlation coefficient value of 0.639. This is the second positive and second statistically significant positive correlation. Statistical significance entails the existence of a positive and/or negative correlation coefficient that cannot be classified as a coincidence. Thus

the positive correlation coefficient ascertained herein did not happen by chance. This is, therefore, the second year in which a negative statistically significant correlation coefficient existed between maize price movements and the exchange rate as aforementioned. For purposes hereof, it should be stated that any coefficient values close to zero, indicates no correlation, whilst positive values denote positive correlations, and negative values denote negative correlations ($-1 < 0 < 1$).

3.1.6 Historic 2012 Spot Prices and subsequent graphs and data

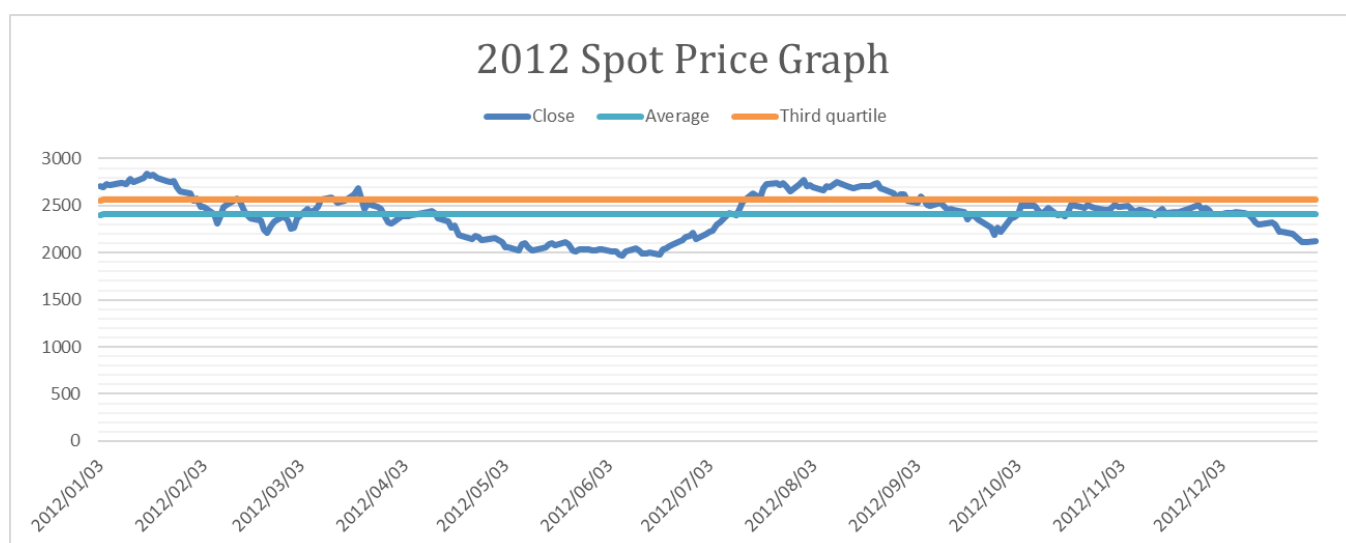


Figure 3-11: Historic 2012 Spot Market price graph

In terms of the aforementioned figure, the average price had been calculated as R2410.00 with the third quartile level being R2559.00. Therefore, in terms of those mentioned above, the third quartile level, or the highest 25% of the seasonal price-band is above the R2559.00 level. In terms thereof, it is evident that the seasonal prices for the year ending December 2012, increased above the third quartile level, during the months of January to February and August to September, whilst trading below said level during the months of March to July.

The highest average monthly price for the aforementioned year, was for January, as can be ascertained from the graph, at a level of R2738.00.

YEAR	MONTH	WHITE	\$/R	WHITE/YEAR	Max Check
2012	January	2738,71	8,02	2406,32	1
2012	February	2399,33	7,66	2406,32	0
2012	March	2480,52	7,61	2406,32	0
2012	April	2292,67	7,83	2406,32	0
2012	May	2059,27	8,17	2406,32	0
2012	June	2055,24	8,39	2406,32	0
2012	July	2537,73	8,25	2406,32	0
2012	August	2679,32	8,28	2406,32	0
2012	September	2419,47	8,27	2406,32	0
2012	October	2452,04	8,65	2406,32	0
2012	November	2453,27	8,80	2406,32	0
2012	December	2308,28	8,64	2406,32	0

Table 3-6: 2012 Spot Market data table

3.1.6.1 SAGIS/BFAP data

In terms of the Bureau for Food and Agricultural Policy (2014), the total white maize harvest for the year ending 2012 was estimated to be approximately 7 million tonnes. This is approximately 1 million tonnes more than the 2011 harvest, in terms of which ample carry-over stock was available.

3.1.6.2 Statistical analysis: Exchange rate and price movement correlation

2012	Spearman's rho	WHITE	Correlation Coefficient	1,000	-0,063
			Sig. (2-tailed)		0,846
			N	12	12
		EXCHANGE	Correlation Coefficient	-0,063	1,000
			Sig. (2-tailed)	0,846	
			N	12	12

Figure 3-12: Correlation between 2012 White maize price movement and the R/\$ exchange rate.

For the year ended 2012, a neutral correlation existed between white maize price movement and the subsequent R/\$ exchange rate, with a correlation coefficient value of -0.063. This is the third neutral to slightly negative correlation for this analysis. Therefore, though the value is slightly negative, it could be construed as a neutral value, subsequent to the explanation below. For purposes hereof, it should be stated that any coefficient values close to zero, indicates no correlation, whilst positive values denote positive correlations, and negative values denote negative correlations ($-1 < 0 < 1$).

3.1.7 Historic 2013 Spot Prices and subsequent graphs and data

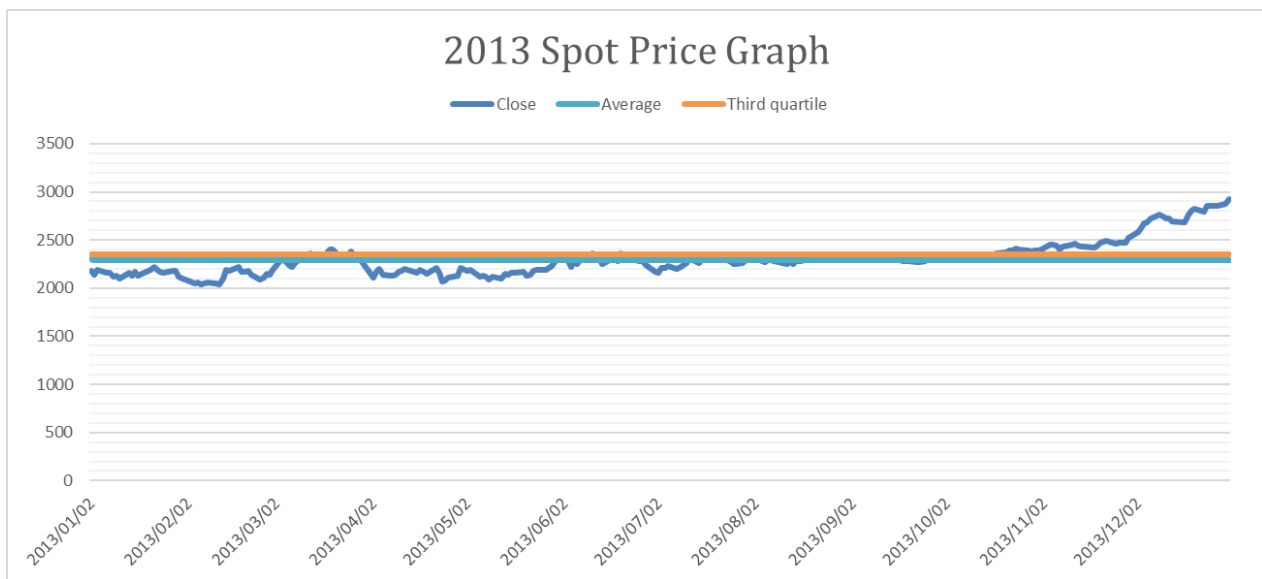


Figure 3-13: Historic 2013 Spot Market price graph

In terms of the aforementioned figure, the average price had been calculated as R2299.00 with the third quartile level being R2351.00. Therefore, in terms of the aforementioned, the third quartile level, or the highest 25% of the seasonal price-band is above the R2351.00 level. In terms thereof, it is evident that the seasonal prices for the year ending December 2013, increased above the third quartile level, during the months of November to December, whilst trading below said level during the months of January to December.

The highest average monthly price for the year mentioned above, was for December, as can be ascertained from the graph, at a level of R2753.00.

YEAR	MONTH	WHITE	\$/R	WHITE/YEAR	Max Check
2013	January	2156,05	8,79	2303,17	0
2013	February	2112,40	8,89	2303,17	0
2013	March	2318,37	9,18	2303,17	0
2013	April	2154,90	9,10	2303,17	0
2013	May	2169,41	9,38	2303,17	0
2013	June	2293,32	10,03	2303,17	0
2013	July	2263,22	9,92	2303,17	0
2013	August	2297,00	10,09	2303,17	0
2013	September	2307,40	9,99	2303,17	0
2013	October	2360,30	9,91	2303,17	0
2013	November	2452,24	10,20	2303,17	0
2013	December	2753,47	10,38	2303,17	1

Table 3-7: 2013 Spot Market data table

3.1.7.1 SAGIS/BFAP data

In terms of the Bureau for Food and Agricultural Policy (2014), the total white maize harvest for the year ending 2012 was estimated to be approximately 7 million tonnes. Ample carry-over stock was available.

3.1.7.2 Statistical analysis: Exchange rate and price movement correlation

2013	Spearman's rho	WHITE	Correlation Coefficient	1,000	.755**
			Sig. (2-tailed)		0,005
			N	12	12
		EXCHANGE	Correlation Coefficient	.755**	1,000
			Sig. (2-tailed)	0,005	
			N	12	12

Figure 3-14: Correlation between 2013 White maize price movement and the R/\$ exchange rate.

For the year ended 2013, a positive and statistically significant correlation existed between white maize price movement and the subsequent R/\$ exchange rate, with a correlation coefficient value of 0.755. This is the third positive correlation and third statistically positive correlation for this analysis. Statistical significance entails the existence of a positive and/or negative correlation coefficient that cannot be classified as a coincidence. Thus the positive correlation coefficient ascertained herein did not happen by chance. This is, therefore, the second year in which a negative statistically significant correlation coefficient existed between maize price movements and the exchange rate as aforementioned. For purposes hereof, it should be stated that any coefficient values close

to zero, indicates no correlation, whilst positive values denote positive correlations, and negative values denote negative correlations ($-1 < 0 < 1$).

3.1.8 Historic 2014 Spot Prices and subsequent graphs and data

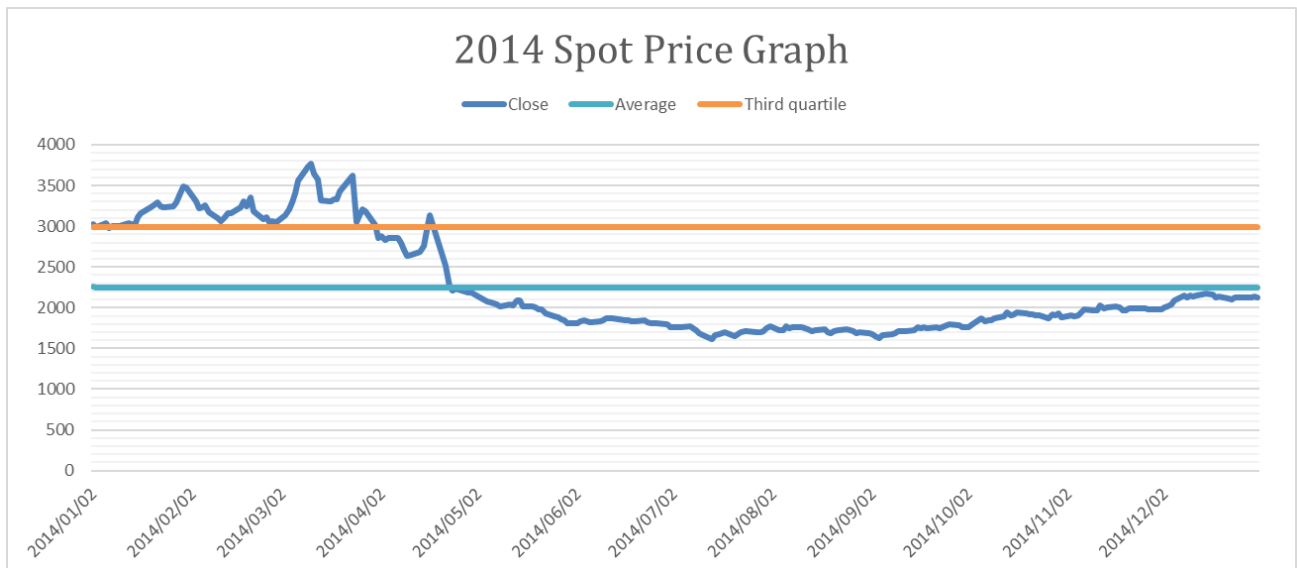


Figure 3-15: Historic 2014 Spot Market price graph

In terms of the aforementioned figure, the average price had been calculated as R2263.00 with the third quartile level being R2985.00. Therefore, in terms of the aforementioned, the third quartile level, or the highest 25% of the seasonal price-band is above the R2985.00 level. In terms thereof, it is evident that the seasonal prices for the year ending December 2014, increased above the third quartile level, during the months of February to April, whilst trading below said level during the months of May to December.

The highest average monthly price for the year mentioned above, was for March, as can be ascertained from the graph, at a level of R3361.00.

YEAR	MONTH	WHITE	\$/R	WHITE/YEAR	Max Check
2014	January	3159,91	10,89	2273,41	0
2014	February	3172,50	10,97	2273,41	0
2014	March	3361,45	10,75	2273,41	1
2014	April	2640,95	10,55	2273,41	0
2014	May	1989,45	10,41	2273,41	0
2014	June	1834,40	10,68	2273,41	0
2014	July	1707,57	10,67	2273,41	0
2014	August	1728,24	10,67	2273,41	0
2014	September	1723,19	10,96	2273,41	0
2014	October	1881,74	11,08	2273,41	0
2014	November	1973,30	11,11	2273,41	0
2014	December	2108,20	11,47	2273,41	0

Table 3-8: 2014 Spot Market data table

3.1.8.1 SAGIS/BFAP data

In terms of the Bureau for Food and Agricultural Policy (2014), the total white maize harvest for the year ending 2014 was estimated to be approximately 7.5 million tonnes. Ample carry-over stock was available. Considering the relatively large crop for the year ended December 2014, depressed producer prices during the months of May to December were to be expected.

3.1.8.2 Statistical analysis: Exchange rate and price movement correlation

2014	Spearman's rho	WHITE	Correlation Coefficient	1,000	0,147
			Sig. (2-tailed)		0,648
			N	12	12
		EXCHANGE	Correlation Coefficient	0,147	1,000
			Sig. (2-tailed)	0,648	
			N	12	12

Figure 3-16: Correlation between 2014 White maize price movement and the R/\$ exchange rate.

For the year ended 2014, a neutral to slightly positive correlation existed between white maize price movement and the subsequent R/\$ exchange rate, with a correlation coefficient value of 0.147. There was, therefore, no material correlation between maize price movements and the exchange rate as aforementioned. For purposes hereof, it should be stated that any coefficient values close to zero, indicates no correlation, whilst positive values denote positive correlations, and negative values denote negative correlations ($-1 < 0 < 1$).

3.1.9 Historic 2015 Spot Prices and subsequent graphs and data

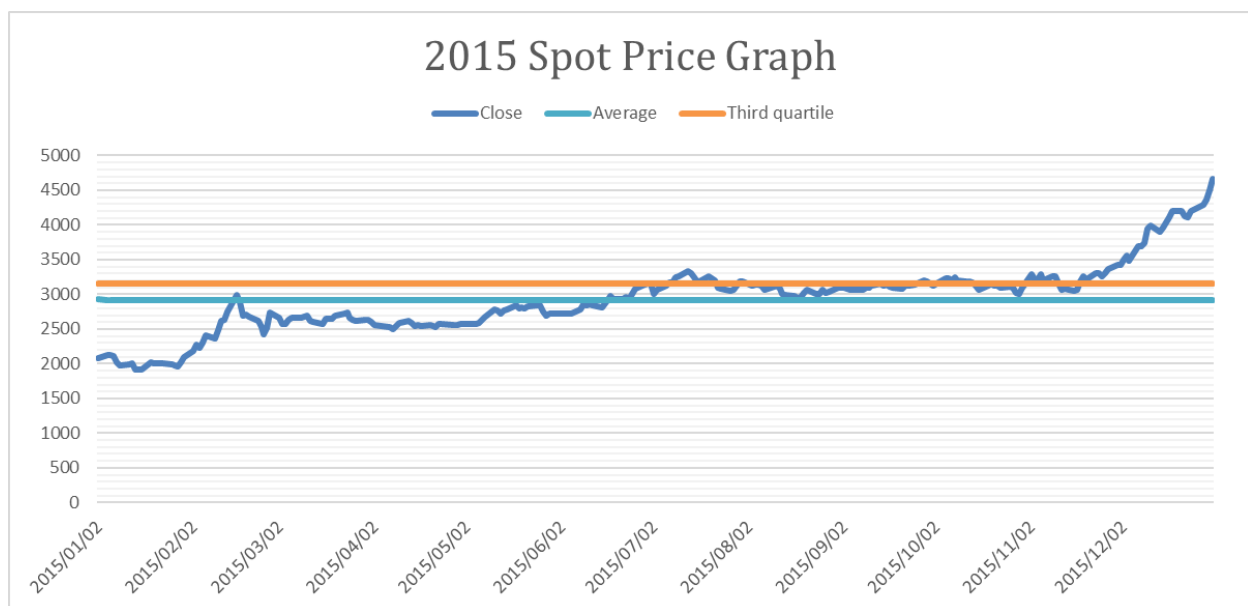


Figure 3-17: Historic 2015 Spot Market price graph

In terms of the aforementioned figure, the average price had been calculated as R2930.00 with the third quartile level being R3159.00. Therefore, in terms of the aforementioned, the third quartile level, or the highest 25% of the seasonal price-band is above the R3159.00 level. In terms thereof, it is evident that the seasonal prices for the year ending December 2015, increased above the third quartile level, during the months of November to December, whilst trading below said level during the months of January to July.

The highest average monthly price for the aforementioned year, was for December, as can be ascertained from the graph, at a level of R3984.00.

YEAR	MONTH	WHITE	\$/R	WHITE/YEAR	Max Check
2015	January	2012,38	11,58	2923,93	0
2015	February	2553,00	11,58	2923,93	0
2015	March	2647,68	12,07	2923,93	0
2015	April	2559,47	12,01	2923,93	0
2015	May	2740,65	11,97	2923,93	0
2015	June	2886,43	12,30	2923,93	0
2015	July	3170,61	12,45	2923,93	0
2015	August	3049,85	12,92	2923,93	0
2015	September	3116,48	13,61	2923,93	0
2015	October	3139,41	13,49	2923,93	0
2015	November	3226,52	14,13	2923,93	0
2015	December	3984,71	14,96	2923,93	1

Table 3-9: 2015 Spot Market data table

3.1.9.1 SAGIS/BFAP data

In terms of the Bureau for Food and Agricultural Policy. (2018), the total white maize harvest for the year ending 2015 was estimated to be approximately 5 million tonnes. The carry-over stock was limited, hence the great price increase to the end of the year.

3.1.9.2 Statistical analysis: Exchange rate and price movement correlation

2015	Spearman's rho	WHITE	Correlation Coefficient	1,000	.928**
			Sig. (2-tailed)		0,000
			N	12	12
		EXCHANGE	Correlation Coefficient	.928**	1,000
			Sig. (2-tailed)	0,000	
			N	12	12

Figure 3-18: Correlation between 2015 White maize price movement and the R/\$ exchange rate.

For the year ended 2015, a positive and statistically significant correlation existed between white maize price movement and the subsequent R/\$ exchange rate, with a correlation coefficient value of 0.928. This is the fourth positive correlation and fourth statistically significant positive correlation in this analysis. Statistical significance entails the existence of a positive and/or negative correlation coefficient that cannot be classified as a coincidence. Thus, the positive correlation coefficient ascertained herein did not happen by chance. This is, therefore, the third year in which a positive statistically significant correlation coefficient existed between maize price movements and the exchange rate as aforementioned. For purposes hereof, it should be stated that any

coefficient values close to zero, indicates no correlation, whilst positive values denote positive correlations, and negative values denote negative correlations ($-1 < 0 < 1$).

3.1.10 Historic 2016 Spot Prices and subsequent graphs and data

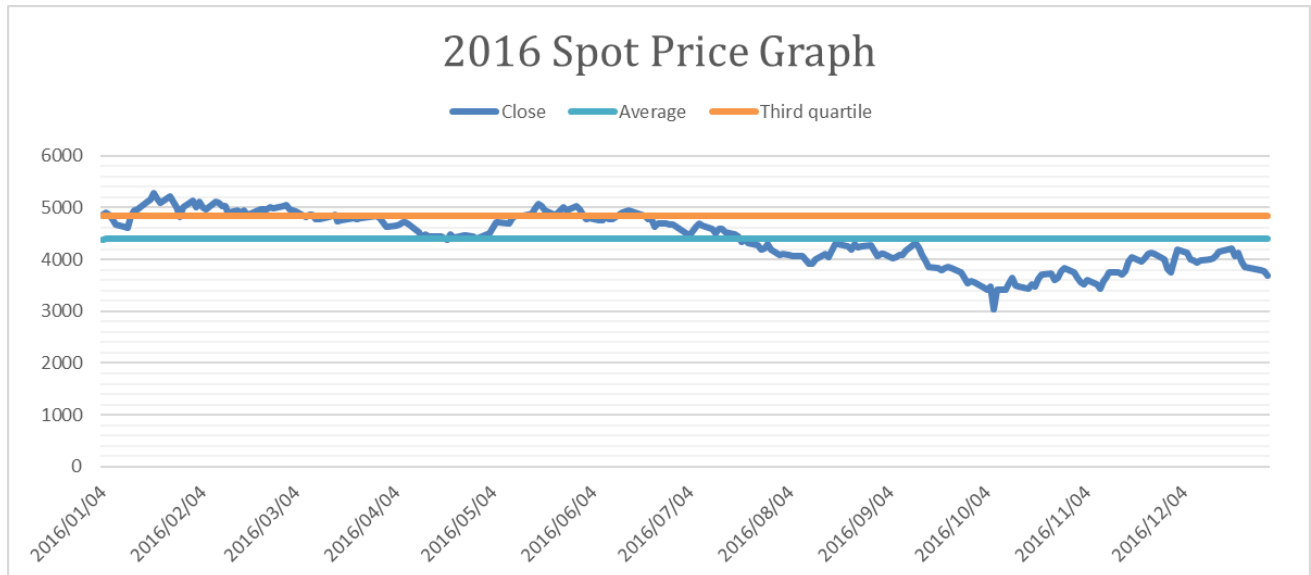


Figure 3-19: Historic 2016 Spot Market price graph

In terms of the aforementioned figure, the average price had been calculated as R4393.00 with the third quartile level being R4844.00. Therefore, in terms of the aforementioned, the third quartile level, or the highest 25% of the seasonal price-band is above the R4844.00 level. In terms thereof, it is evident that the seasonal prices for the year ending December 2016, increased above the third quartile level, during the months of January to March, and between May and June whilst trading below said level during the months of July to December.

The highest average monthly price for the aforementioned year, was for February, as can be ascertained from the graph, at a level of R4991.00.

YEAR	MONTH	WHITE	\$/R	WHITE/YEAR	Max Check
2016	January	4949,65	16,36	4398,38	0
2016	February	4991,57	15,77	4398,38	1
2016	March	4835,75	15,44	4398,38	0
2016	April	4512,80	14,63	4398,38	0
2016	May	4863,86	15,38	4398,38	0
2016	June	4781,76	15,07	4398,38	0
2016	July	4453,45	14,42	4398,38	0
2016	August	4137,34	13,74	4398,38	0
2016	September	3922,72	14,04	4398,38	0
2016	October	3545,87	13,94	4398,38	0
2016	November	3789,83	13,92	4398,38	0
2016	December	3995,97	13,84	4398,38	0

Table 3-10: 2016 Spot Market data table

3.1.10.1 SAGIS/BFAP data

In terms of the Bureau for Food and Agricultural Policy. (2018), the total white maize harvest for the year ending 2016 was estimated to be approximately 4 million tonnes, being the lowest in a decade. The carry-over stock was limited, hence the high prices throughout the year, as per Figure 3-19: Historic 2016 Spot Market price graph.

3.1.10.2 Statistical analysis: Exchange rate and price movement correlation

2016	Spearman's rho	WHITE	Correlation Coefficient	1,000	.867**
			Sig. (2-tailed)		0,000
			N	12	12
		EXCHANGE	Correlation Coefficient	.867**	1,000
			Sig. (2-tailed)	0,000	
			N	12	12

Figure 3-20: Correlation between 2016 White maize price movement and the R/\$ exchange rate.

For the year ended 2016, a positive and statistically significant correlation existed between white maize price movement and the subsequent R/\$ exchange rate, with a correlation coefficient value of 0.867. This is the fifth positive correlation and fifth statistically significant positive correlation in this analysis. Statistical significance entails the existence of a positive and/or negative correlation coefficient that cannot be classified as a coincidence. Thus, the positive correlation coefficient ascertained herein did not happen by chance. This is, therefore, the fifth year in which a positive statistically significant correlation coefficient existed between maize price movements and the exchange rate as aforementioned. For purposes hereof, it should be stated that any

coefficient values close to zero, indicates no correlation, whilst positive values denote positive correlations, and negative values denote negative correlations ($-1 < 0 < 1$).

3.1.11 Historic 2017 Spot Prices and subsequent graphs and data

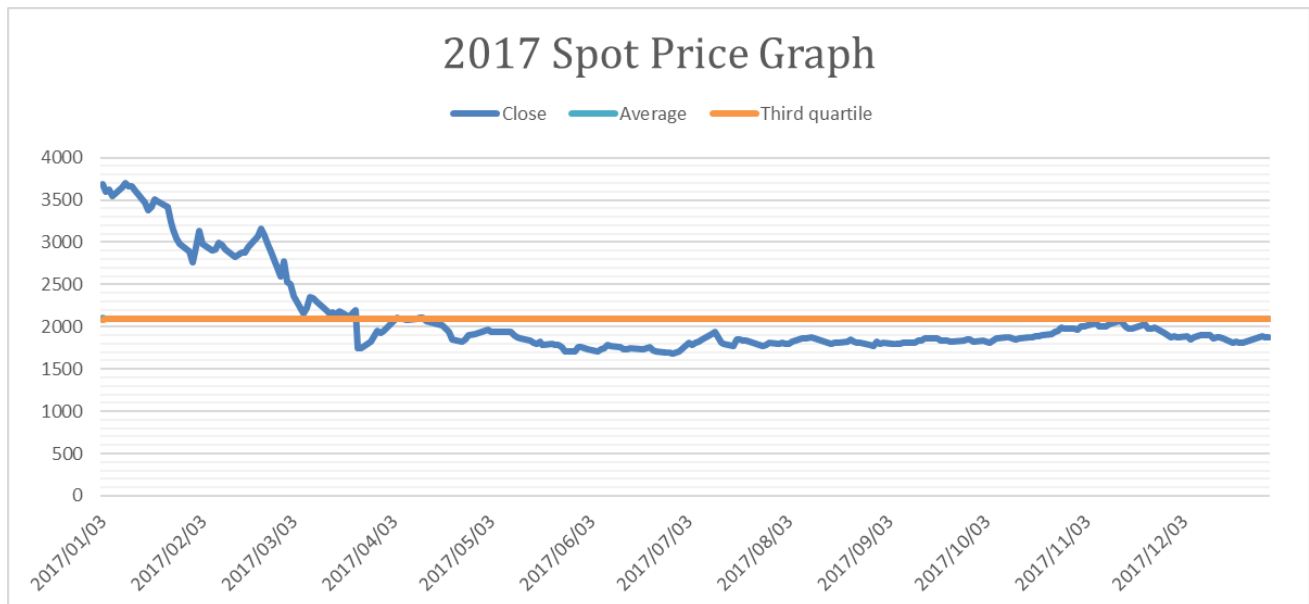


Figure 3-21: Historic 2017 Spot Market price graph

The year 2017 could be considered to be an anomaly. This is the only year within this analysis, and subsequent sub-sections, where the average price calculated for the period is above the third quartile level, as discussed below. The main reason, therefore, is because this specific harvest was the largest in South African history, which in turn, depressed prices considerably.

In terms of the aforementioned figure, the average price had been calculated as R2103.00 with the third quartile level being R2088.00. Therefore, in terms of the aforementioned, the third quartile level, or the highest 25% of the seasonal price-band is above the R2088.00 level. In terms thereof, it is evident that the seasonal prices for the year ending December 2017, increased above the third quartile level, during the months of January to March, whilst trading below said level during the months of April to December.

The highest average monthly price for the aforementioned year, was for January, as can be ascertained from the graph, at a level of R3404.00.

YEAR	MONTH	WHITE	\$/R	WHITE/YEAR	Max Check
2017	January	3403,18	13,56	2105,20	1
2017	February	2935,34	13,21	2105,20	0
2017	March	2135,93	12,95	2105,20	0
2017	April	2005,60	13,48	2105,20	0
2017	May	1838,03	13,27	2105,20	0
2017	June	1728,91	12,91	2105,20	0
2017	July	1824,87	13,15	2105,20	0
2017	August	1818,69	13,26	2105,20	0
2017	September	1830,08	13,15	2105,20	0
2017	October	1892,05	13,70	2105,20	0
2017	November	1989,42	14,09	2105,20	0
2017	December	1860,33	13,18	2105,20	0

Table 3-11: 2017 Spot Market data table

3.1.11.1 SAGIS/BFAP data

In terms of the Bureau for Food and Agricultural Policy. (2018), the total white maize harvest for the year ending 2017 was estimated to be approximately 8.5 million tonnes, being the highest ever recorded in South Africa. The carry-over stock was ample, hence the low prices throughout the year, as per Figure 3-21: Historic 2017 Spot Market price graph.

3.1.11.2 Statistical analysis: Exchange rate and price movement correlation

2017	Spearman's rho	WHITE	Correlation Coefficient	1,000	0,438
			Sig. (2-tailed)		0,155
			N	12	12
		EXCHANGE	Correlation Coefficient	0,438	1,000
			Sig. (2-tailed)	0,155	
			N	12	12

Figure 3-22: Correlation between 2017 White maize price movement and the R/\$ exchange rate.

For the year ended 2017, a positive correlation existed between white maize price movement and the subsequent R/\$ exchange rate, with a correlation coefficient value of 0.438. This is, therefore, the sixth year in which a positive correlation coefficient existed between maize price movements and the exchange rate as aforementioned. For purposes hereof, it should be stated that any coefficient values close to zero, indicates no correlation, whilst positive values denote positive correlations, and negative values denote negative correlations ($-1 < 0 < 1$).

3.1.12 Historic 2018 Spot Prices and subsequent graphs and data

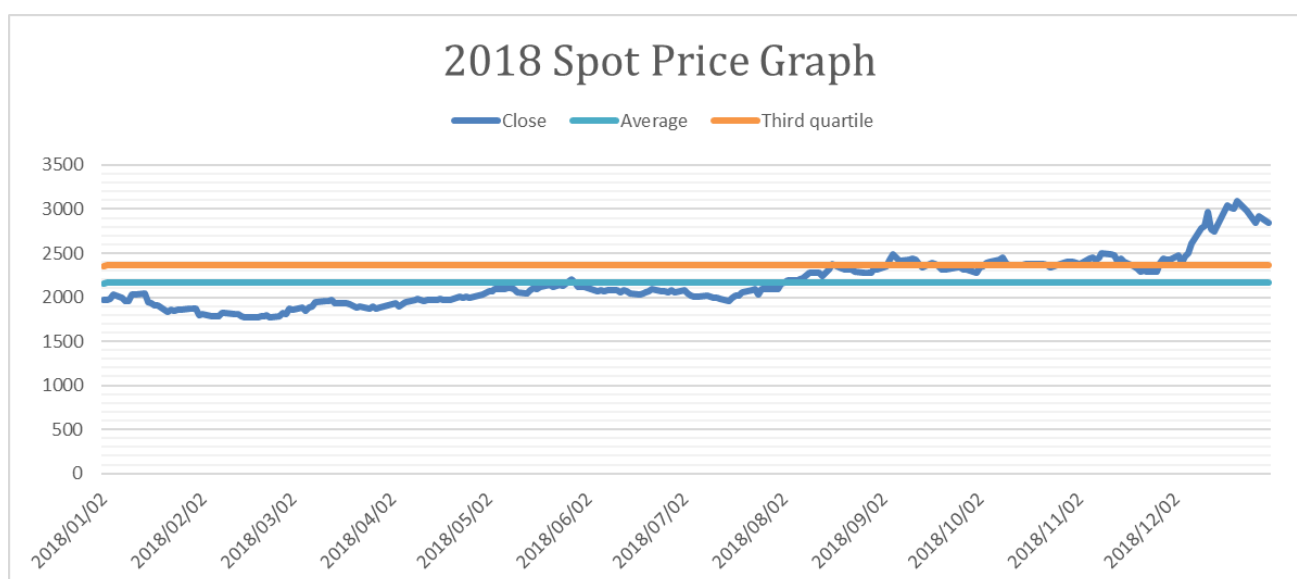


Figure 3-23: Historic 2018 Spot Market price graph

In terms of the aforementioned figure, the average price had been calculated as R2165.00 with the third quartile level being R2359.00. Therefore, in terms of the aforementioned, the third quartile level, or the highest 25% of the seasonal price-band is above the R2359.00 level. In terms thereof, it is evident that the seasonal prices for the year ending December 2018, increased above the third quartile level, during the month of December, whilst trading below said level during the months of January to November.

The highest average monthly price for the aforementioned year, was for December, as can be ascertained from the graph, at a level of R2792.00.

YEAR	MONTH	WHITE	\$/R	WHITE/YEAR	Max Check
2018	January	1932,10	12,24	2168,59	0
2018	February	1793,62	11,81	2168,59	0
2018	March	1902,83	11,84	2168,59	0
2018	April	1969,03	12,13	2168,59	0
2018	May	2109,81	12,54	2168,59	0
2018	June	2070,43	13,30	2168,59	0
2018	July	2034,75	13,42	2168,59	0
2018	August	2267,78	14,04	2168,59	0
2018	September	2378,32	14,82	2168,59	0
2018	October	2373,66	14,51	2168,59	0
2018	November	2398,17	14,11	2168,59	0
2018	December	2792,57	14,20	2168,59	1

Table 3-12: 2018 Spot Market data table

3.1.12.1 SAGIS/BFAP data

In terms of the Bureau for Food and Agricultural Policy. (2018), the total white maize harvest for the year ending 2018 was estimated to be approximately 6.5 million tonnes. The carry-over stock was ample, hence the low prices throughout the year, as per Figure 3-23: Historic 2018 Spot Market price graph.

3.1.12.2 Statistical analysis: Exchange rate and price movement correlation

2018	Spearman's rho	WHITE	Correlation Coefficient	1,000	.909**
			Sig. (2-tailed)		0,000
			N	12	12
		EXCHANGE	Correlation Coefficient	.909**	1,000
			Sig. (2-tailed)	0,000	
			N	12	12

Figure 3-24: Correlation between 2018 White maize price movement and the R/\$ exchange rate.

For the year ended 2018, a positive and statistically significant correlation existed between white maize price movement and the subsequent R/\$ exchange rate, with a correlation coefficient value of 0.909. This is the seventh positive correlation and sixth statistically significant positive correlation of this analysis. Statistical significance entails the existence of a positive and/or negative correlation coefficient that cannot be classified as a coincidence. Thus, the positive correlation coefficient ascertained herein did not happen by chance. This is, therefore, the sixth year in which a positive statistically significant correlation coefficient existed between maize price movements and the exchange rate as aforementioned. For purposes hereof, it should be stated that any coefficient values close to zero, indicates no correlation, whilst positive values denote positive correlations, and negative values denote negative correlations ($-1 < 0 < 1$).

3.1.13 Historic 2019 Spot Prices and subsequent graphs and data

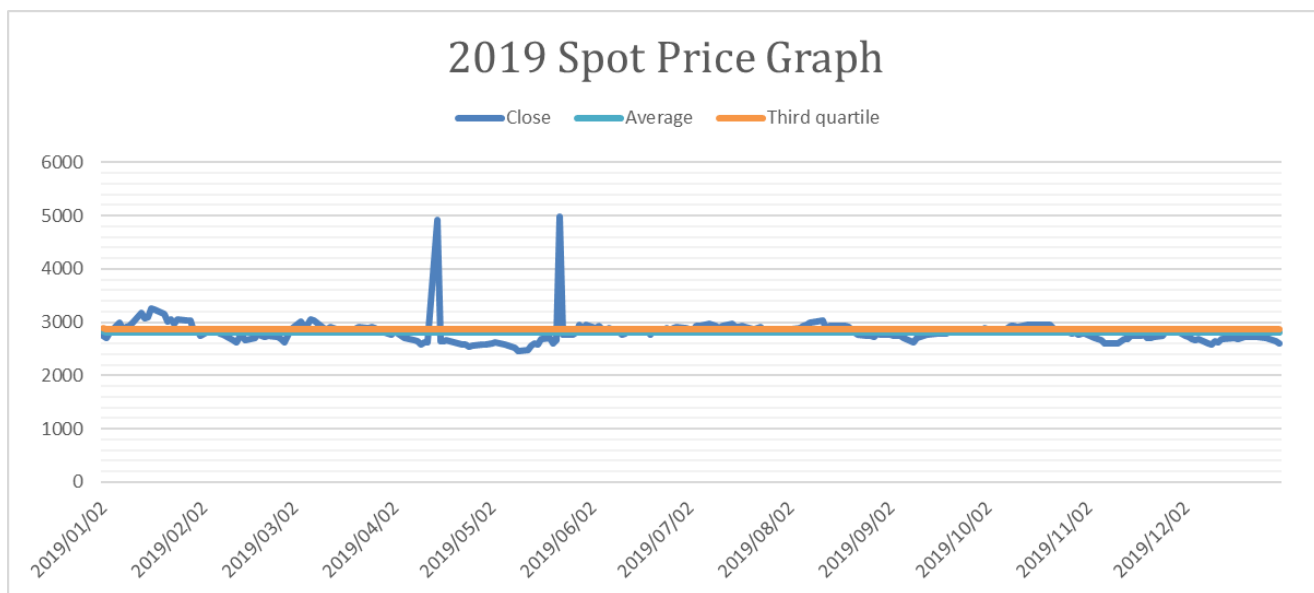


Figure 3-25: Historic 2019 Spot Market price graph

In terms of the aforementioned figure, the average price had been calculated as R2824.00 with the third quartile level being R2897.00. Therefore, in terms of the aforementioned, the third quartile level, or the highest 25% of the seasonal price-band is above the R2897.00 level. In terms thereof, it is evident that the seasonal prices for the year ending December 2019, increased above the third quartile level, during the month of January, April and June whilst trading below said level mostly during the rest of the year.

The highest average monthly price for the aforementioned year, was for January, as can be ascertained from the graph, at a level of R2990.00.

YEAR	MONTH	WHITE	\$/R	WHITE/YEAR	Max Check
2019	January	2990,37	13,73	2821,03	1
2019	February	2736,79	13,80	2821,03	0
2019	March	2901,38	14,38	2821,03	0
2019	April	2764,82	14,15	2821,03	0
2019	May	2777,42	14,43	2821,03	0
2019	June	2851,97	14,57	2821,03	0
2019	July	2903,80	14,05	2821,03	0
2019	August	2866,80	15,14	2821,03	0
2019	September	2774,24	14,84	2821,03	0
2019	October	2880,99	14,91	2821,03	0
2019	November	2723,68	14,79	2821,03	0
2019	December	2680,08	14,43	2821,03	0

Table 3-13: 2019 Spot Market data table

3.1.13.1 SAGIS/BFAP data

In terms of the (Bureau for Food and Agricultural Policy, 2020), the total white maize harvest for the year ending 2019 was estimated to be approximately 5 million tonnes.

3.1.13.2 Statistical analysis: Exchange rate and price movement correlation

2019	Spearman's rho	WHITE	Correlation Coefficient	1,000	-0,179
			Sig. (2-tailed)		0,579
			N	12	12
		EXCHANGE	Correlation Coefficient	-0,179	1,000
			Sig. (2-tailed)	0,579	
			N	12	12

Figure 3-26: Correlation between 2019 White maize price movement and the R/\$ exchange rate.

For the year ended 2019, a neutral to slightly negative correlation existed between white maize price movement and the subsequent R/\$ exchange rate, with a correlation coefficient value of -0.179. For purposes hereof, it should be stated that any coefficient values close to zero, indicates no correlation, whilst positive values denote positive correlations, and negative values denote negative correlations ($-1 < 0 < 1$).

3.1.14 Historic 2019 Spot Prices and subsequent graphs and data

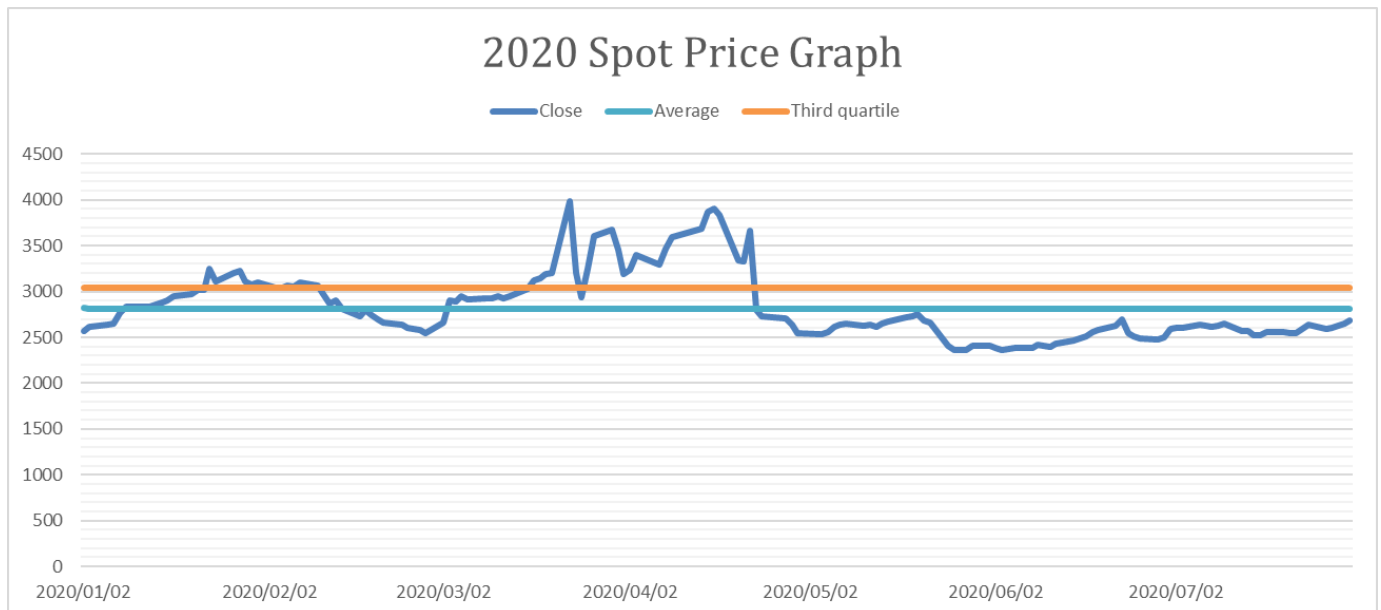


Figure 3-27: Historic 2020 Spot Market price graph

In terms of the aforementioned figure, the average price had been calculated as R2826.00 with the third quartile level being R3040.00. Therefore, in terms of the aforementioned, the third quartile level, or the highest 25% of the seasonal price-band is above the R3040.00 level. In terms thereof, it is evident that the seasonal prices for the year ending July 2020, increased above the third quartile level, during the months of February, April and May whilst trading below said level mostly during the rest of the year.

The highest average monthly price for the aforementioned year, was for April, as can be ascertained from the graph, at a level of R3291.00.

It should, however, be noted that the data for the year 2020 ended on 31 July 2020, and should therefore be considered incomplete, as it does not illustrate the months of August to December.

YEAR	MONTH	WHITE	\$/R	WHITE/YEAR	Max Check
2020	January	2926,98	14,40	2831,13	0
2020	February	2824,41	15,03	2831,13	0
2020	March	3128,02	16,64	2831,13	0
2020	April	3291,27	18,56	2831,13	1
2020	May	2580,55	18,13	2831,13	0
2020	June	2471,48	17,12	2831,13	0
2020	July	2595,23	16,78	2831,13	0

Table 3-14: 2019 Spot Market data table

3.1.14.1 SAGIS/BFAP data

In terms of the (Bureau for Food and Agricultural Policy, 2020), the total white maize harvest for the year ending 2019 was estimated to be approximately 7 million tonnes, with the second-highest annual crop in South Africa's history.

3.1.14.2 Statistical analysis: Exchange rate and price movement correlation

An exchange rate and price movement correlation has not been done for the year 2020.

3.1.15 Historical Spot Price Summary

3.1.15.1 Historical Continuous Spot Price Graph



Figure 3-28: Historical Continuous Spot Price Graph

In terms of

Figure 3-28: Historical Continuous Spot Price Graph, a clear and concise trend can be ascertained, being:

1. During years of average to above-average annual crops, with ample carry-over stock, prices tend to increase towards maximum levels (third quartile and above) toward the end of the year and/or the beginning of the new year;
2. During years of below-average to poor annual crops, prices tend to increase toward maximum levels (third quartile and above) during the harvest months. However, this is not the norm, but rather a general price increase as noted under point one, supra. The level of carry-over stock also significantly influences prices for white maize leading up to the harvest months (March to May)

3.1.15.2 Historical Statistical analysis: Exchange rate and price movement correlation for the year 2007 to 2019

Spearman's rho	WHITE	Correlation Coefficient	1,000	.726**
		Sig. (2-tailed)		0,000
		N	156	156
	EXCHANGE	Correlation Coefficient	.726**	1,000
		Sig. (2-tailed)	0,000	
		N	156	156

Figure 3-29: Correlation between White maize price movement and the R/\$ exchange rate for the years 2007 to 2019

As can be ascertained from the aforementioned figure, the general historic correlation spanning over 156 months had been determined, and found a strong statistically significant positive correlation between the R/\$ exchange rate and the local price movement of White Maize (WM1), with a correlation coefficient of 0.726, thus a positive correlation.

In lieu of the aforementioned, it can therefore be inferred that despite the fact that this correlation analysis did only examine local spot market prices and the R/\$ exchange rate, and not also CBOT prices, that it may yet subsequently be used as an indicator of possible price movements. It would therefore be appropriate to use the R/\$ exchange tracker as had been alluded to earlier in Figure 2-6: Historical R/\$ exchange rate to ascertain when the Rand is relatively appreciated and/or depreciated against the dollar, as these exchange rate movements may significantly affect local white maize price movements.

3.1.15.3 Historical Maximum Price Level Checker

MONTH	COUNT	PERCENTAGE
January	5	38
February	1	8
March	2	15
April	0	
May	0	
June	1	8
July	0	
August	0	
September	0	
October	0	
November	1	8
December	3	23

Table 3-15: Historical Maximum Price Level Checker

As can be ascertained from the aforementioned table, prices tend to be the highest, cumulatively, during the months of December, January and March, with 76% of the highest prices attained during these months. It should once again be reiterated that prices are usually the highest during these aforementioned months when the annual crop harvest is average or above average. The month of June recorded 8% of the highest prices, in large part due to the years of a below or poor national crop harvest. If one factor November and February into the equation, together with December, January and March, 92% of the highest prices occurred during these months. If one, therefore, sells between December and January, there is a 61% chance of attaining the highest prices during a seasonal price band.

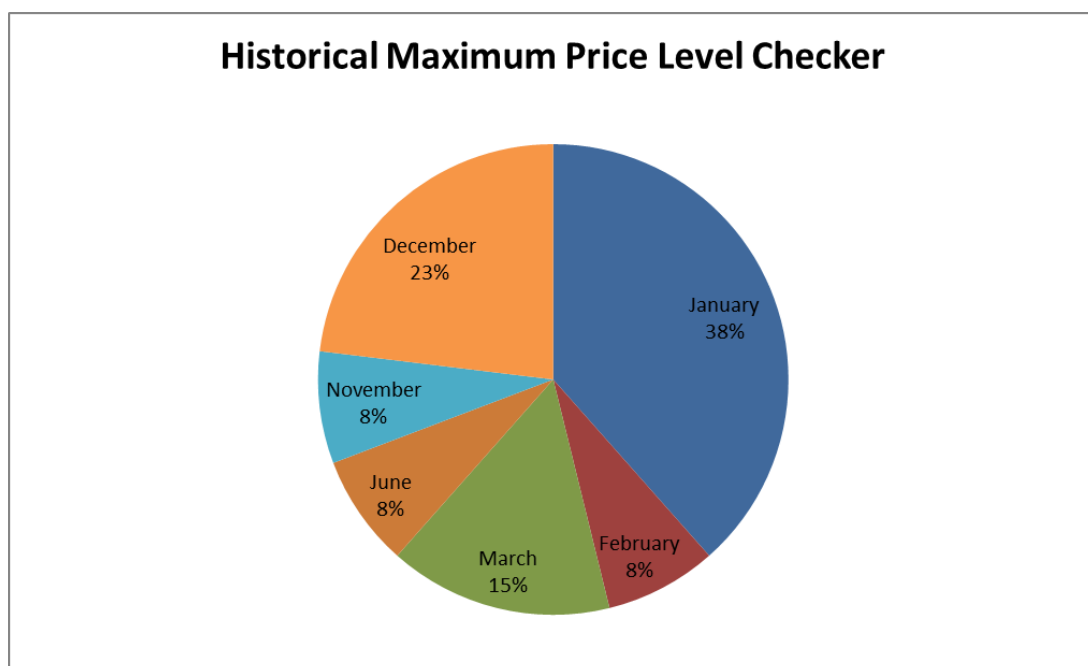


Figure 3-30: Historical Maximum Price Level Check, Pie Graph

3.2 SAFEX FUTURES DATA ANALYSIS

For purposes of SAFEX, futures months are indicated as March, May, July, September and December. Unlike the Spot and/or *Loco* months, these tradeable futures months open several months in advance of the last trade date.

The purpose of the futures market analysis is, therefore, to ascertain which futures market months *usually* produce the highest prices within a year and which months within each specific futures months usually produces the highest prices within each seasonal future price-band. The purpose hereof is further to determine the frequency thereof and to infer any long-term trends from this data. Reference will not be made herein to SAGIS data or the R/\$ exchange rate, due to the fact that it had already been analysed within paragraph 3.1 *supra*.

Futures market selling usually occurs when the producer wants to make use of pre-harvest hedging and/or marketing as had been alluded to in Chapter 2 *supra*, or when the producer has ‘carried’ stock from previous seasons that he/she wishes to sell at a future date, though usually carried-over stock is sold within the Spot market months.

The methodology used herein is one in which the daily close prices are examined, whereafter an average price for the year is determined and whereafter the third quartile

for the year is determined. The seasonal 'price-band' may be divided into three quartiles. For purposes hereof, it is assumed that the producer wishes to sell his/her produce within the third quartile of the seasonal 'price-band' meaning that only the top 25% highest prices are considered as possible 'selling-levels'.

For purposes hereof, spot market data from 2007 to 2020 shall be examined, and should it be noted that all prices referred to herein, shall only apply to white maize grade 1 (WM1).

All prices indicated are per ton prices.

An analysis over several years shall be conducted, with each futures months analysed separately. These futures months shall therefore be analysed in the following order:

- March;
- May;
- July;
- September;
- December.

3.2.1 Historical SAFEX March Future Data

3.2.1.1 2010 March Future data

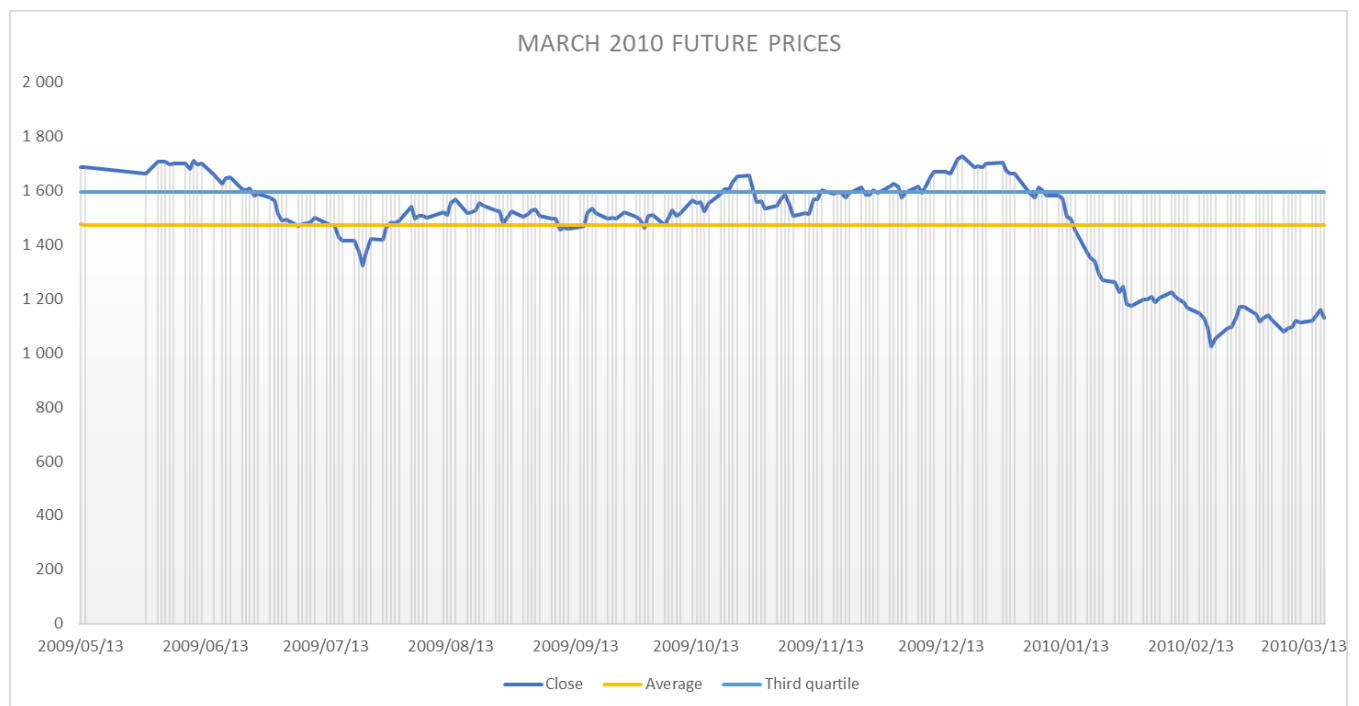


Figure 3-31: March 2010 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R1476.00, with the third quartile price-level calculated to be R1593.00. As can be inferred from, daily close prices traded above the third quartile level (within the uppermost 25% of the seasonal price band) for the months of May and June 2009, followed briefly by October 2009 and December 2009 to January 2010 respectively, while trading below the third quartile level for the rest of the period.

3.2.1.1.1 March 2010 Future Max Price Check

Month	Ave. Price	Max Check
May-09	1678	1
Jun-09	1652	0
Jul-09	1453	0
Aug-09	1521	0
Sep-09	1496	0
Oct-09	1558	0
Nov-09	1574	0
Dec-09	1656	0
Jan-10	1413	0
Feb-10	1154	0
Mar-10	1 121	0

Table 3-16: 2010 March Future Max Price Check Table

As can be inferred from the aforementioned, the March 2010 Future Month attained its highest price during the month of May 2009, for the period in which the aforementioned future traded.

3.2.1.2 2011 March Future Data

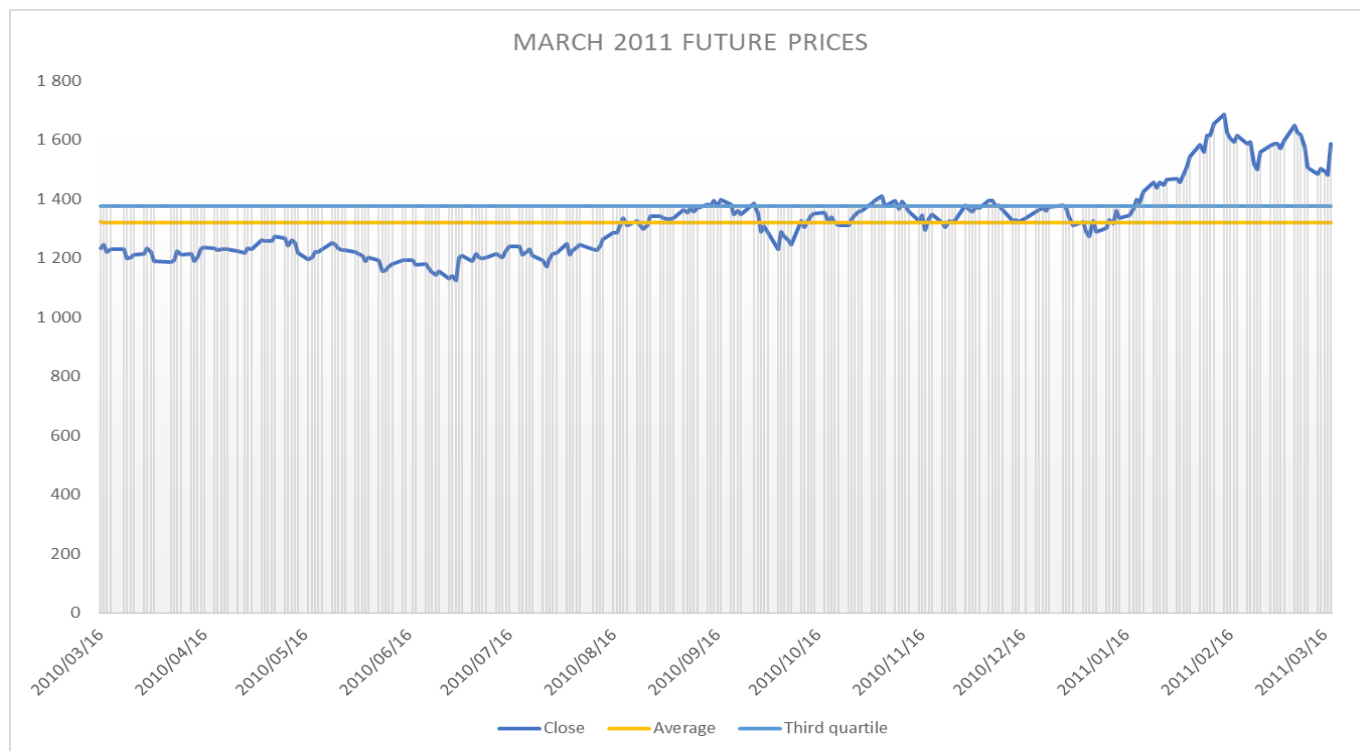


Figure 3-32: March 2011 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R1323.00, with the third quartile price-level calculated to be R1375.00. As can be inferred therefrom, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of January to March 2011, while trading below the third quartile level for the rest of the period.

3.2.1.2.1 March 2011 Future Max Price Check

Month	Ave. Price	Max Check
Mar-10	1222	0
Apr-10	1218	0
May-10	1239	0
Jun-10	1173	0
Jul-10	1210	0
Aug-10	1282	0
Sep-10	1358	0
Oct-10	1314	0
Nov-10	1357	0
Dec-10	1359	0
Jan-11	1371	0
Feb-11	1574	1
Mar-11	1562	0

Table 3-17: 2011 March Future Max Price Check Table

As can be inferred from the aforementioned, the March 2011 Future Month attained its highest price during the month of February 2011, for the period in which the aforementioned future traded.

3.2.1.3 2012 March Future Data

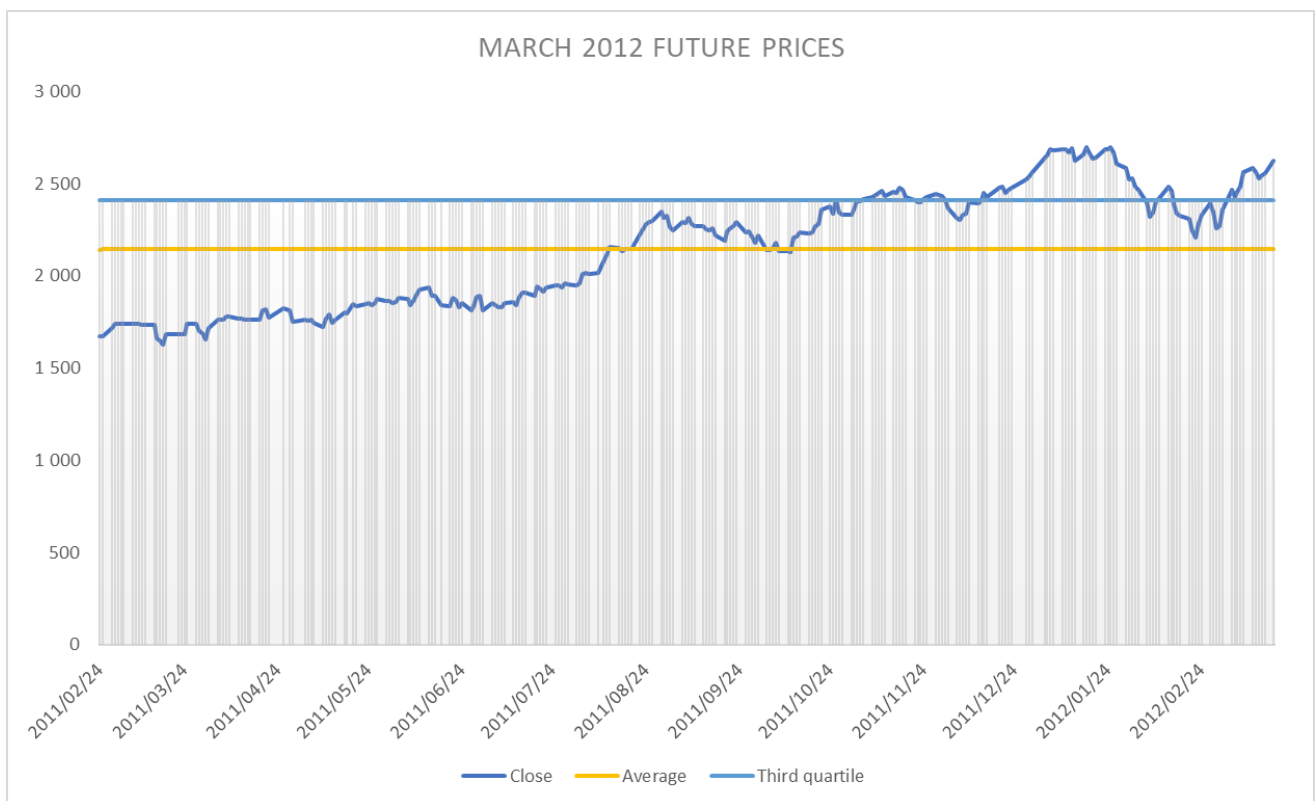


Figure 3-33: March 2012 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2148, with the third quartile price-level calculated to be R2410.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of December to January 2012, and again toward the end of March 2012 while trading below the third quartile level for the rest of the period.

3.2.1.3.1 March 2012 Future Max Price Check

Month	Ave. Price	Max Check
Feb-11	1 687	0
Mar-11	1709	0
Apr-11	1775	0
May-11	1805	0
Jun-11	1869	0
Jul-11	1894	0
Aug-11	2153	0
Sep-11	2252	0
Oct-11	2246	0
Nov-11	2429	0
Dec-11	2428	0
Jan-12	2656	1
Feb-12	2368	0
Mar-12	2495	0

Table 3-18: 2012 March Future Max Price Check Table

As can be inferred from the aforementioned, the March 2012 Future Month attained its highest price during the month of January 2012, for the period in which the aforementioned future traded.

3.2.1.4 2013 March Future Data

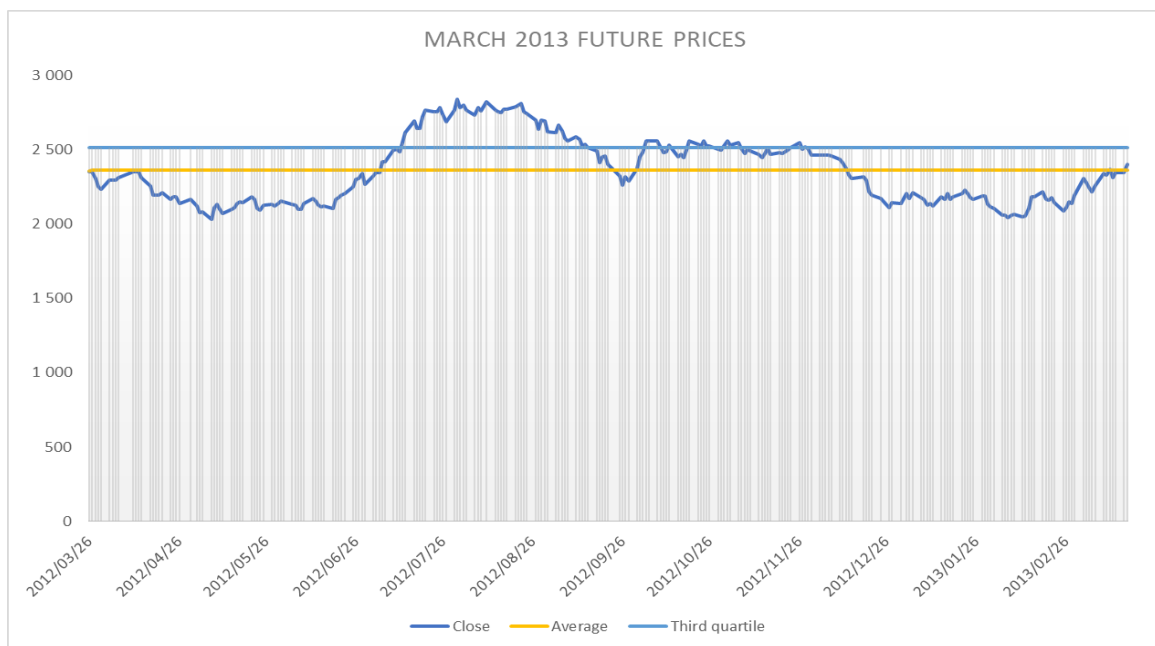


Figure 3-34: March 2013 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2362.00, with the third quartile price-level calculated to be R2514.00 As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of July to August 2012, while trading below the third quartile level for the rest of the period.

3.2.1.4.1 March 2013 Future Max Price Check

Month	Ave. Price	Max Check
Mar-12	2 296	0
Apr-12	2 246	0
May-12	2 116	0
Jun-12	2 177	0
Jul-12	2 603	0
Aug-12	2 748	1
Sep-12	2 482	0
Oct-12	2 504	0
Nov-12	2 497	0
Dec-12	2 319	0
Jan-13	2 173	0
Feb-13	2 115	0
Mar-13	2 302	0

Table 3-19: 2013 March Future Max Price Check Table

As can be inferred from the aforementioned, the March 2013 Future Month attained its highest price during the month of August 2012, for the period in which the aforementioned future traded.

3.2.1.5 2014 March Future Data

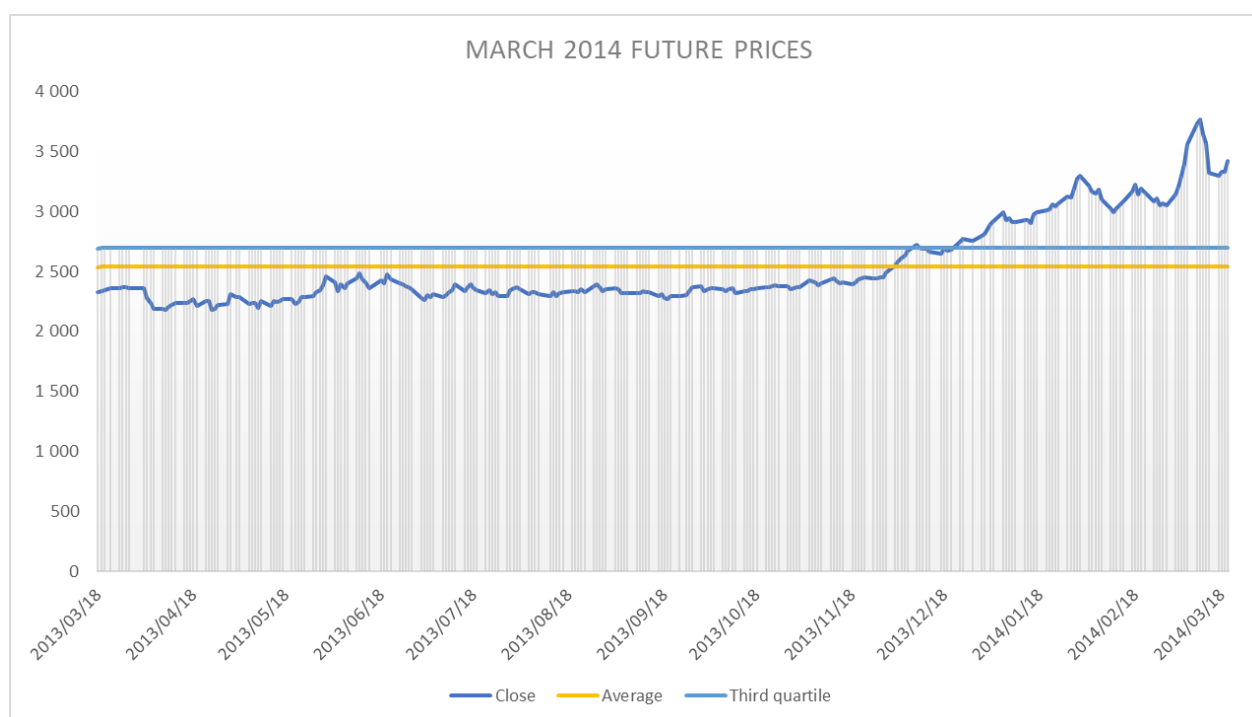


Figure 3-35: March 2014 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2453.00, with the third quartile price-level calculated to be R2699.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of January to March 2014, while trading below the third quartile level for the rest of the period.

3.2.1.5.1 March 2014 Future Max Price Check

Month	Ave. Price	Max Check
Mar-13	2 351	0
Apr-13	2 234	0
May-13	2 277	0
Jun-13	2 404	0
Jul-13	2 325	0
Aug-13	2 335	0
Sep-13	2 321	0
Oct-13	2 356	0
Nov-13	2 425	0
Dec-13	2 689	0
Jan-14	3 032	0
Feb-14	3 112	0
Mar-14	3 429	1

Table 3-20: 2014 March Future Max Price Check Table

As can be inferred from the aforementioned, the March 2014 Future Month attained its highest price during the month of March 2014, for the period in which the aforementioned future traded.

3.2.1.6 2015 March Future Data

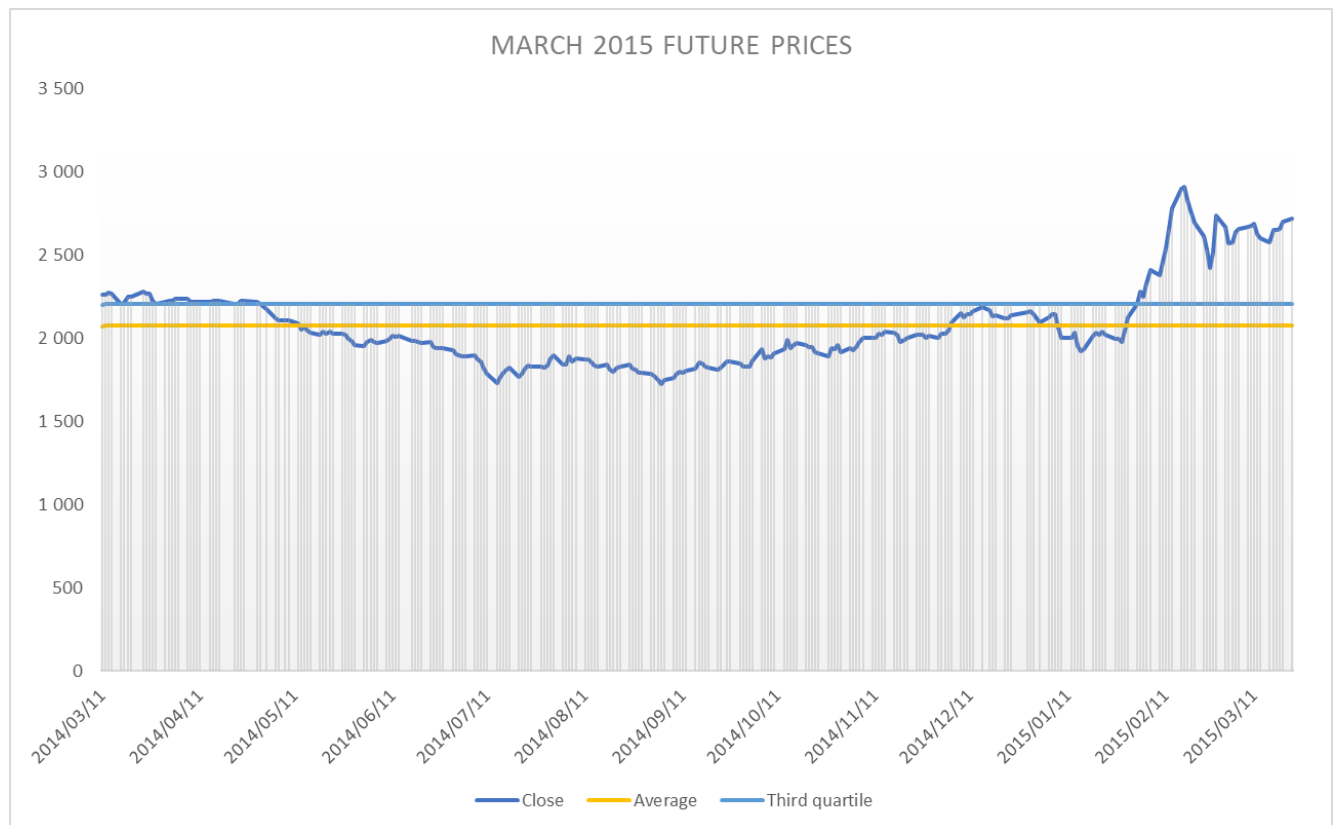


Figure 3-36: March 2015 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2076, with the third quartile price-level calculated to be R2206.00. As can be inferred from, daily close prices traded above the third quartile level (within the uppermost 25% of the seasonal price band) for the months of January to March 2015, while trading below the third quartile level for the rest of the period.

3.2.1.6.1 March 2015 Future Max Price Check

Month	Ave.Price	Max Check
Mar-14	2 246	0
Apr-14	2 222	0
May-14	2 052	0
Jun-14	1 974	0
Jul-14	1 832	0
Aug-14	1 839	0
Sep-14	1 806	0
Oct-14	1 920	0
Nov-14	1 999	0
Dec-14	2 119	0
Jan-15	2 032	0
Feb-15	2 559	0
Mar-15	2 645	1

Table 3-21: 2015 March Future Max Price Check Table

As can be inferred from the aforementioned, the March 2015 Future Month attained its highest price during the month of March 2015, for the period in which the aforementioned future traded.

3.2.1.7 2016 March Future Data

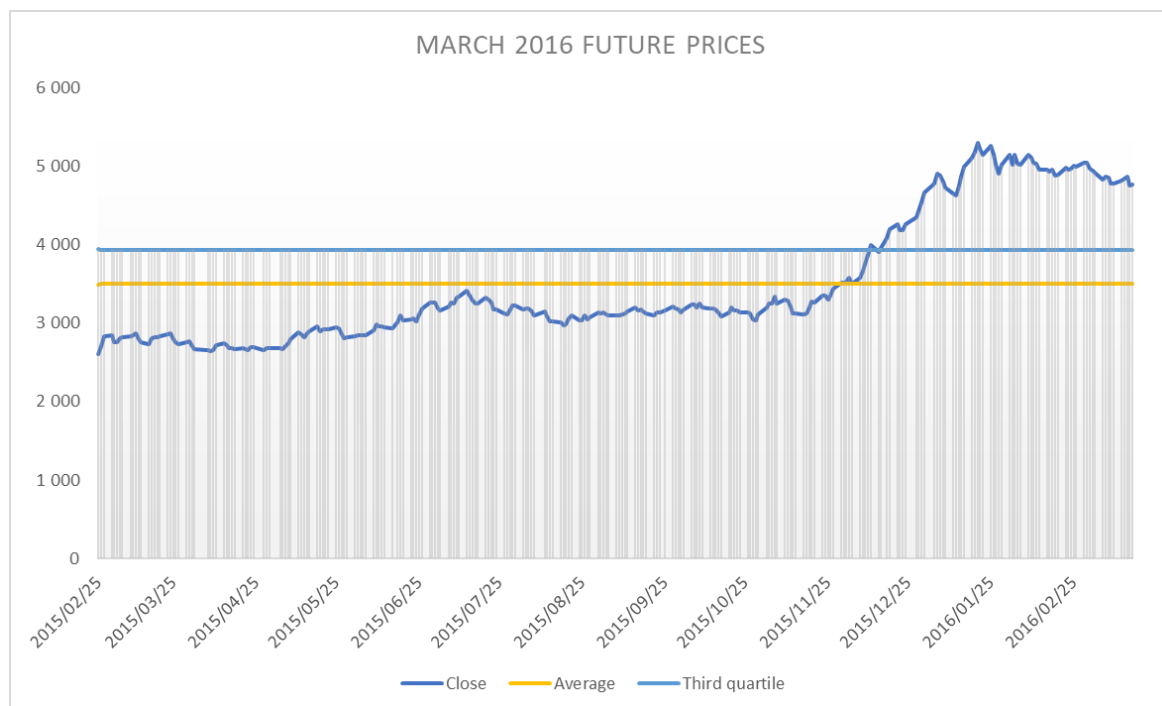


Figure 3-37: March 2016 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R3496.00, with the third quartile price-level calculated to be R3945.00 As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of December 2015 to March 2016, while trading below the third quartile level for the rest of the period.

3.2.1.7.1 March 2016 Future Max Price Check

Month	Ave. Price	Max Check
Feb-15	2 714	0
Mar-15	2 800	0
Apr-15	2 681	0
May-15	2 844	0
Jun-15	2 997	0
Jul-15	3 244	0
Aug-15	3 079	0
Sep-15	3 140	0
Oct-15	3 156	0
Nov-15	3 264	0
Dec-15	3 999	0
Jan-16	4 961	0
Feb-16	5 006	1
Mar-16	4 855	0

Table 3-22: 2016 March Future Max Price Check Table

As can be inferred from the aforementioned, the March 2016 Future Month attained its highest price during the month of February 2016, for the period in which the aforementioned future traded.

3.2.1.8 2017 March Future Data

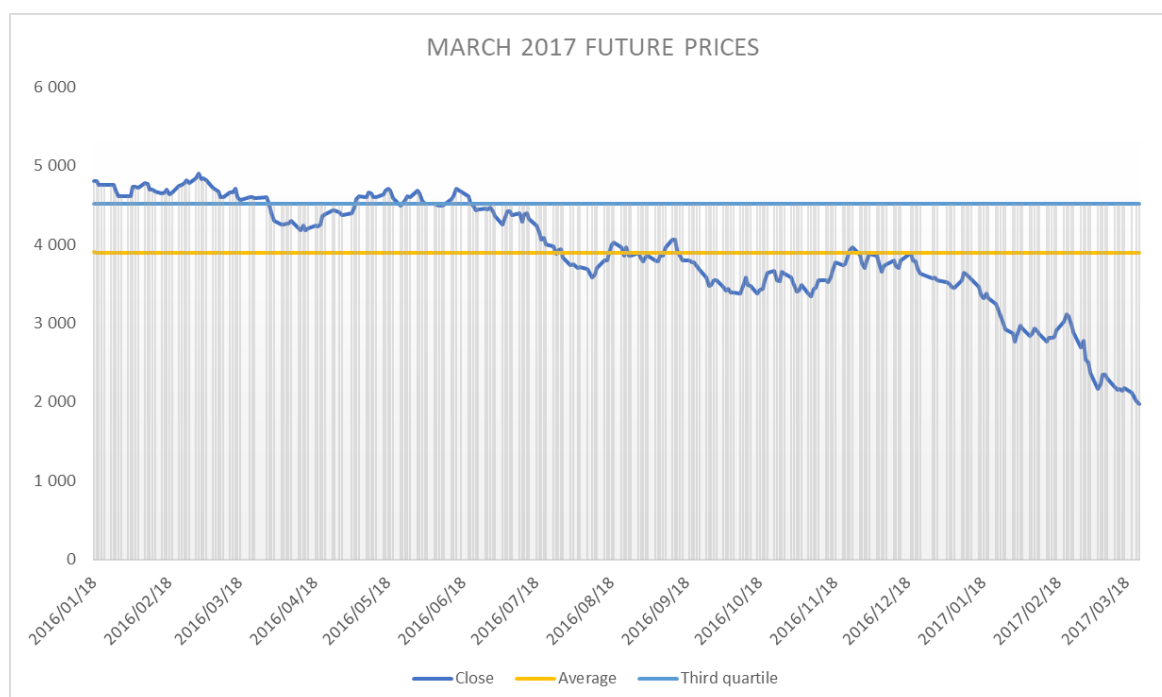


Figure 3-38: March 2017 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R3902.00 with the third quartile price-level calculated to be R4521.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of January 2016 to March 2016, while trading below the third quartile level for the rest of the period.

3.2.1.8.1 March 2017 Future Max Price Check

Month	Ave. Price	Max Check
Jan-16	4 727	1
Feb-16	4 715	0
Apr-16	4 288	0
May-16	4 599	0
Jun-16	4 523	0
Jul-16	4 194	0
Aug-16	3 808	0
Sep-16	3 771	0
Oct-16	3 499	0
Nov-16	3 617	0
Dec-16	3 733	0
Jan-17	3 323	0
Feb-17	2 893	0
Mar-17	2 232	0

Table 3-23: 2017 March Future Max Price Check Table

As can be inferred from the aforementioned, the March 2017 Future Month attained its highest price during the month of January 2016, for the period in which the aforementioned future traded.

3.2.1.9 2018 March Future Data

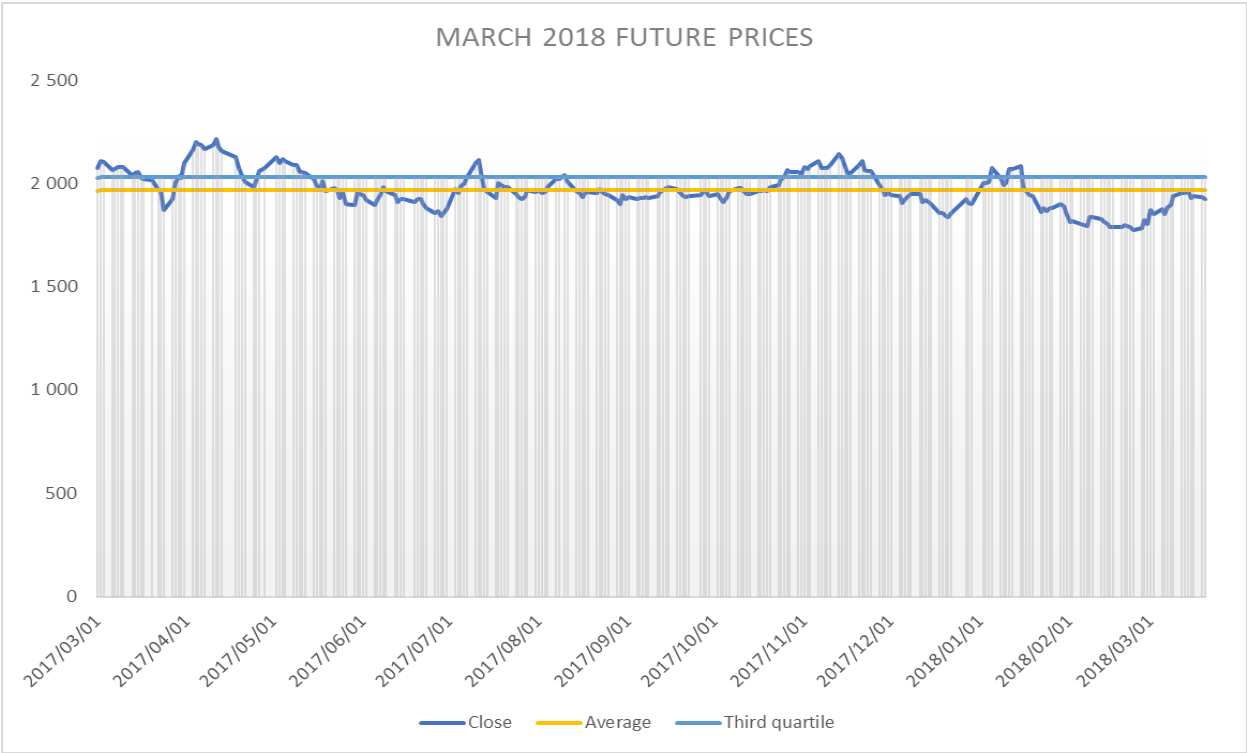


Figure 3-39: March 2018 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R1970.00 with the third quartile price-level calculated to be R2033.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of April 2017 to May 2017, while trading below the third quartile level for the rest of the period.

3.2.1.9.1 March 2018 Future Max Price Check

Month	Ave. Price	Max Check
Mar-17	2 034	0
Apr-17	2 118	1
May-17	2 013	0
Jun-17	1 910	0
Jul-17	1 985	0
Aug-17	1 962	0
Sep-17	1 947	0
Oct-17	1 983	0
Nov-17	2 061	0
Dec-17	1 903	0
Jan-18	1 962	0
Feb-18	1 804	0
Mar-18	1 912	0

Table 3-24: 2018 March Future Max Price Check Table

As can be inferred from the aforementioned, the March 2018 Future Month attained its highest price during the month of April 2017, for the period in which the aforementioned future traded.

3.2.1.10 2019 March Future Data

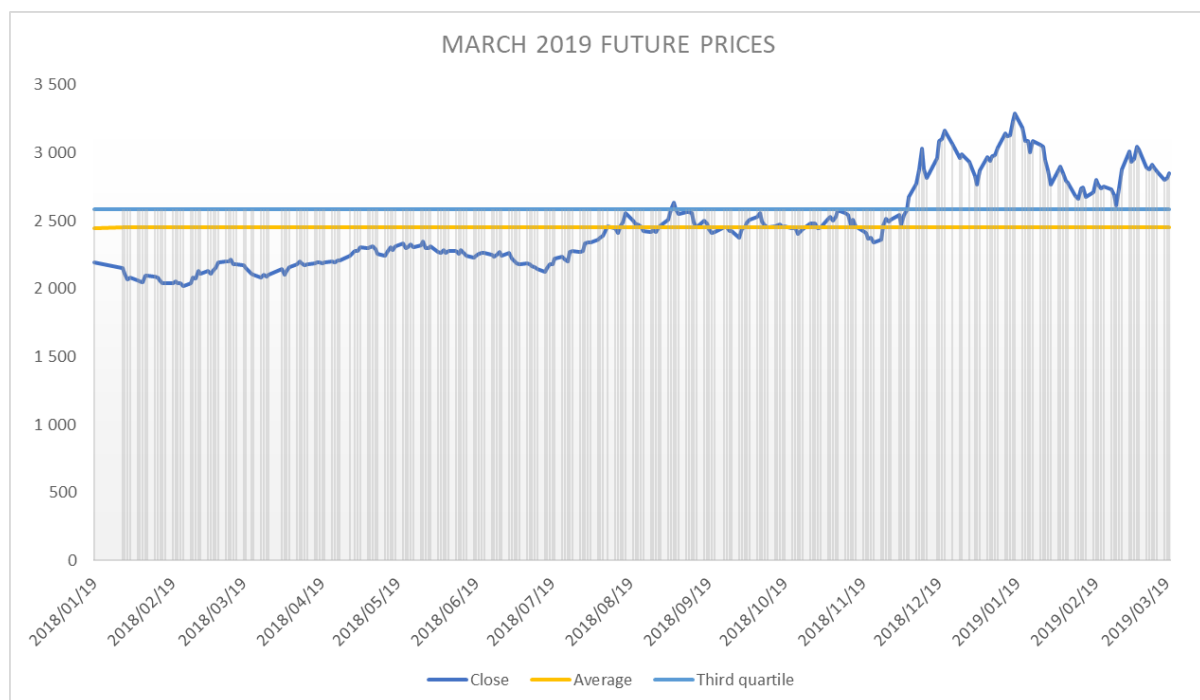


Figure 3-40: March 2019 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2454.00 with the third quartile price-level calculated to be R2582.00 As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of December 2018 to March 2019, while trading below the third quartile level for the rest of the period.

3.2.1.10.1 March 2019 Future Max Price Check

Month	Ave. Price	Max Check
Jan-18	2 152	0
Feb-18	2 060	0
Mar-18	2 143	0
Apr-18	2 183	0
May-18	2 299	0
Jun-18	2 261	0
Jul-18	2 202	0
Aug-18	2 430	0
Sep-18	2 491	0
Oct-18	2 464	0
Nov-18	2 469	0
Dec-18	2 858	0
Jan-19	3 029	1
Feb-19	2 750	0
Mar-19	2 911	0

Table 3-25: 2019 March Future Max Price Check Table

As can be inferred from the aforementioned, the March 2019 Future Month attained its highest price during the month of January 2019, for the period in which the aforementioned future traded.

3.2.1.11 2020 March Future Data

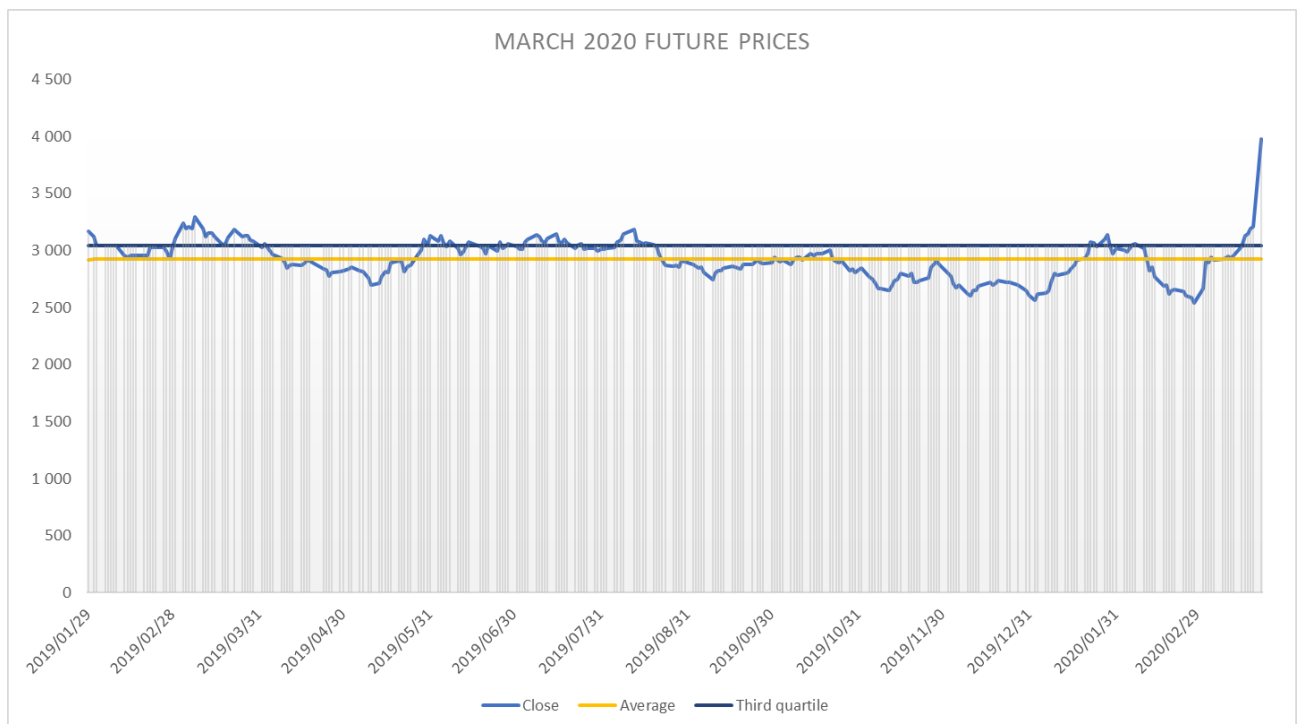


Figure 3-41: March 2020 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2926.00 with the third quartile price-level calculated to be R3041.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of February 2019 to March 2019, followed by March 2020, while trading below the third quartile level for the rest of the period.

3.2.1.11.1 March 2020 Future Max Price Check

Month	Ave. Price	Max Check
Jan-19	3 146	1
Feb-19	2 998	0
Mar-19	3 145	0
Apr-19	2 897	0
May-19	2 876	0
Jun-19	3 038	0
Jul-19	3 059	0
Aug-19	3 003	0
Sep-19	2 852	0
Oct-19	2 915	0
Nov-19	2 765	0
Dec-19	2 690	0
Jan-20	2 879	0
Feb-20	2 788	0
Mar-20	3 043	0

Table 3-26: 2020 March Future Max Price Check Table

As can be inferred from the aforementioned, the March 2020 Future Month attained its highest price during the month of January 2019, for the period in which the aforementioned future traded.

3.2.1.12 Summary for March Futures data

3.2.1.12.1 Continuous March Future data

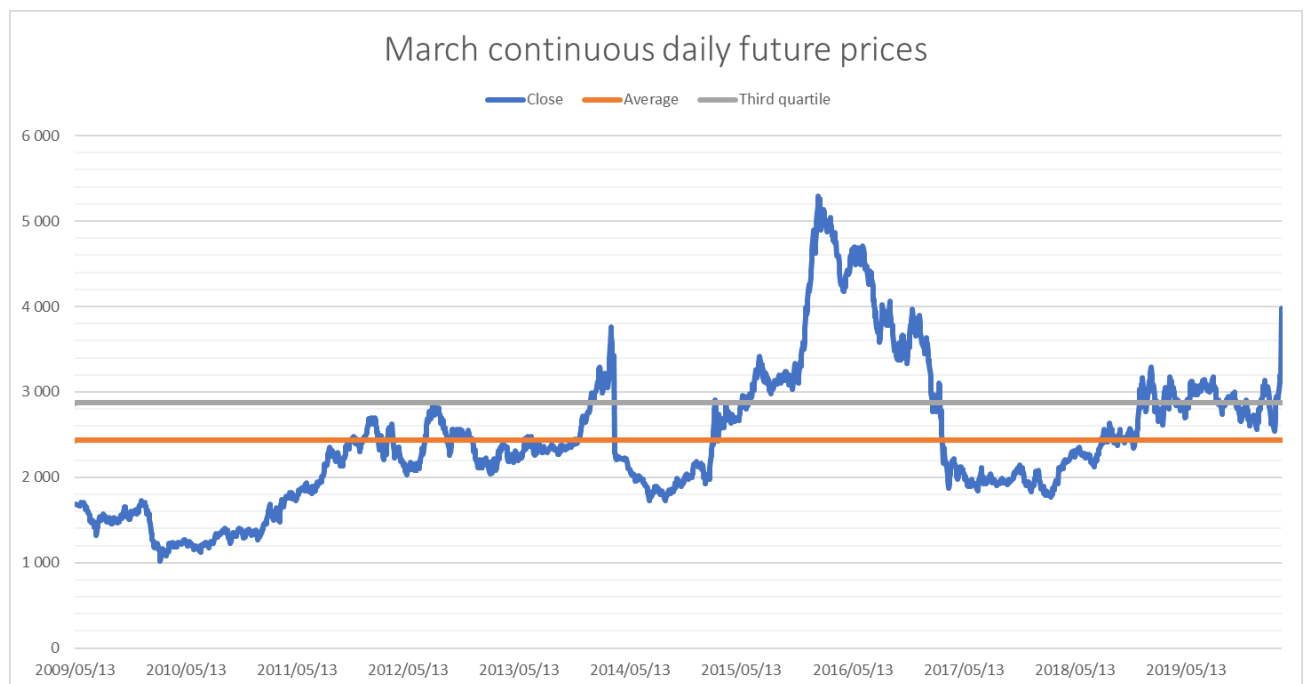


Figure 3-42: Continuous March Future Graph

In terms of the aforementioned graph, a seasonal trend is clearly ascertainable. Between May 2010 and May 2011, a clear upward trend was visible, between May 2011 to May 2012, an upward trend was also ascertainable. Between May 2015 to May 2016, an upward trend was once again ascertainable. Between May 2017 to May 2019, upward trends were also ascertainable.

It is clear from, despite the years 2013 and 2016, when smaller than average crops were realised, that the trend is for prices to increase toward the end of each future period, and closer to the last trade date of each subsequent March Future period.

The average price and third quartile had also been indicated herein, for the sake of comprehensiveness, and shows the values for the two factors over the whole period of analysis.

3.2.1.12.2 Cumulative Max Price Check

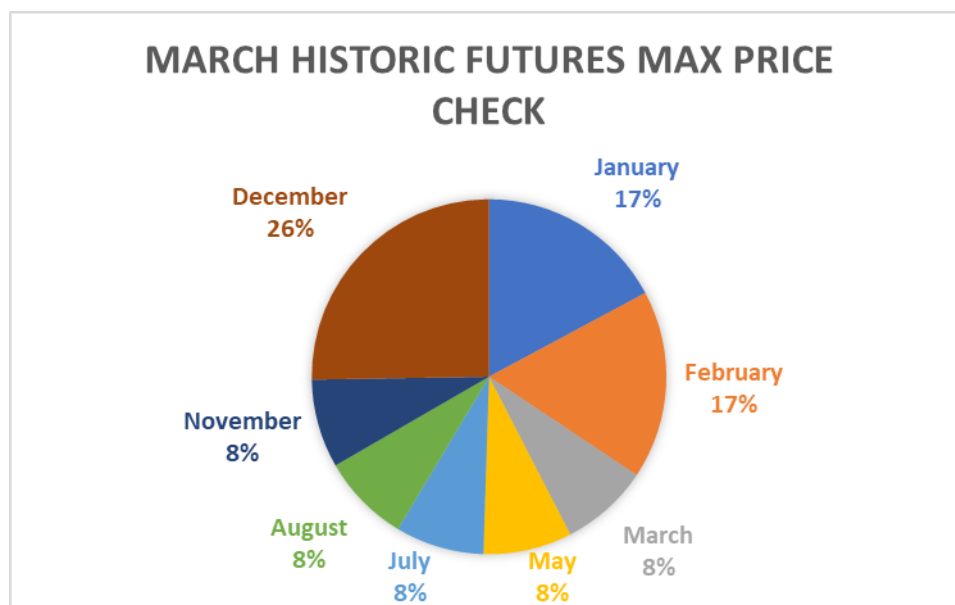


Figure 3-43: March Historic Futures Max Price Check

As can be inferred from the aforementioned figure, maximum price levels per month are spread out more evenly than its spot market counterpart. The reason, therefore, is that unlike the spot market months, futures months open several months in advance of the last trade date, and are much more readily susceptible to speculative price movements and the volatility of the R/\$ exchange rate. Irrespective, the month in which the majority of high prices were tabulated is the month of December, followed by January and

February. Therefore, if a producer would wish to hedge (sell) within the March Future, it would be wise to sell during the months of December to February, immediately preceding the last trade date.

3.2.2 Historical SAFEX May Future Data

3.2.2.1 2010 May Future Data

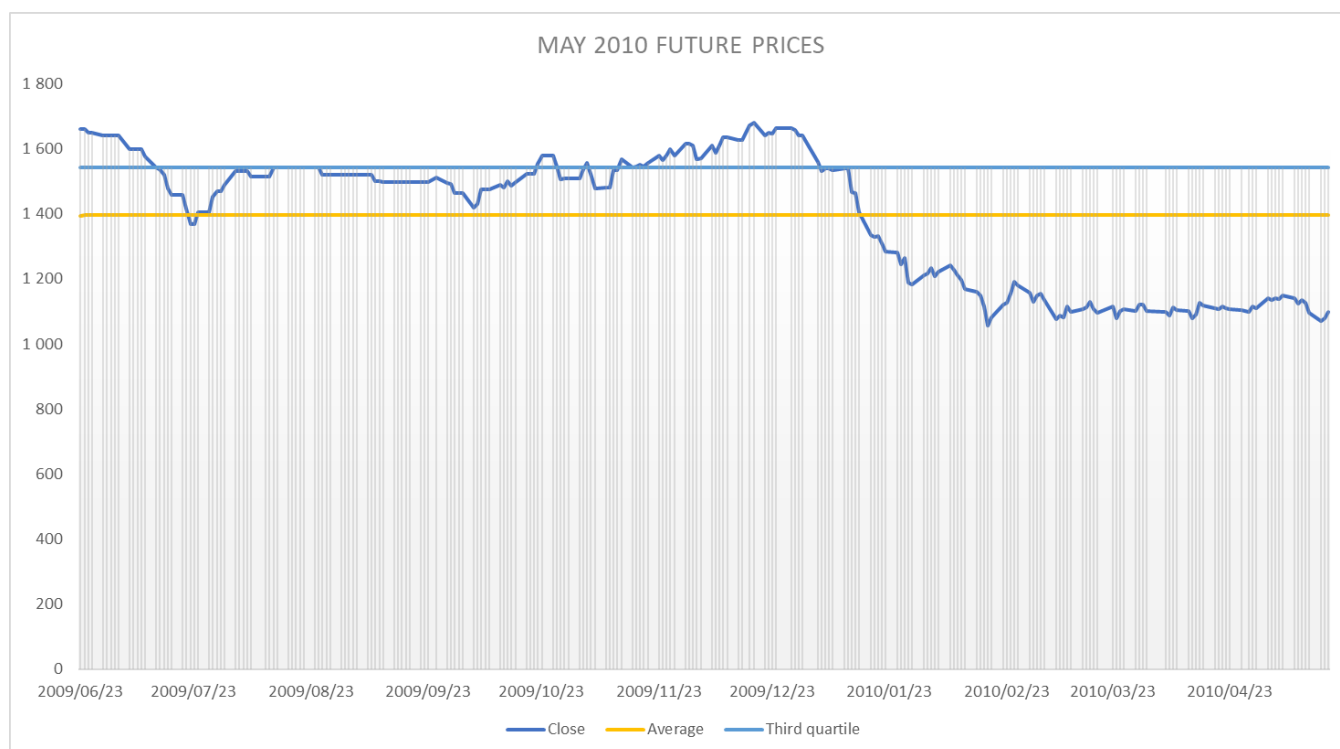


Figure 3-44: May 2010 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R1395.00 with the third quartile price-level calculated to be R1543.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of November 2009 to December 2009, while trading below the third quartile level for the rest of the period.

3.2.2.1.1 May 2010 Future Max Price Check

Month	Ave. Price	Max check
Jun-09	1 650	1
Jul-09	1 510	0
Aug-09	1 531	0
Sep-09	1 503	0
Oct-09	1 500	0
Nov-09	1 546	0
Dec-09	1 631	0
Jan-10	1 394	0
Feb-10	1 174	0
Mar-10	1 123	0
Apr-10	1 105	0
May-10	1 121	0

Table 3-27: 2010 May Future Max Price Check Table

As can be inferred from the aforementioned, the May 2010 Future Month attained its highest price during the month of June 2009, for the period in which the aforementioned future traded.

3.2.2.2 2011 May Future Data

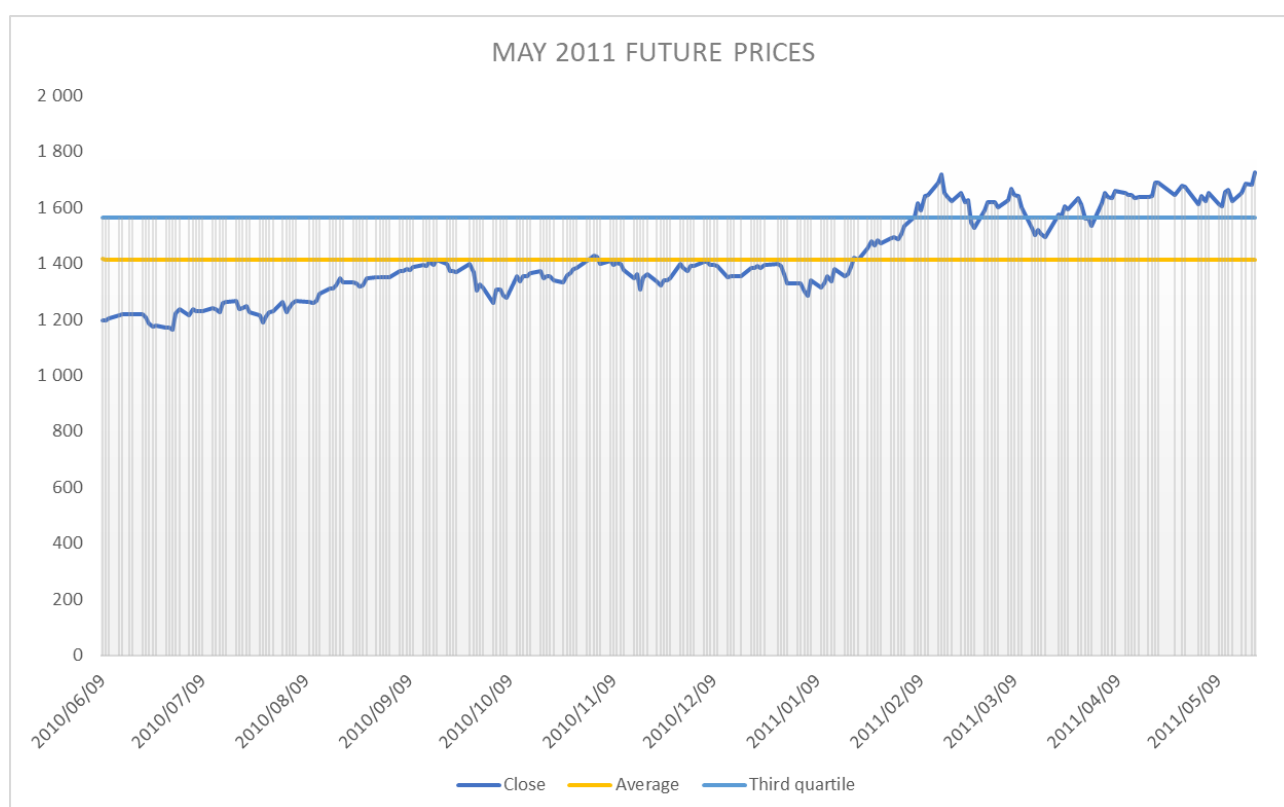


Figure 3-45: May 2011 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R1415.00 with the third quartile price-level calculated to be R1565.00. As can be inferred from, daily close prices traded above the third quartile level (within the uppermost 25% of the seasonal price band) for the months of February 2011 to May 2011, while trading below the third quartile level for the rest of the period.

3.2.2.2.1 May 2011 Future Max Price Check

Month	Ave. Price	Max Check
Jun-10	1 195	0
Jul-10	1 232	0
Aug-10	1 300	0
Sep-10	1 374	0
Oct-10	1 338	0
Nov-10	1 375	0
Dec-10	1 380	0
Jan-11	1 385	0
Feb-11	1 597	0
Mar-11	1 586	0
Apr-11	1 634	0
May-11	1 648	1

Table 3-28: 2011 May Future Max Price Check Table

As can be inferred from the aforementioned, the May 2011 Future Month attained its highest price during the month of May 2011, for the period in which the aforementioned future traded.

3.2.2.3 2012 May Future Data

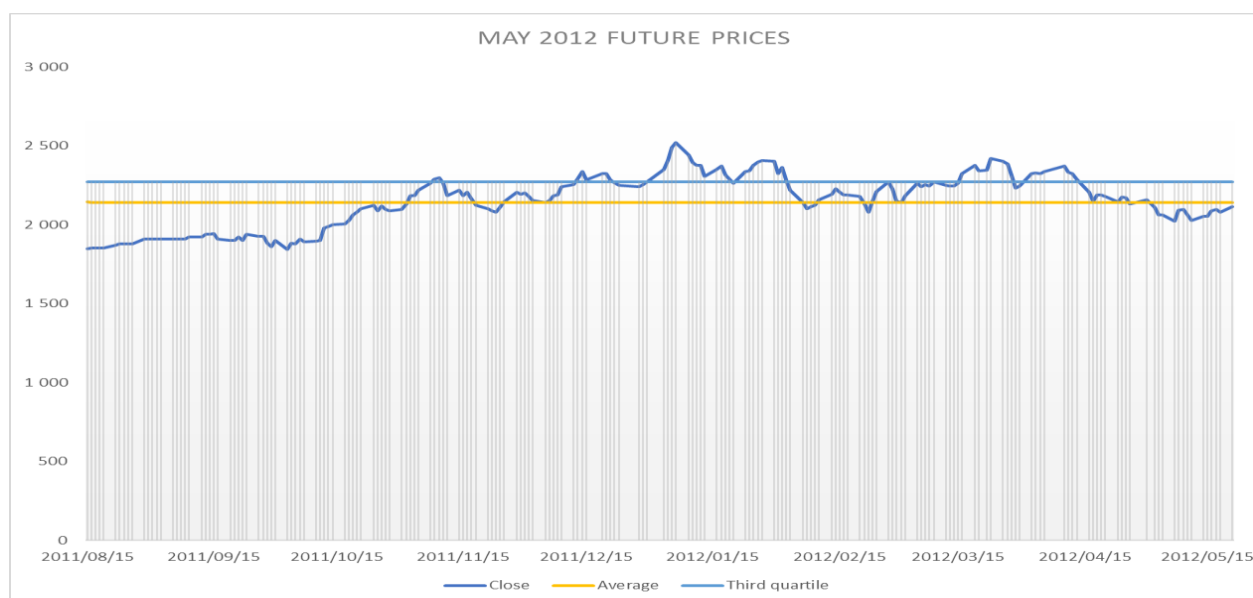


Figure 3-46: May 2012 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2147.00 with the third quartile price-level calculated to be R2270.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-

most 25% of the seasonal price band) for the months of January to February 2012, and again in March 2012, while trading below the third quartile level for the rest of the period.

3.2.2.3.1 May 2012 Future Max Price Check

Month	Ave. Price	Max. Check
Aug-11	1 875	0
Sep-11	1 913	0
Oct-11	2 003	0
Nov-11	2 184	0
Dec-11	2 243	0
Jan-12	2 373	1
Feb-12	2 186	0
Mar-12	2 285	0
Apr-12	2 240	0
May-12	2 073	0

Table 3-29: 2012 May Future Max Price Check Table

As can be inferred from the aforementioned, the May 2012 Future Month attained its highest price during the month of January 2012, for the period in which the aforementioned future traded.

3.2.2.4 2013 May Future Data

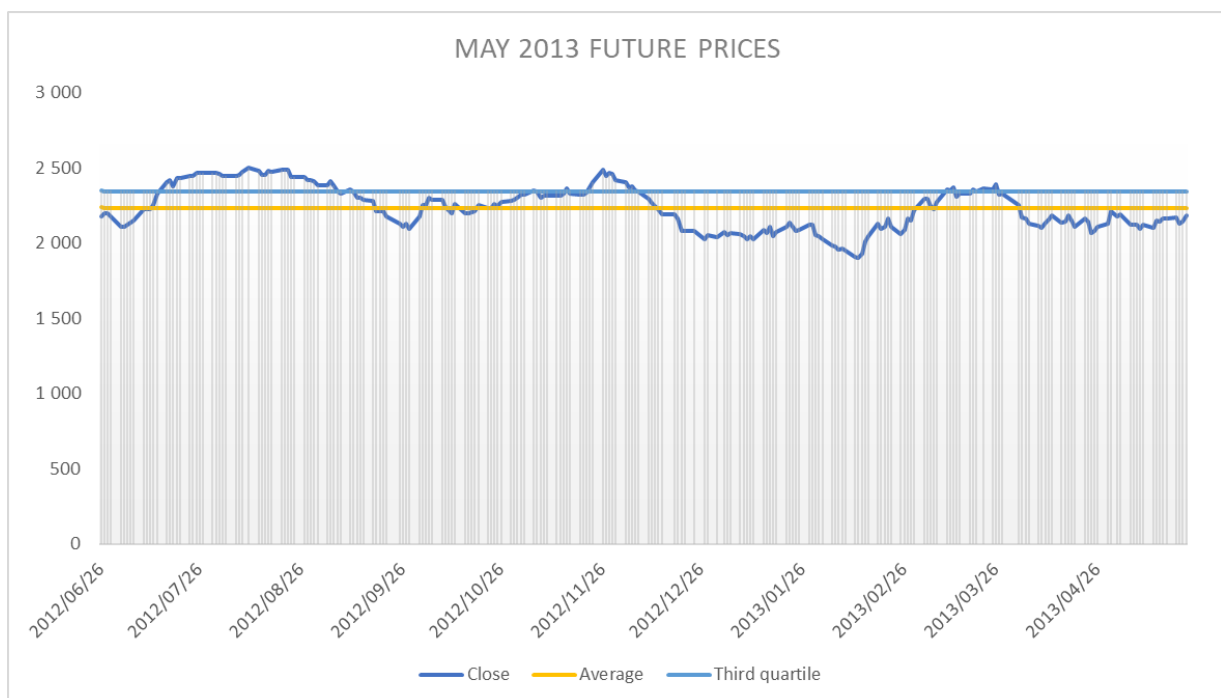


Figure 3-47: May 2013 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2237.00 with the third quartile price-level calculated to be R2352.00 As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of July to August 2012, and again in November 2012, while trading below the third quartile level for the rest of the period.

3.2.2.4.1 May 2013 Future Max Price Check

Month	Ave. Price	Max. Check
Jun-12	2 190	0
Jul-12	2 327	0
Aug-12	2 454	1
Sep-12	2 263	0
Oct-12	2 246	0
Nov-12	2 361	0
Dec-12	2 210	0
Jan-13	2 074	0
Feb-13	2 036	0
Mar-13	2 319	0
Apr-13	2 145	0
May-13	2 143	0

Table 3-30: 2013 May Future Max Price Check Table

As can be inferred from the aforementioned, the May 2013 Future Month attained its highest price during the month of August 2012, for the period in which the aforementioned future traded.

3.2.2.5 2014 May Future Data

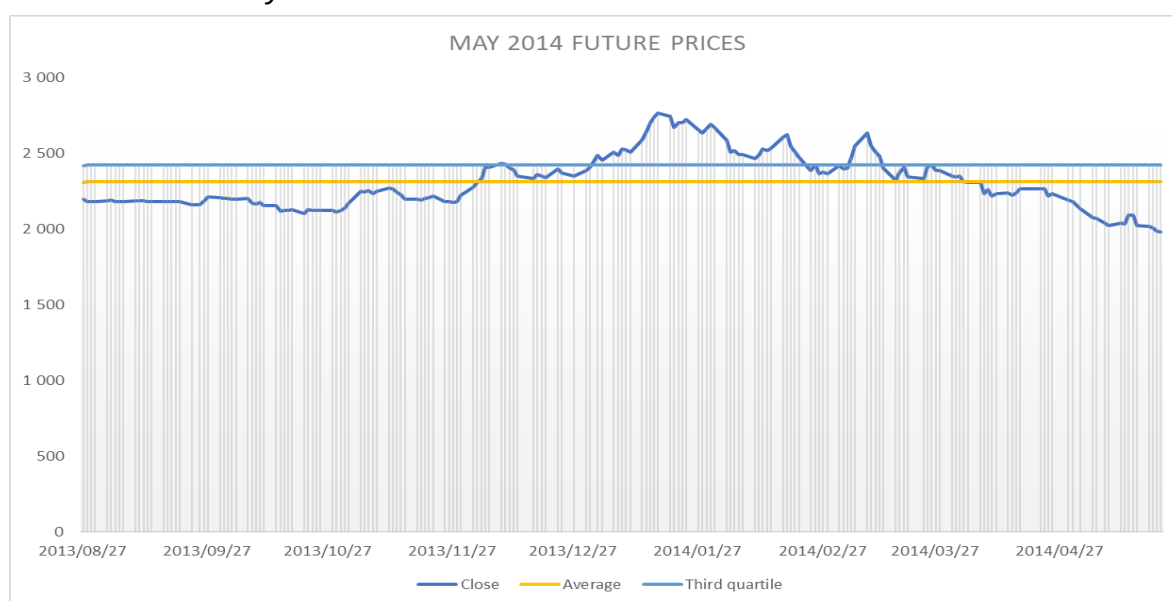


Figure 3-48: May 2014 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2312.00 with the third quartile price-level calculated to be R2423.00 As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of December 2013 to February 2014, while trading below the third quartile level for the rest of the period.

3.2.2.5.1 May 2014 Future Max Price Check

Month	Ave.Price	Max. Check
Aug-13	2 183	0
Sep-13	2 183	0
Oct-13	2 147	0
Nov-13	2 216	0
Dec-13	2 368	0
Jan-14	2 625	1
Feb-14	2 488	0
Mar-14	2 425	0
Apr-14	2 255	0
May-14	2 042	0

Table 3-31: 2014 May Future Max Price Check Table

As can be inferred from the aforementioned, the May 2014 Future Month attained its highest price during the month of January 2014, for the period in which the aforementioned future traded.

3.2.2.6 2015 May Future Data

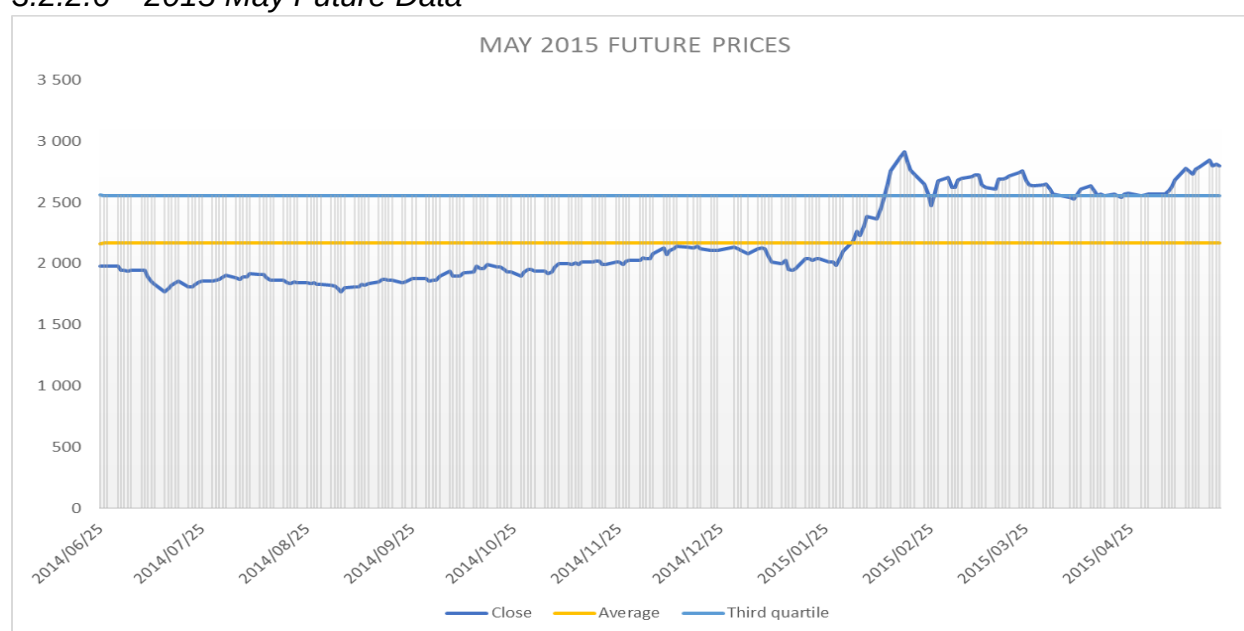


Figure 3-49: May 2015 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2170.00 with the third quartile price-level calculated to be R2563.00 As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of February to April 2015, while trading below the third quartile level for the rest of the period.

3.2.2.6.1 May 2015 Future Max Price Check

Month	Ave. Price	Max. Check
Jun-14	1 979	0
Jul-14	1 868	0
Aug-14	1 868	0
Sep-14	1 839	0
Oct-14	1 932	0
Nov-14	1 993	0
Dec-14	2 101	0
Jan-15	2 035	0
Feb-15	2 557	0
Mar-15	2 677	0
Apr-15	2 569	0
May-15	2 723	1

Table 3-32: 2015 May Future Max Price Check Table

As can be inferred from the aforementioned, the May 2015 Future Month attained its highest price during the month of May 2015, for the period in which the aforementioned future traded.

3.2.2.7 2016 May Future Data

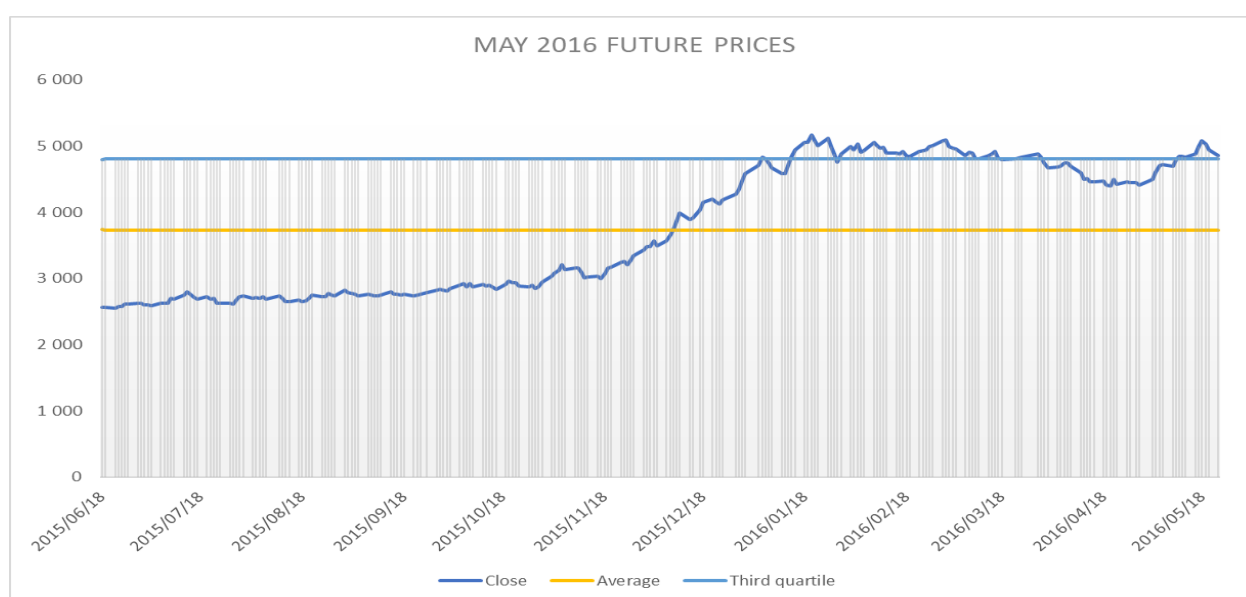


Figure 3-50: May 2016 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R3744.00 with the third quartile price-level calculated to be R4812.00 As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of January to March 2016, while trading below the third quartile level for the rest of the period.

3.2.2.7.1 May 2016 Future Max Price Check

Month	Ave. Price	Max. Check
Jun-15	2 592	0
Jul-15	2 676	0
Aug-15	2 712	0
Sep-15	2 769	0
Oct-15	2 895	0
Nov-15	3 155	0
Dec-15	3 961	0
Jan-16	4 872	0
Feb-16	4 952	1
Mar-16	4 873	0
Apr-16	4 539	0
May-16	4 823	0

Table 3-33: 2016 May Future Max Price Check Table

As can be inferred from the aforementioned, the May 2016 Future Month attained its highest price during the month of February 2016, for the period in which the aforementioned future traded.

3.2.2.8 2017 May Future Data

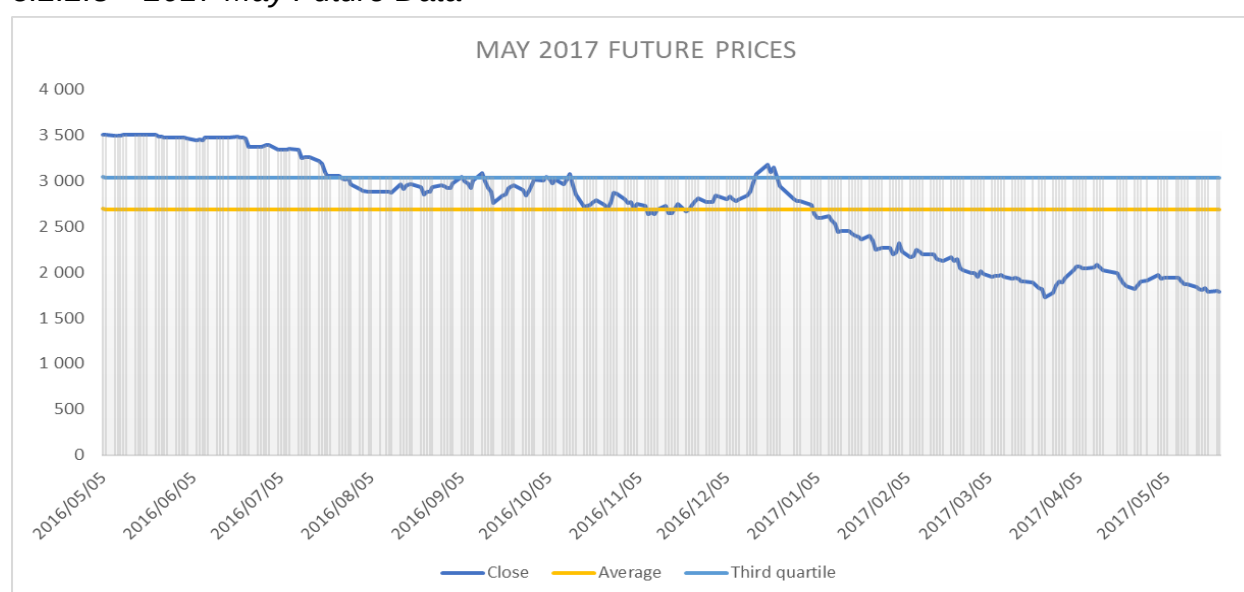


Figure 3-51: May 2017 Future Price Graph

Concerning the aforementioned figure, the average price for the period was calculated to be R2697.00 with the third quartile price-level calculated to be R3044.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of May to August 2016, while trading below the third quartile level for the rest of the period.

3.2.2.8.1 May 2017 Future Max Price Check

Month	Ave. Price	Max. Check
May-16	3 494	1
Jun-16	3 448	0
Jul-16	3 199	0
Aug-16	2 911	0
Sep-16	2 935	0
Oct-16	2 874	0
Nov-16	2 717	0
Dec-16	2 905	0
Jan-17	2 437	0
Feb-17	2 153	0
Mar-17	1 907	0
Apr-17	1 976	0
May-17	1 872	0

Table 3-34: 2017 May Future Max Price Check Table

As can be inferred from the aforementioned, the May 2017 Future Month attained its highest price during the month of May 2016, for the period in which the aforementioned future traded.

3.2.2.9 2018 May Future Data

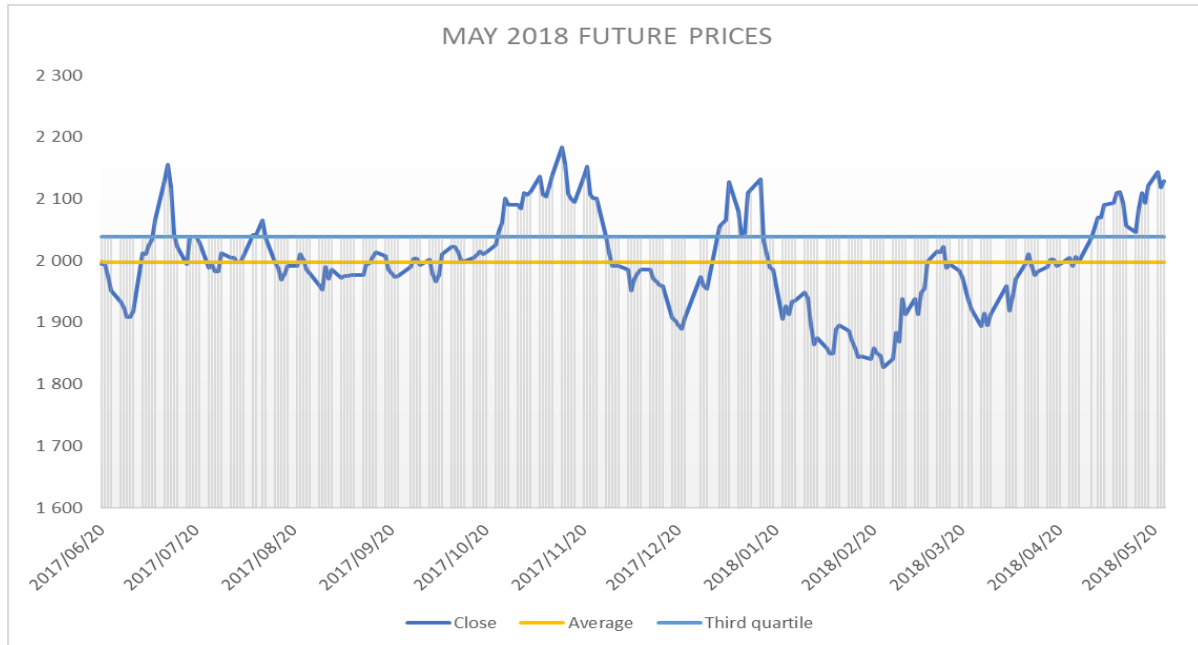


Figure 3-52: May 2018 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R1998.00 with the third quartile price-level calculated to be R2039.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of July 2017, October to November 2017, January 2018 and May 2018, while trading below the third quartile level for the rest of the period.

3.2.2.9.1 May 2018 Future Max Price Check

Month	Ave. Price	Max. Check
Jun-17	1 946	0
Jul-17	2 034	0
Aug-17	1 998	0
Sep-17	1 988	0
Oct-17	2 025	0
Nov-17	2 100	1
Dec-17	1 952	0
Jan-18	2 011	0
Feb-18	1 860	0
Mar-18	1 953	0
Apr-18	1 988	0
May-18	2 096	0

Table 3-35: 2018 May Future Max Price Check Table

As can be inferred from the aforementioned, the May 2018 Future Month attained its highest price during the month of November 2017, for the period in which the aforementioned future traded.

3.2.2.10 2019 May Future Data

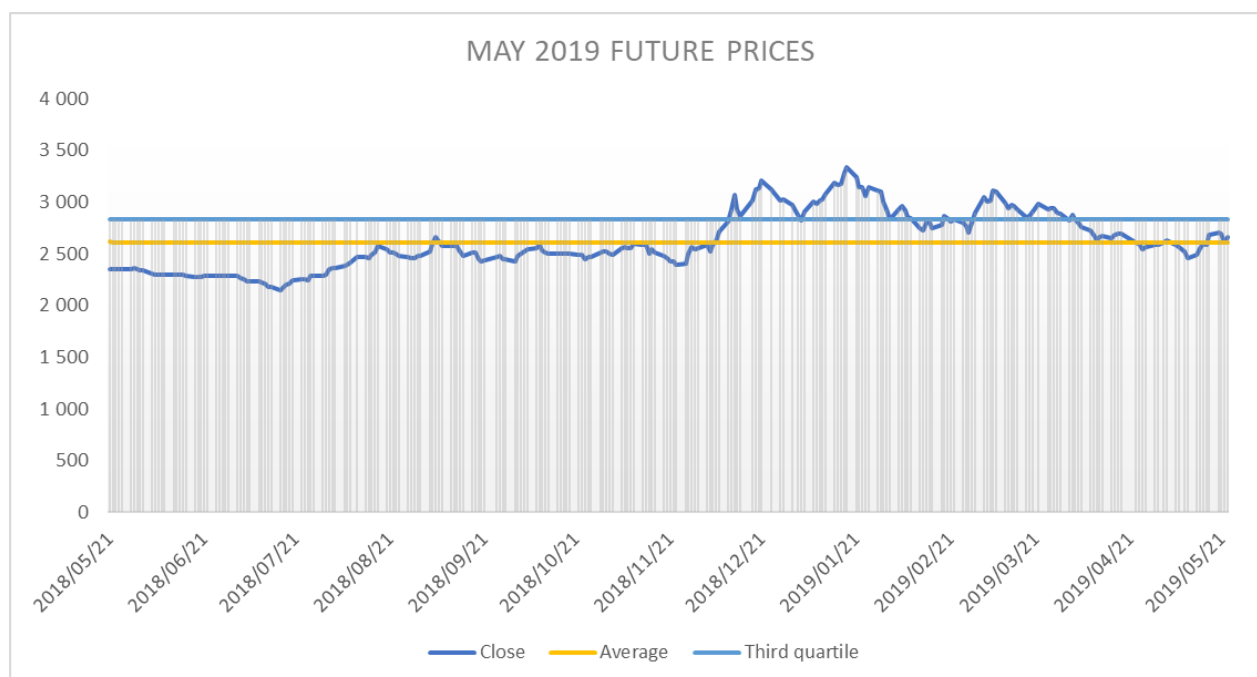


Figure 3-53: May 2019 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2614 with the third quartile price-level calculated to be R2830.00 As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of December 2018 to February 2019, while trading below the third quartile level for the rest of the period.

3.2.2.10.1 May 2019 Future Max Price Check

Month	Ave. Price	Max. Check
May-18	2 350	0
Jun-18	2 293	0
Jul-18	2 236	0
Aug-18	2 459	0
Sep-18	2 520	0
Oct-18	2 504	0
Nov-18	2 513	0
Dec-18	2 903	0
Jan-19	3 078	1
Feb-19	2 818	0
Mar-19	2 959	0
Apr-19	2 682	0
May-19	2 595	0

Table 3-36: 2019 May Future Max Price Check Table

As can be inferred from the aforementioned, the May 2019 Future Month attained its highest price during the month of January 2019, for the period in which the aforementioned future traded.

3.2.2.11 2020 May Future Data

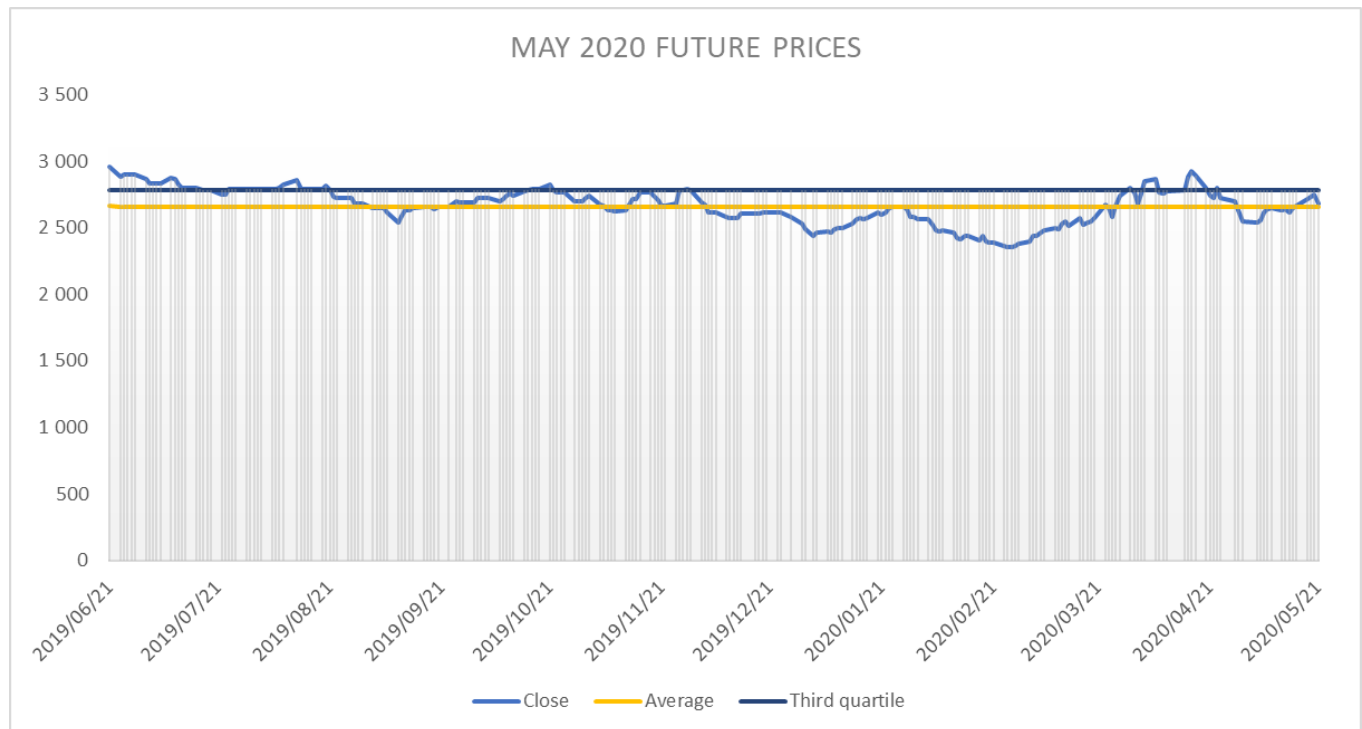


Figure 3-54: May 2020 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2666.00 with the third quartile price-level calculated to be R2780.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of June to July 2019, while trading below the third quartile level for the rest of the period.

3.2.2.11.1 May 2020 Future Max Price Check

Month	Ave. Price	Max. Check
Jun-19	2 908	1
Jul-19	2 805	0
Aug-19	2 769	0
Sep-19	2 647	0
Oct-19	2 747	0
Nov-19	2 706	0
Dec-19	2 598	0
Jan-20	2 557	0
Feb-20	2 426	0
Mar-20	2 565	0
Apr-20	2 769	0
May-20	2 647	0

Table 3-37: 2020 May Future Max Price Check Table

As can be inferred from the aforementioned, the May 2020 Future Month attained its highest price during the month of June 2019, for the period in which the aforementioned future traded.

3.2.2.12 Summary for May Futures data

3.2.2.12.1 Continuous May Futures Data

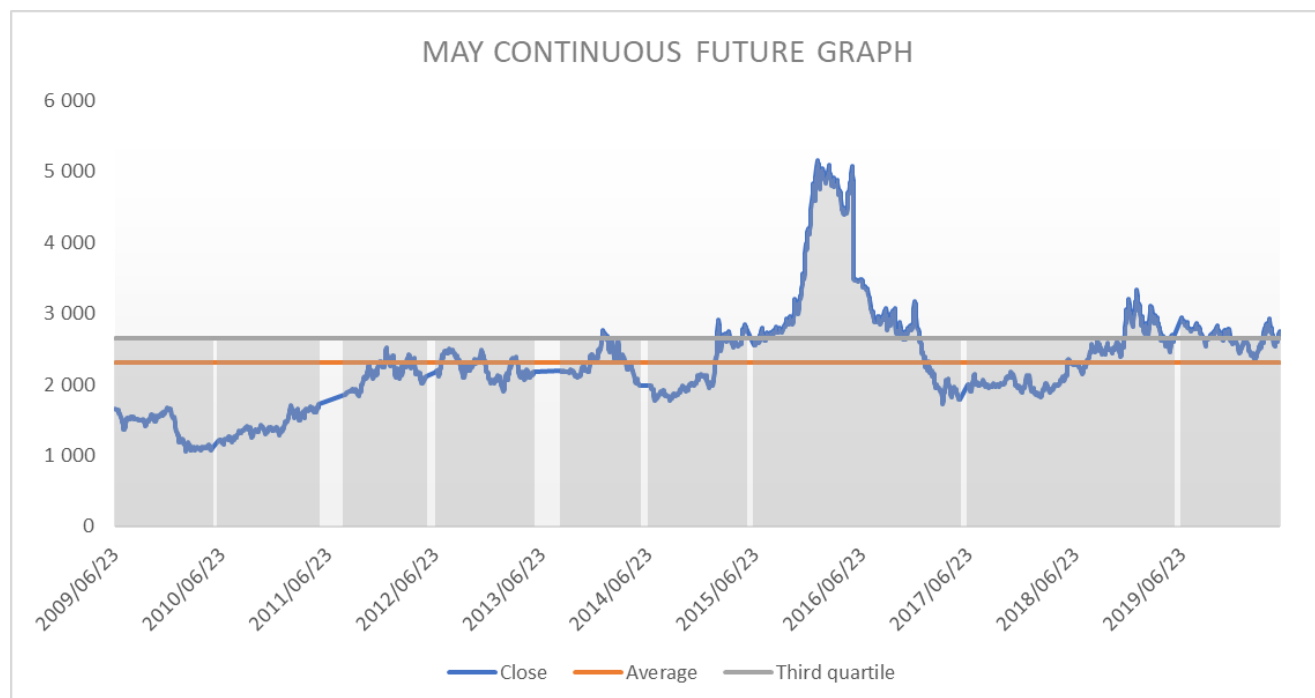


Figure 3-55: Historic May Continuous Future Graph

With regard to the above figure, a general trend can be ascertained, which is confirmed by the historic max price check, in terms of which prices tended to 'spike' 68% of the time

during December and January, in terms of which the highest seasonal prices can be attained within these two months for the majority of the seasons.

3.2.2.12.2 Cumulative Max Price Check

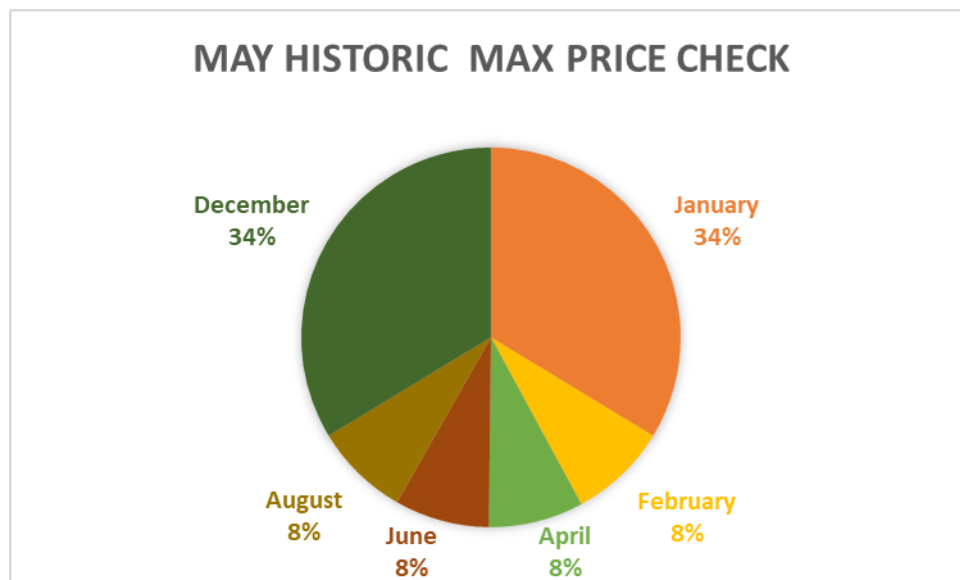


Figure 3-56: May Historic Futures Max Price Check

As can be ascertained from the aforementioned figure, the May Futures historically attained its seasonal highest prices during the months of December and January for 68% of the time. It can therefore be inferred that any seller who wishes to hedge May futures can do so during the months of December and January, with a 68% chance of attaining the highest average prices during the said period.

3.2.3 Historical SAFEX July Future Data

3.2.3.1 2010 July Future data

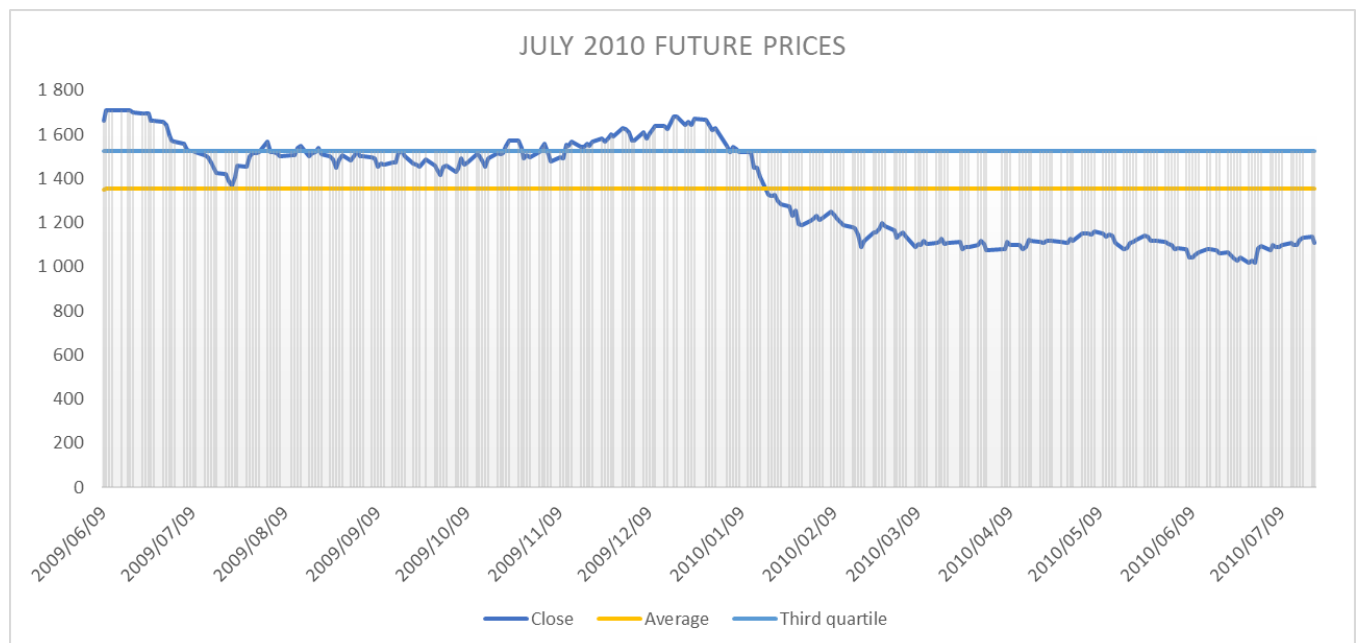


Figure 3-57: July 2010 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R1354.00 with the third quartile price-level calculated to be R1525.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of June to July 2009, and between December 2009 to January 2010 while trading below the third quartile level for the rest of the period.

3.2.3.1.1 July 2010 Future Max Price Check

Month	Ave.Price	Max. Check
Jun-09	1 689	1
Jul-09	1 490	0
Aug-09	1 511	0
Sep-09	1 480	0
Oct-09	1 496	0
Oct-09	1 552	0
Dec-09	1 630	0
Jan-10	1 386	0
Feb-10	1 188	0
Mar-10	1 114	0
Apr-10	1 105	0
May-10	1 128	0
Jun-10	1 059	0
Jul-10	1 103	0

Table 3-38: 2010 July Future Max Price Check Table

As can be inferred from the aforementioned, the July 2010 Future Month attained its highest price during the month of June 2009, for the period in which the aforementioned future traded.

3.2.3.2 2011 July Future data

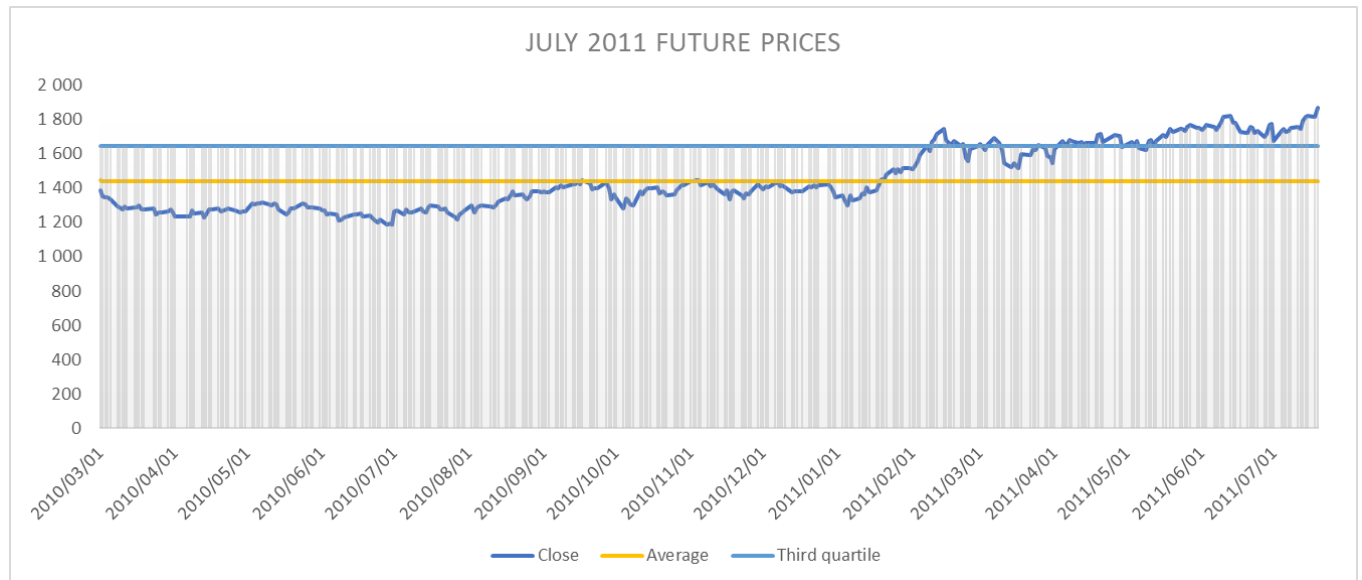


Figure 3-58: July 2011 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R1447.00 with the third quartile price-level calculated to be R1643.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of June to July 2011, while trading below the third quartile level for the rest of the period.

3.2.3.2.1 July 2011 Future Max Price Check

Month	Ave. Price	Max. Check
Mar-10	1 293	0
Apr-10	1 259	0
May-10	1 293	0
Jun-10	1 228	0
Jul-10	1 264	0
Aug-10	1 330	0
Sep-10	1 402	0
Oct-10	1 366	0
Nov-10	1 397	0
Dec-10	1 401	0
Jan-11	1 415	0
Feb-11	1 631	0
Mar-11	1 604	0
Apr-11	1 670	0
May-11	1 701	0
Jun-11	1 754	0
Jul-11	1 766	1

Table 3-39: 2011 July Future Max Price Check Table

As can be inferred from the aforementioned, the July 2011 Future Month attained its highest price during the month of July 2011, for the period in which the aforementioned future traded.

3.2.3.3 2012 July Future data

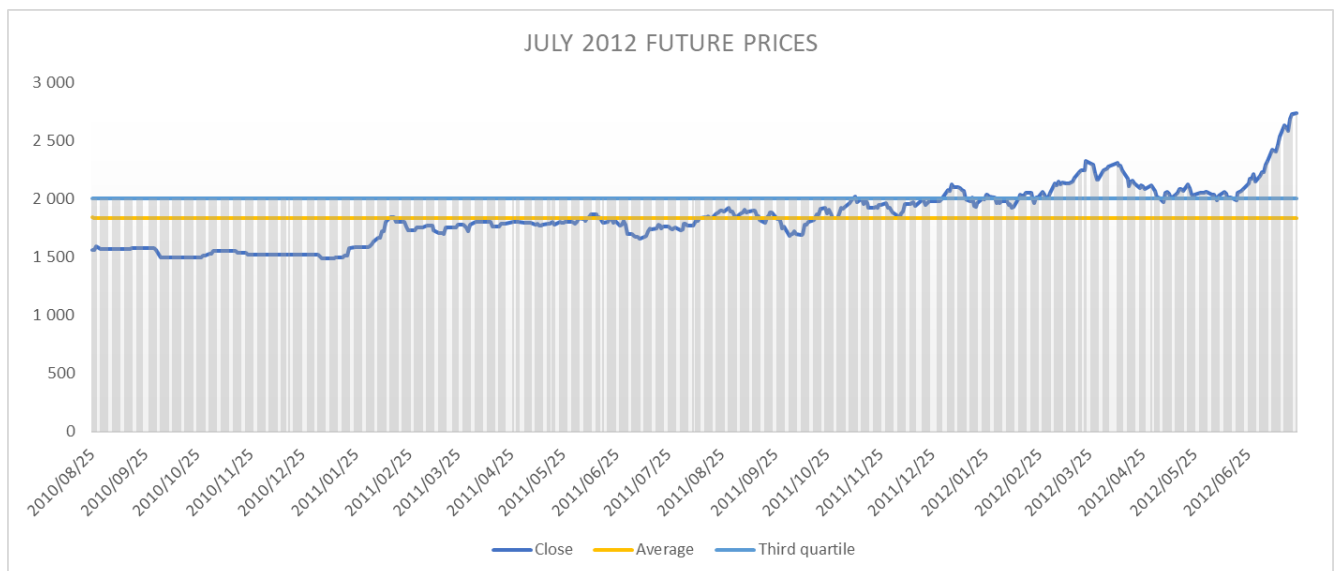


Figure 3-59: July 2012 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R1841.00 with the third quartile price-level calculated to be R2004.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-

most 25% of the seasonal price band) for the months of March to April 2012 and again in June of 2012, while trading below the third quartile level for the rest of the period.

3.2.3.3.1 July 2012 Future Max Price Check

Month	Ave. Price	Max. Check
Aug-10	1 571	0
Sep-10	1 574	0
Oct-10	1 501	0
Nov-10	1 538	0
Dec-10	1 522	0
Jan-11	1 528	0
Feb-11	1 733	0
Mar-11	1 746	0
Apr-11	1 790	0
May-11	1 790	0
Jun-11	1 818	0
Jul-11	1 723	0
Aug-11	1 836	0
Sep-11	1 848	0
Oct-11	1 800	0
Nov-11	1 950	0
Dec-11	1 941	0
Jan-12	2 029	0
Feb-12	2 000	0
Mar-12	2 175	0
Apr-12	2 190	0
May-12	2 050	0
Jun-12	2 066	0
Jul-12	2 469	1

Table 3-40: 2012 July Future Max Price Check Table

As can be inferred from the aforementioned, the July 2012 Future Month attained its highest price during the month of July 2012, for the period in which the aforementioned future traded.

3.2.3.4 2013 July Future data

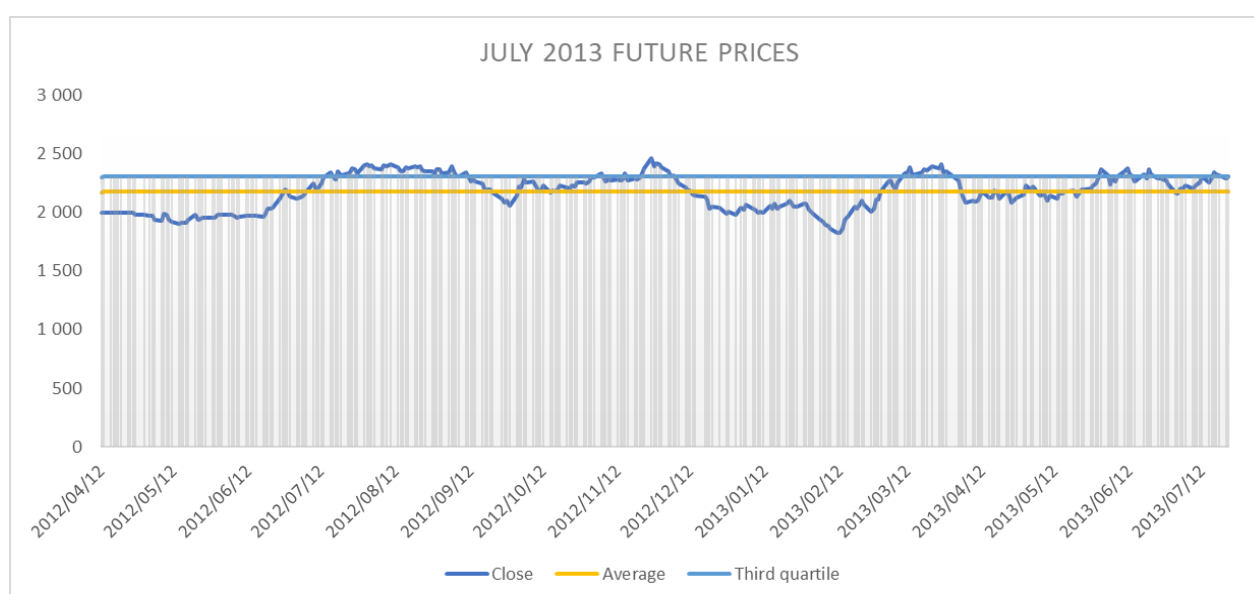


Figure 3-60: July 2013 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2178.00 with the third quartile price-level calculated to be R2306.00 As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of July to September 2012 and while trading below or close to the third quartile level for the rest of the period.

3.2.3.4.1 July 2013 Future Max Price Check

Month	Ave. Price	Max. Check
Apr-12	1 996	0
May-12	1 948	0
Jun-12	2 027	0
Jul-12	2 277	0
Aug-12	2 374	1
Sep-12	2 238	0
Oct-12	2 219	0
Nov-12	2 325	0
Dec-12	2 153	0
Jan-13	2 045	0
Feb-13	1 974	0
Mar-13	2 318	0
Apr-13	2 146	0
May-13	2 188	0
Jun-13	2 304	0
Jul-13	2 257	0

Table 3-41: 2013 July Future Max Price Check Table

As can be inferred from the aforementioned, the July 2013 Future Month attained its highest price during the month of August 2012, for the period in which the aforementioned future traded.

3.2.3.5 2014 July Future data

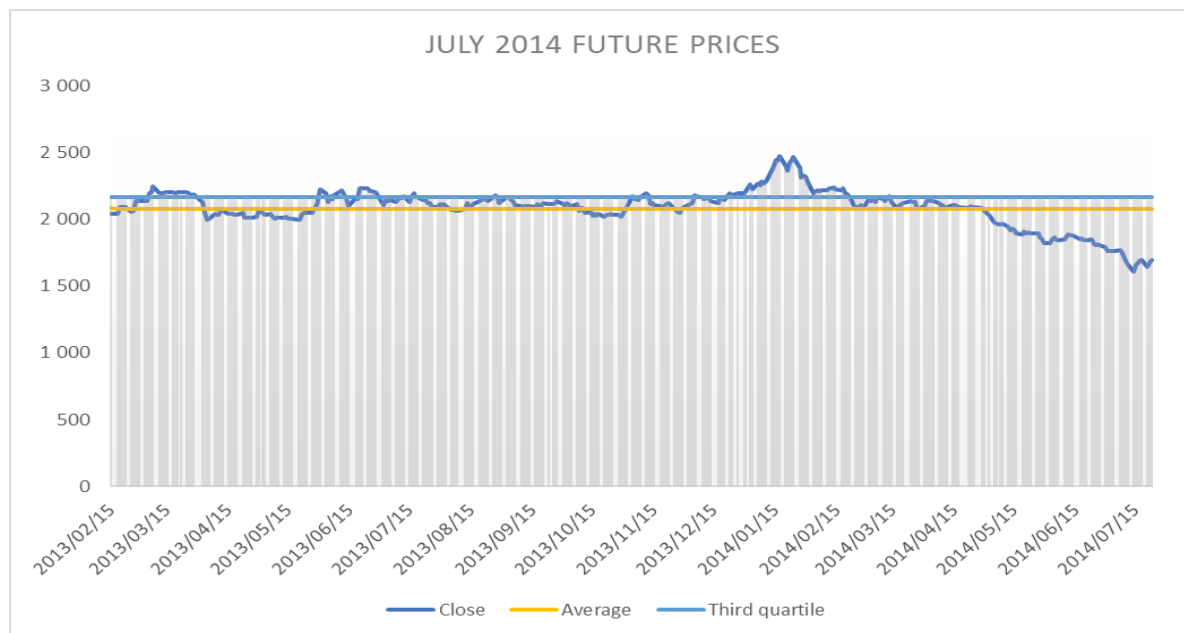


Figure 3-61: July 2014 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2087.00 with the third quartile price-level calculated to be R2166.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of January to February 2014 and while trading below or close to the third quartile level for the rest of the period.

3.2.3.5.1 July 2014 Future Max Price Check

Month	Ave. Price	Max. Check
Feb-13	2 085	0
Mar-13	2 191	0
Apr-13	2 038	0
May-13	2 045	0
Jun-13	2 189	0
Jul-13	2 141	0
Aug-13	2 119	0
Sep-13	2 118	0
Oct-13	2 059	0
Nov-13	2 118	0
Dec-13	2 161	0
Jan-14	2 351	1
Feb-14	2 184	0
Mar-14	2 129	0
Apr-14	2 105	0
May-14	1 917	0
Jun-14	1 845	0
Jul-14	1 705	0

Table 3-42: 2014 July Future Max Price Check Table

As can be inferred from the aforementioned, the July 2014 Future Month attained its highest price during the month of January 2014, for the period in which the aforementioned future traded.

3.2.3.6 2015 July Future data

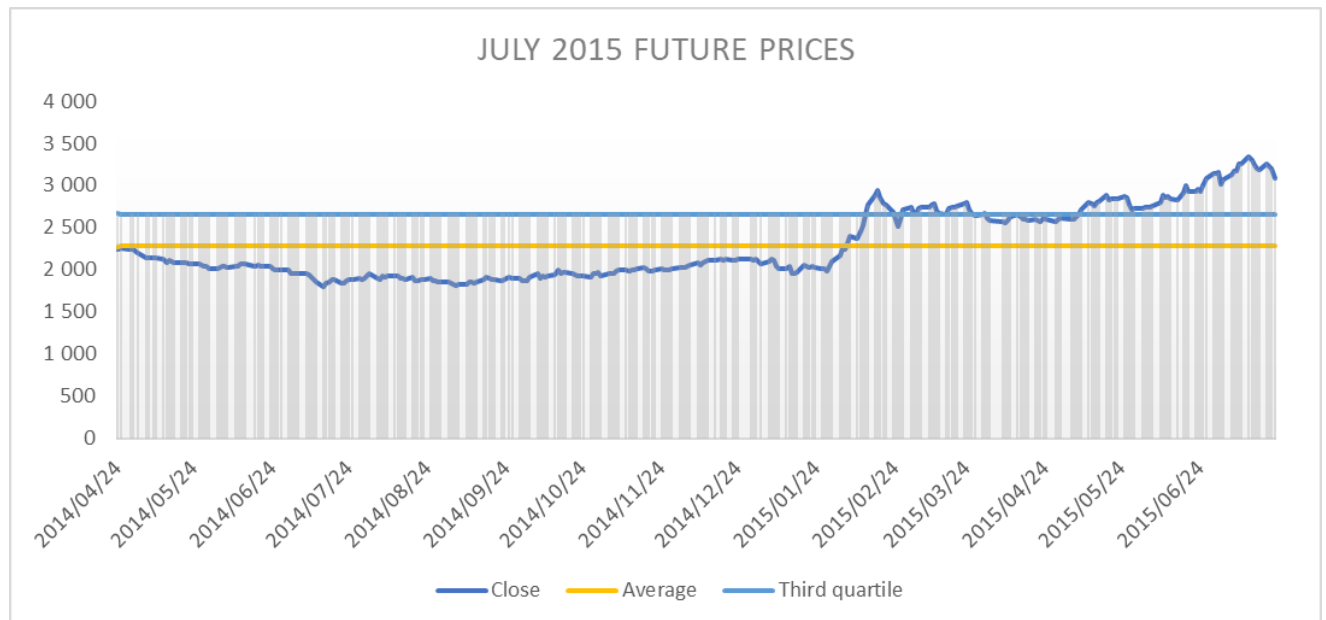


Figure 3-62: July 2015 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2288.00 with the third quartile price-level calculated to be R2674.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of May to July 2015 and while trading below or close to the third quartile level for the rest of the period.

3.2.3.6.1 July 2015 Future Max Price Check

Month	Ave. Price	Max. Check
Apr-14	2 245	0
May-14	2 094	0
Jun-14	2 030	0
Jul-14	1 894	0
Aug-14	1 895	0
Sep-14	1 867	0
Oct-14	1 935	0
Nov-14	1 994	0
Dec-14	2 091	0
Jan-15	2 033	0
Feb-15	2 575	0
Mar-15	2 717	0
Apr-15	2 596	0
May-15	2 765	0
Jun-15	2 897	0
Jul-15	3 191	1

Table 3-43: 2015 July Future Max Price Check Table

As can be inferred from the aforementioned, the July 2015 Future Month attained its highest price during the month of July 2015, for the period in which the aforementioned future traded.

3.2.3.7 2016 July Future data

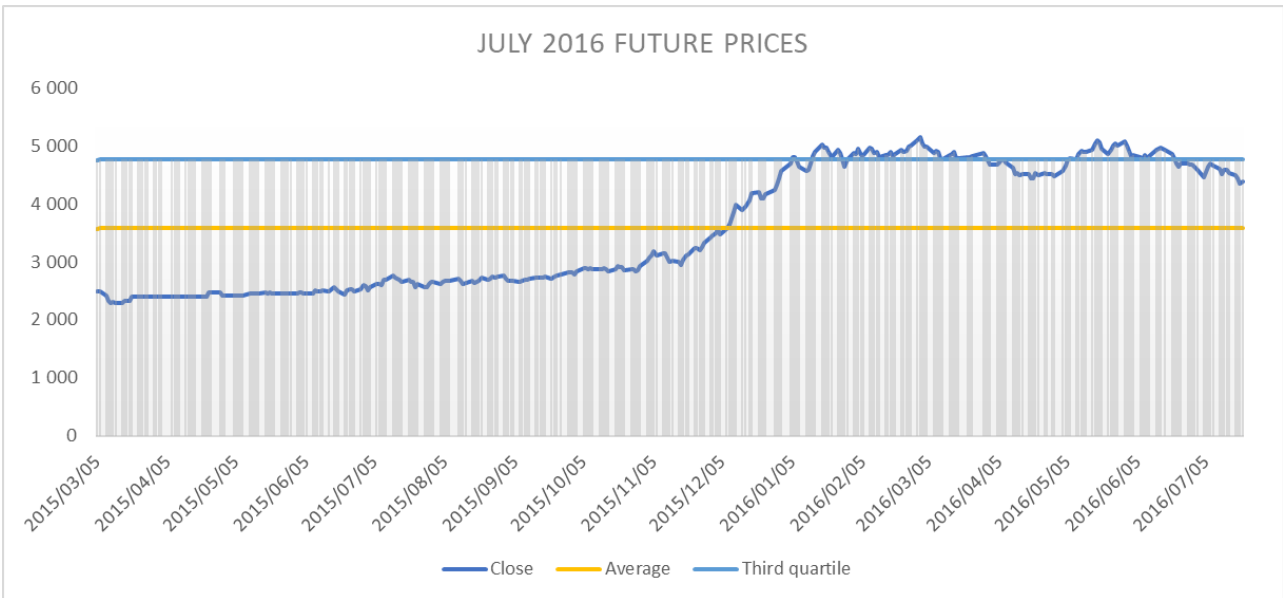


Figure 3-63: July 2016 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R3580.00 with the third quartile price-level calculated to be R4764.00 As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of January to June 2016 and while trading below or close to the third quartile level for the rest of the period.

3.2.3.7.1 July 2016 Future Max Price Check

Month	Ave. Price	Max. Check
Mar-15	2 373	0
Apr-15	2 415	0
May-15	2 445	0
Jun-15	2 496	0
Jul-15	2 636	0
Aug-15	2 683	0
Sep-15	2 726	0
Oct-15	2 872	0
Nov-15	3 129	0
Dec-15	3 949	0
Jan-16	4 793	0
Feb-16	4 899	0
Mar-16	4 871	0
Apr-16	4 572	0
May-16	4 907	1
Jun-16	4 795	0
Jul-16	4 536	0

Table 3-44: 2016 July Future Max Price Check Table

As can be inferred from the aforementioned, the July 2016 Future Month attained its highest price during the month of May 2016, for the period in which the aforementioned future traded.

3.2.3.8 2017 July Future data

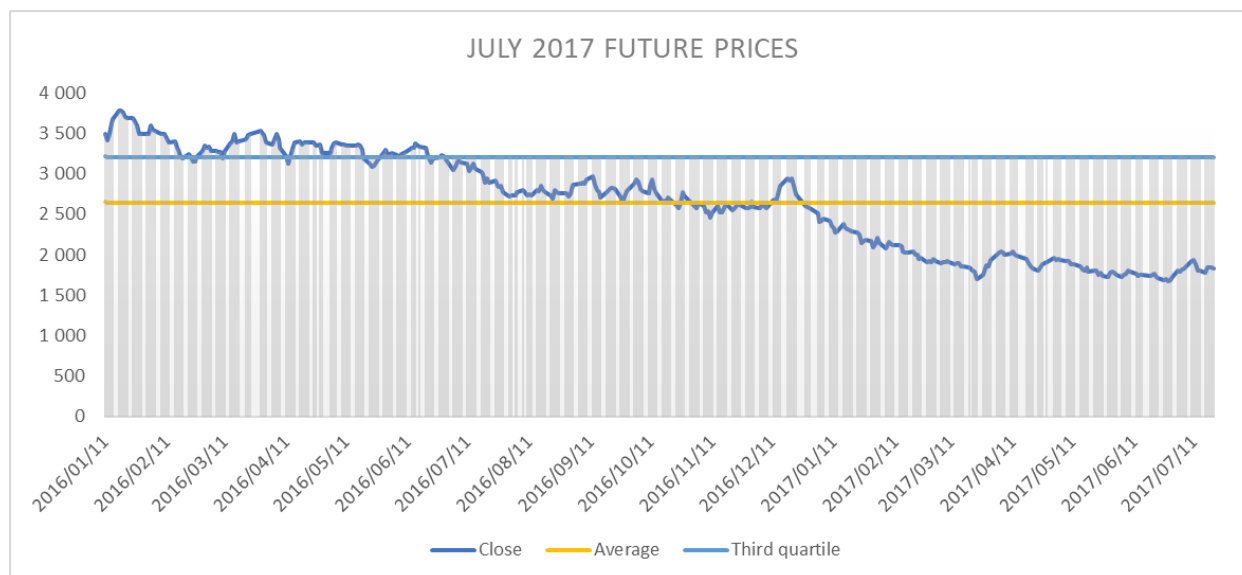


Figure 3-64: July 2017 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2654.00 with the third quartile price-level calculated to be R3224.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-

most 25% of the seasonal price band) for the months of January to June 2016 and while trading below or close to the third quartile level for the rest of the period.

3.2.3.8.1 July 2017 Future Max Price Check

Month	Ave. Price	Max. Check
Jan-16	3 624	1
Feb-16	3 367	0
Mar-16	3 380	0
Apr-16	3 349	0
May-16	3 279	0
Jun-16	3 246	0
Jul-16	3 005	0
Aug-16	2 761	0
Sep-16	2 815	0
Oct-16	2 754	0
Nov-16	2 576	0
Dec-16	2 702	0
Jan-17	2 304	0
Feb-17	2 057	0
Mar-17	1 866	0
Apr-17	1 947	0
May-17	1 844	0
Jun-17	1 741	0
Jul-17	1 838	0

Table 3-45: 2017 July Future Max Price Check Table

As can be inferred from the aforementioned, the July 2017 Future Month attained its highest price during the month of January 2016, for the period in which the aforementioned future traded.

3.2.3.9 2018 July Future data

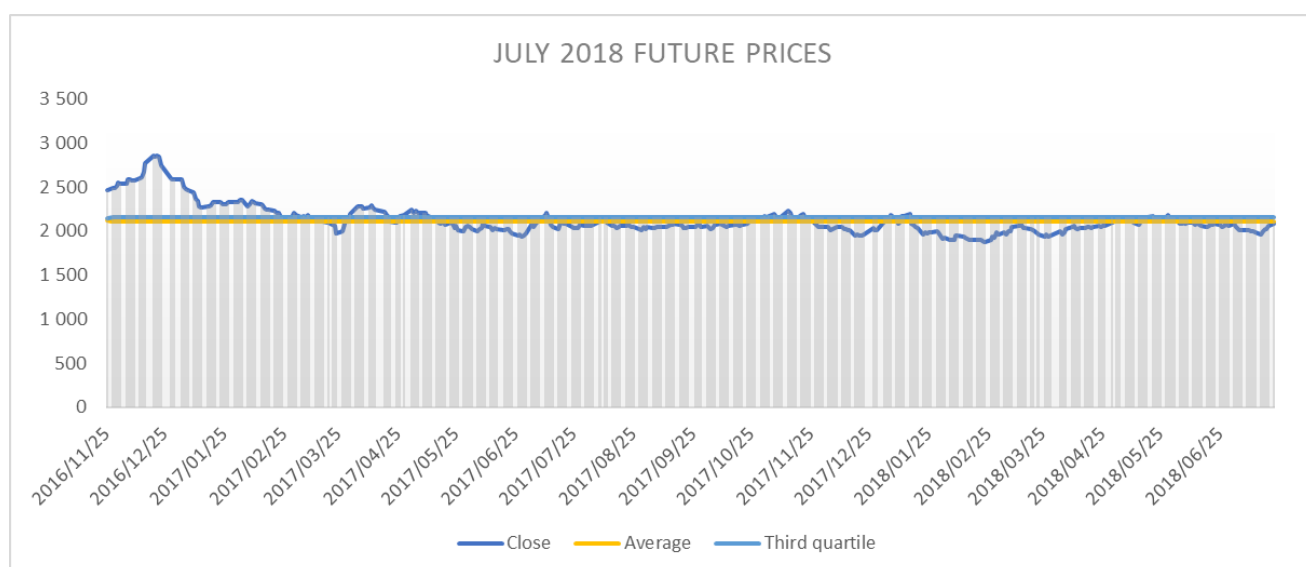


Figure 3-65: July 2018 Future Price Graph

Concerning the aforementioned figure, the average price for the period was calculated to be R2122.00 with the third quartile price-level calculated to be R2162.00. As can be Inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of November 2016 to February 2017 and while trading below or close to the third quartile level for the rest of the period.

3.2.3.9.1 July 2018 Future Max Price Check

Month	Ave. Price	Max. Check
Nov-16	2 486	0
Dec-17	2 659	1
Jan-17	2 355	0
Feb-17	2 257	0
Mar-17	2 122	0
Apr-17	2 215	0
May-17	2 119	0
Jun-17	2 007	0
Jul-17	2 082	0
Aug-17	2 061	0
Sep-17	2 052	0
Oct-17	2 080	0
Nov-17	2 146	0
Dec-17	2 006	0
Jan-18	2 063	0
Feb-18	1 910	0
Mar-18	1 996	0
Apr-18	2 035	0
May-18	2 136	0
Jun-18	2 077	0
Jul-18	2 017	0

Table 3-46: 2018 July Future Max Price Check Table

As can be inferred from the aforementioned, the July 2018 Future Month attained its highest price during the month of December 2017, for the period in which the aforementioned future traded.

3.2.3.10 2019 July Future data

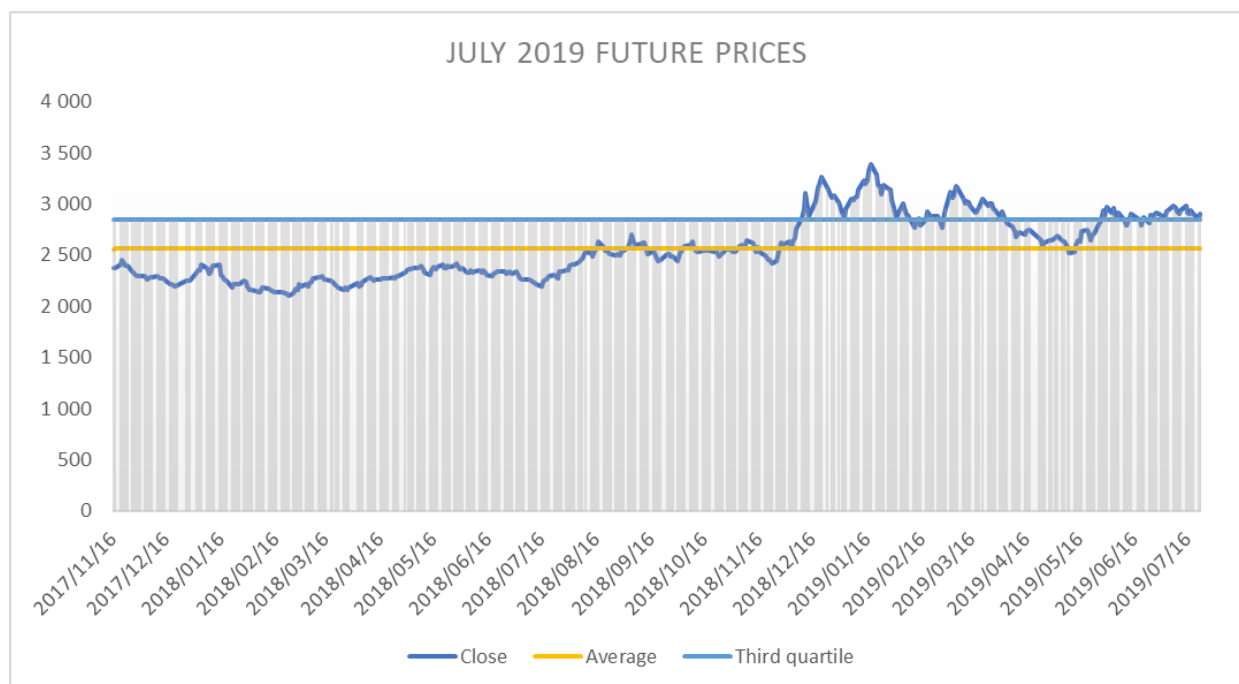


Figure 3-66: July 2019 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2565.00 with the third quartile price-level calculated to be R2851.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of December 2018 to April 2019, while trading below or close to the third quartile level for the rest of the period.

3.2.3.10.1 July 2019 Future Max Price Check

Month	Ave. Price	Max. Check
Nov-17	2 369	0
Dec-17	2 256	0
Jan-18	2 295	0
Feb-18	2 148	0
Mar-18	2 227	0
Apr-18	2 266	0
May-18	2 374	0
Jun-18	2 334	0
Jul-18	2 280	0
Aug-18	2 507	0
Sep-18	2 553	0
Oct-18	2 545	0
Nov-18	2 548	0
Dec-18	2 943	0
Jan-19	3 123	1
Feb-19	2 870	0
Mar-19	3 020	0
Apr-19	2 736	0
May-19	2 706	0
Jun-19	2 868	0
Jul-19	2 916	0

Table 3-47: 2019 July Future Max Price Check Table

As can be inferred from the aforementioned, the July 2019 Future Month attained its highest price during the month of January 2019, for the period in which the aforementioned future traded.

3.2.3.11 2020 July Future data

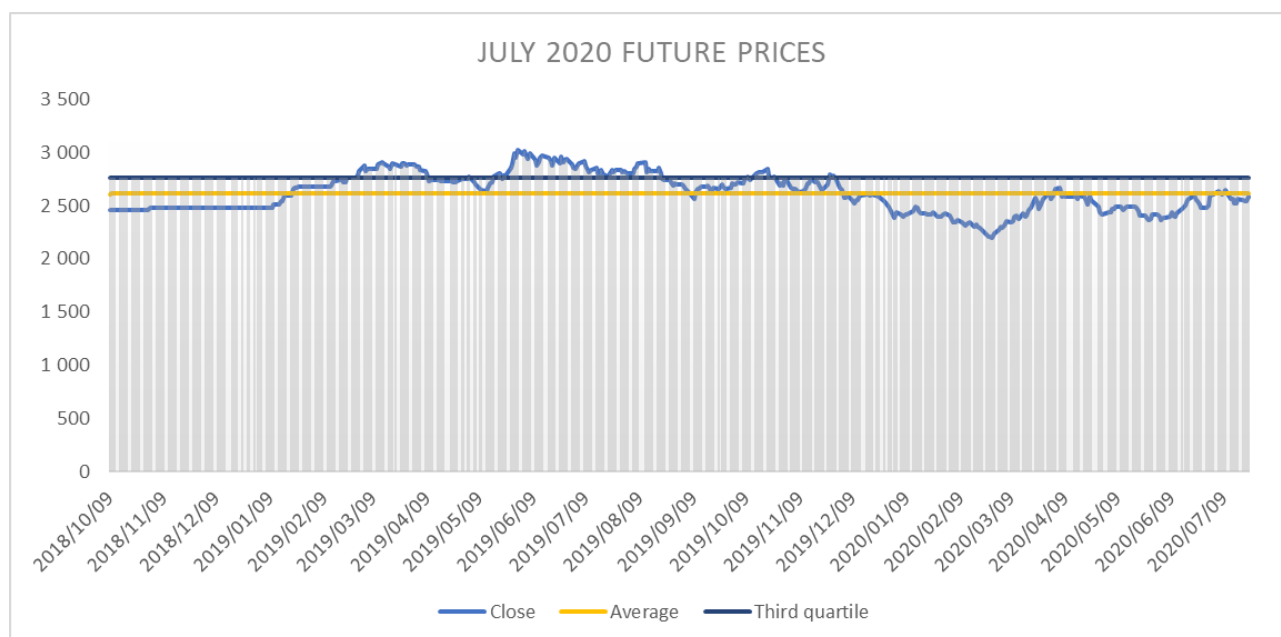


Figure 3-67: July 2020 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2622.00 with the third quartile price-level calculated to be R2760.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of March to April 2019, and again for June to September 2019 while trading below or close to the third quartile level for the rest of the period.

3.2.3.11.1 July 2020 Future Max Price Check

Month	Ave. Price	Max. Check
Oct-18	2 463	0
Nov-18	2 476	0
Dec-18	2 477	0
Jan-19	2 574	0
Feb-19	2 716	0
Mar-19	2 872	0
Apr-19	2 777	0
May-19	2 782	0
Jun-19	2 942	1
Jul-19	2 838	0
Aug-19	2 800	0
Sep-19	2 659	0
Oct-19	2 756	0
Nov-19	2 702	0
Dec-19	2 575	0
Jan-20	2 426	0
Feb-20	2 303	0
Mar-20	2 430	0
Apr-20	2 570	0
May-20	2 450	0
Jun-20	2 468	0
Jul-20	2 582	0

Table 3-48: 2020 July Future Max Price Check Table

As can be inferred from the aforementioned, the July 2020 Future Month attained its highest price during the month of June 2019, for the period in which the aforementioned future traded.

3.2.3.12 Summary for July Future Data

3.2.3.12.1 Continuous July Future Graph

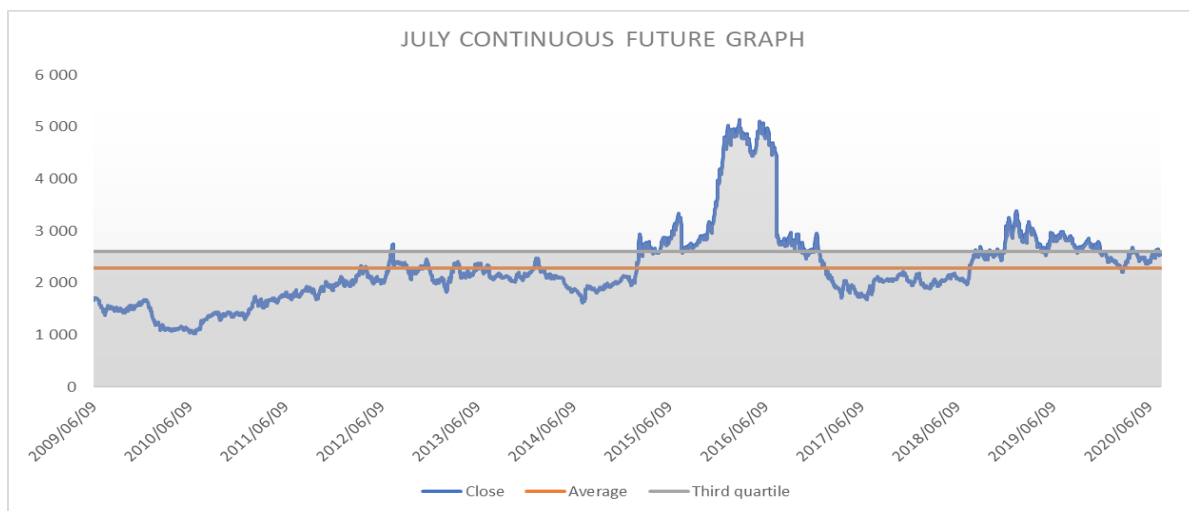


Figure 3-68: Continuous July Future Price Graph

General trends can be ascertained from the above figure, though less so than its spot market counterpart. Despite the period of 2015 to 2016, a general upward trend can be determined between the different periods, with subsequent 'spikes' in prices generally discerned during the summer planting months, or within the harvest months in years of below-average crops. The results of this analysis, however, was quite surprising, due to a general belief of higher July prices during the summer planting months.

3.2.3.12.2 Historic July Future Max Price Check

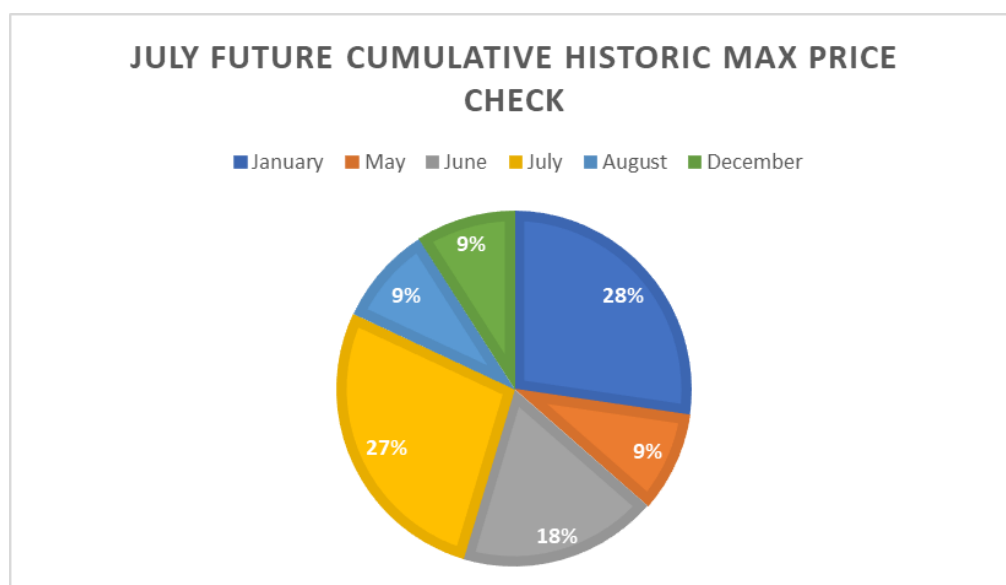


Figure 3-69: July Future Historic Max Price Check

In terms of the aforementioned figure, a seller would have a 37% chance of attaining the highest seasonal price for a July Future, by selling in January and December, however, if the seller wished to remain unhedged and sell during the period of May to July, with a 54% chance of attaining the highest price for the season. Given the lack of a general trend, alternatively the 'split' ascertainable in the above figure, July Futures should be reconsidered as viable pre-harvest hedging months, due to the lack of a general well-established ascertainable trend.

3.2.4 Historical SAFEX September Future data

3.2.4.1 2010 September Future data

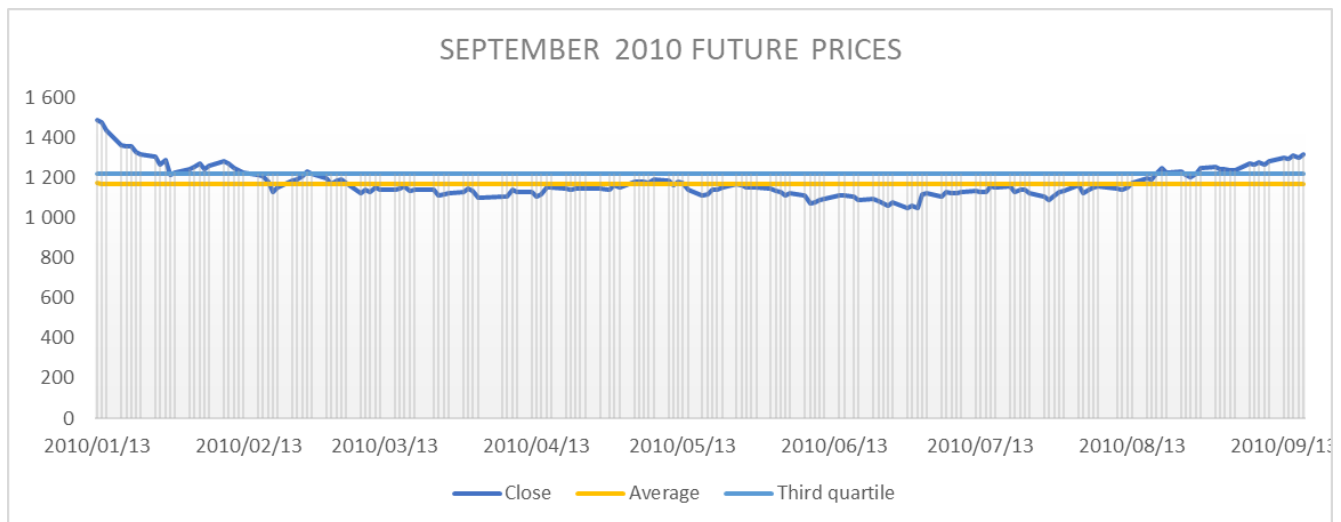


Figure 3-70: September 2010 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R1178.00 with the third quartile price-level calculated to be R1223.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of January 2010, and again for September 2010 while trading below or close to the third quartile level for the rest of the period.

3.2.4.1.1 September 2010 Future Max Price Check

Month	Ave.Price	Max. Check
Jan-10	1 342	1
Feb-10	1 225	0
Mar-10	1 147	0
Apr-10	1 136	0
May-10	1 161	0
Jun-10	1 093	0
Jul-10	1 130	0
Aug-10	1 194	0
Sep-10	1 278	0

Table 3-49: 2010 September Future Max Price Check Table

As can be inferred from the aforementioned, the September 2010 Future Month attained its highest price during the month of January 2010, for the period in which the aforementioned future traded.

3.2.4.2 2011 September Future data

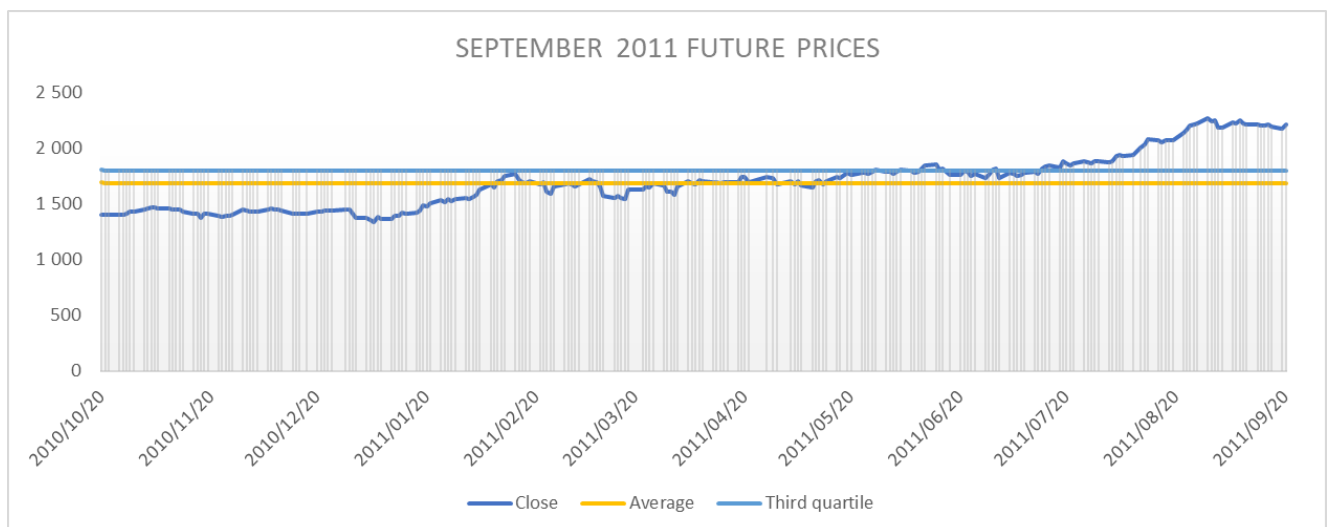


Figure 3-71: September 2011 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R1696.00 with the third quartile price-level calculated to be R1803.00. As can be inferred from, daily close prices traded above the third quartile level (within the uppermost 25% of the seasonal price band) for the months of August to September 2011, while trading below or close to the third quartile level for the rest of the period.

3.2.4.2.1 September 2011 Future Max Price Check

Month	Ave. Price	Max. Check
Oct-10	1 410	0
Nov-11	1 428	0
Dec-10	1 431	0
Jan-11	1 445	0
Feb-11	1 663	0
Mar-11	1 636	0
Apr-11	1 701	0
May-11	1 736	0
Jun-11	1 791	0
Jul-11	1 824	0
Aug-11	2 075	0
Sep-11	2 208	1

Table 3-50: 2011 September Future Max Price Check Table

As can be inferred from the aforementioned, the September 2011 Future Month attained its highest price during the month of September 2011, for the period in which the aforementioned future traded.

3.2.4.3 2012 September Future data

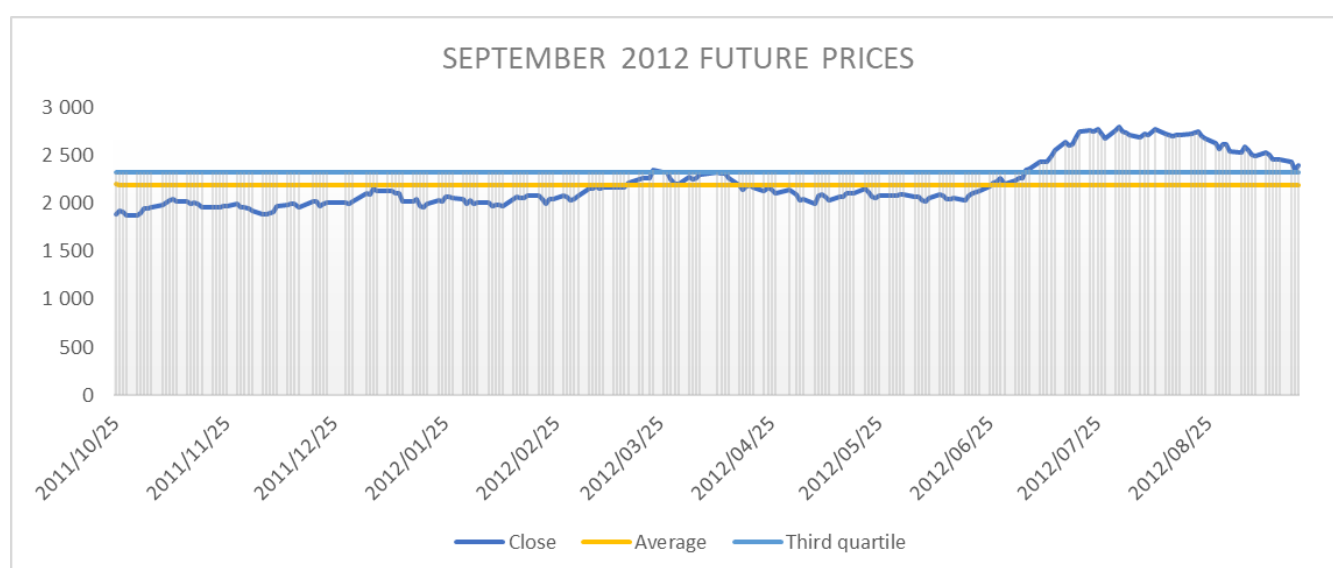


Figure 3-72: September 2012 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2204.00 with the third quartile price-level calculated to be R2323.00. As can be inferred from, daily close prices traded above the third quartile level (within the uppermost 25% of the seasonal price band) for the months of July to September 2012, while trading below or close to the third quartile level for the rest of the period.

3.2.4.3.1 September 2012 Future Max Price Check

Month	Ave. Price	Max. Check
Oct-11	1 892	0
Nov-11	1 980	0
Dec-11	1 968	0
Jan-12	2 061	0
Feb-12	2 032	0
Mar-12	2 202	0
Apr-12	2 215	0
May-12	2 078	0
Jun-12	2 106	0
Jul-12	2 564	0
Aug-12	2 694	1
Sep-12	2 483	0

Table 3-51: 2012 September Future Max Price Check Table

As can be inferred from the aforementioned, the September 2012 Future Month attained its highest price during the month of August 2012, for the period in which the aforementioned future traded.

3.2.4.4 2013 September Future data

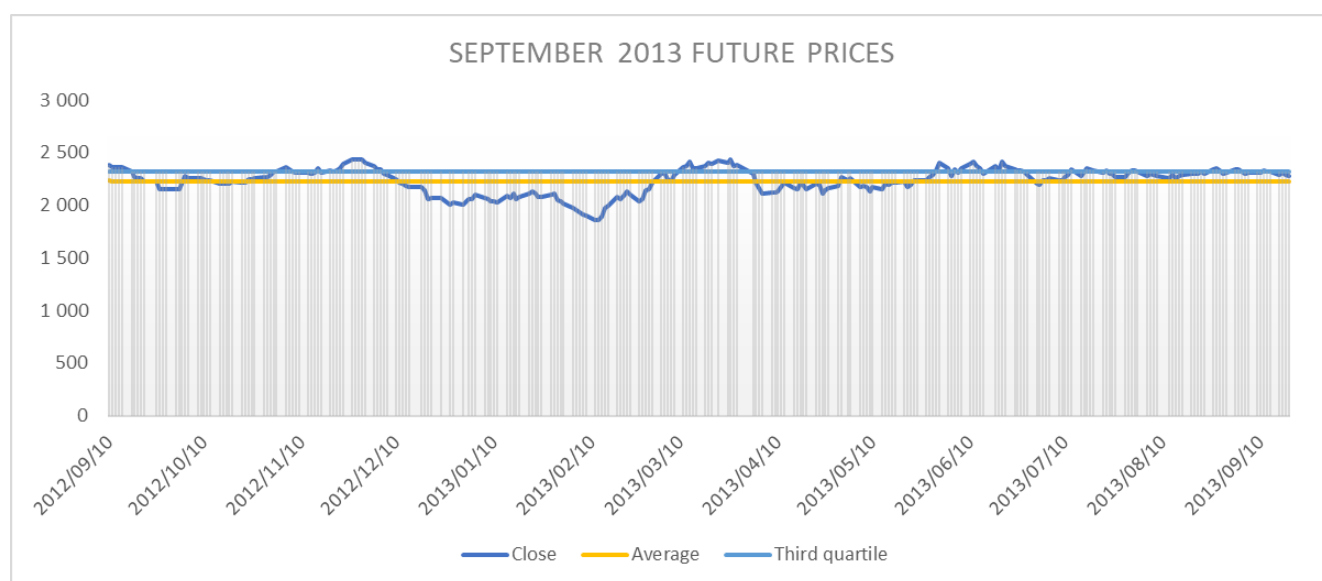


Figure 3-73: September 2013 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2235.00 with the third quartile price-level calculated to be R2323.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of December 2012, and again in April 2013 while trading below or close to the third quartile level for the rest of the period.

3.2.4.5 September 2013 Future Max Price Check

Month	Ave. Price	Max. Check
Sep-12	2 272	0
Oct-12	2 231	0
Nov-12	2 352	1
Dec-12	2 179	0
Jan-13	2 076	0
Feb-13	2 005	0
Mar-13	2 348	0
Apr-13	2 176	0
May-13	2 222	0
Jun-13	2 344	0
Jul-13	2 283	0
Aug-13	2 301	0
Sep-13	2 310	0

Table 3-52: 2013 September Future Max Price Check Table

As can be inferred from the aforementioned, the September 2013 Future Month attained its highest price during the month of November 2012, for the period in which the aforementioned future traded.

3.2.4.6 2014 September Future data

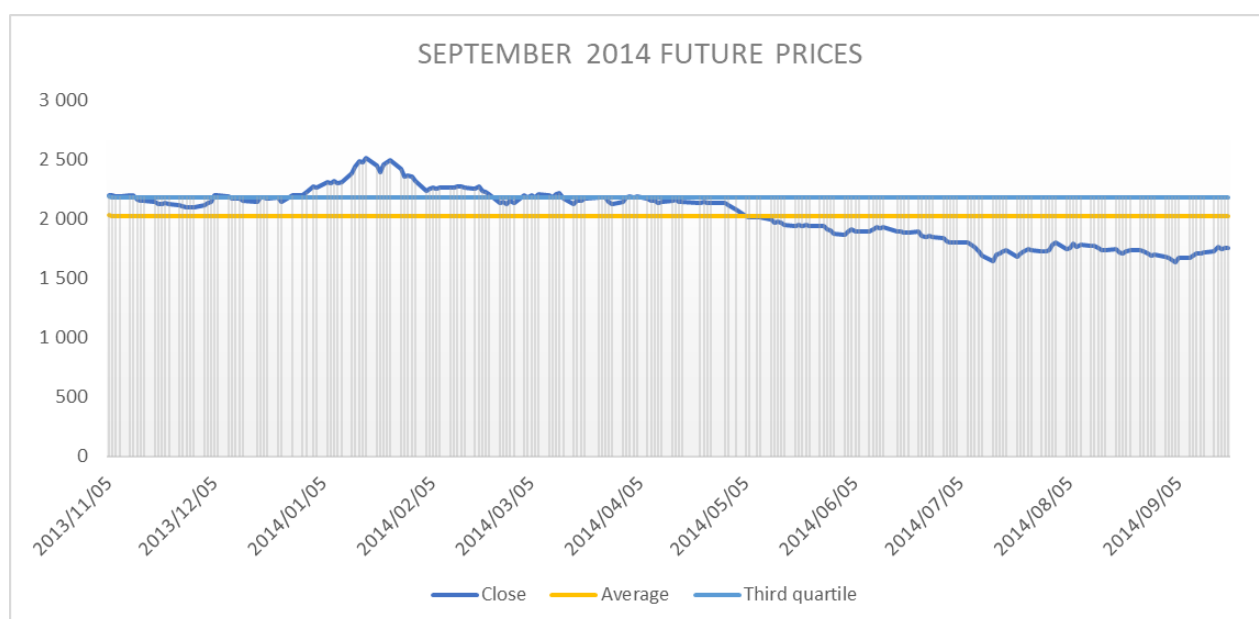


Figure 3-74: September 2014 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2029.00 with the third quartile price-level calculated to be R2189.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of January to February 2014, while trading below or close to the third quartile level for the rest of the period.

3.2.4.6.1 September 2014 Future Max Price Check

Month	Ave. Price	Max Check
November 2013	2 147	0
December 2013	2 171	0
January 2014	2 383	1
February 2014	2 224	0
March 2014	2 174	0
April 2014	2 150	0
May 2014	1 963	0
June 2014	1 887	0
July 2014	1 740	0
August 2014	1 742	0
September 2014	1 703	0

Table 3-53: 2014 September Future Max Price Check Table

As can be inferred from the aforementioned, the September 2014 Future Month attained its highest price during the month of January 2014, for the period in which the aforementioned future traded.

3.2.4.7 2015 September Future data

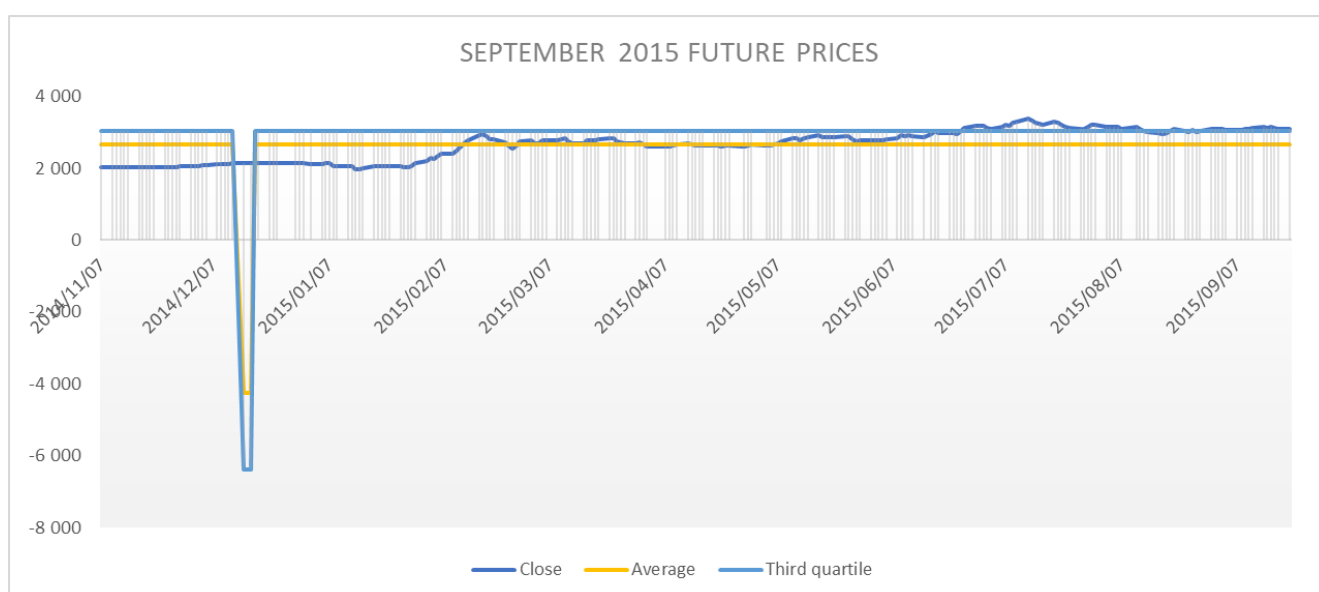


Figure 3-75: September 2015 Future Price Graph

The drop in the graphs between December 2014 and January 2015 is due to a 'data gap' of a few days, and hence bears no significance on this analysis and may be ignored.

Furthermore, and with regard to the aforementioned figure, the average price for the period was calculated to be R2673.00 with the third quartile price-level calculated to be R3036.00. As can be inferred from, daily close prices traded above the third quartile level

(within the upper-most 25% of the seasonal price band) for the months of July to August 2015, while trading below or close to the third quartile level for the rest of the period.

3.2.4.7.1 September 2015 Future Max Price Check

Month	Ave. Price	Max. Check
November 2014	2 033	0
December 2014	2 117	0
January 2015	2 064	0
February 2015	2 600	0
March 2015	2 754	0
April 2015	2 636	0
May 2015	2 802	0
June 2015	2 937	0
July 2015	3 203	1
August 2015	3 063	0
September 2015	3 101	0

Table 3-54: 2015 September Future Max Price Check Table

As can be inferred from the aforementioned, the September 2015 Future Month attained its highest price during the month of July 2015, for the period in which the aforementioned future traded. This is primarily due to the poor coinciding national harvest for the period.

3.2.4.8 2016 September Future data

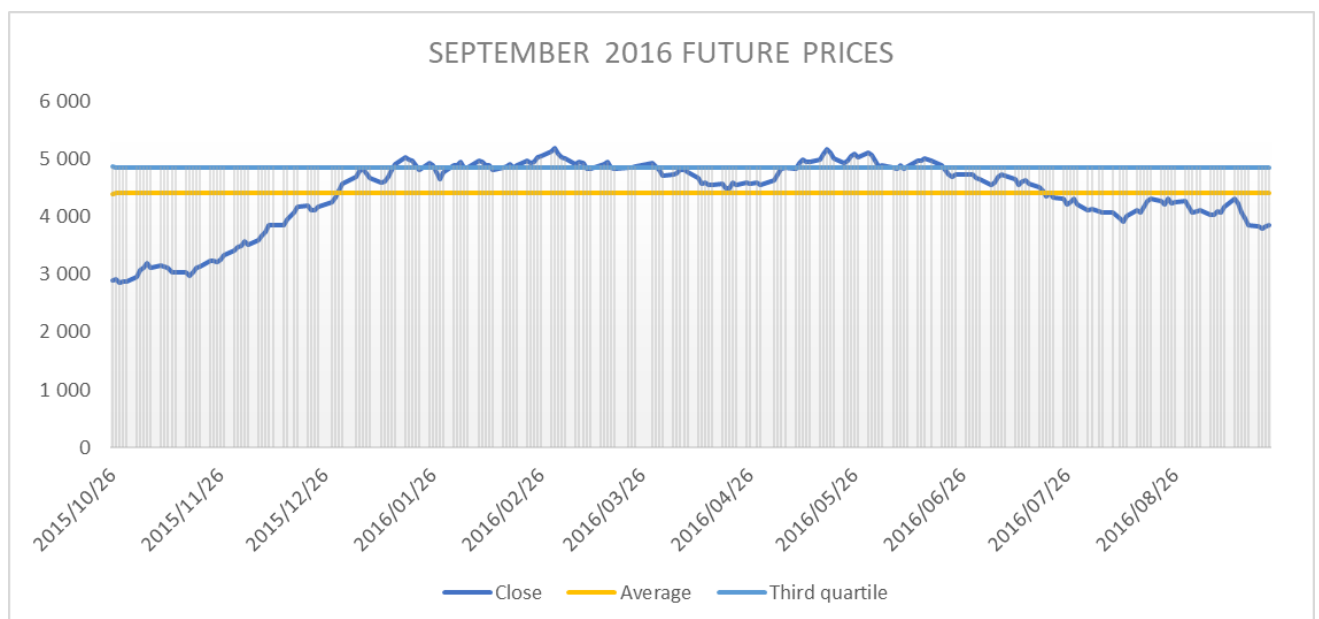


Figure 3-76: September 2016 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R4411.00 with the third quartile price-level calculated to be R4882.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of February to March 2016, and again for May to June 2016, while trading below or close to the third quartile level for the rest of the period.

3.2.4.8.1 September 2016 Future Max Price Check

Month	Ave. Price	Max. Check
Oct-15	2 884	0
Nov-15	3 139	0
Dec-15	3 950	0
Jan-16	4 804	0
Feb-16	4 926	0
Mar-16	4 921	0
Apr-16	4 628	0
May-16	4 970	1
Jun-16	4 843	0
Jul-16	4 492	0
Aug-16	4 148	0
Sep-16	4 024	0

Table 3-55: 2016 September Future Max Price Check Table

As can be inferred from the aforementioned, the September 2016 Future Month attained its highest price during the month of May 2016, for the period in which the aforementioned future traded.

3.2.4.9 2017 September Future data

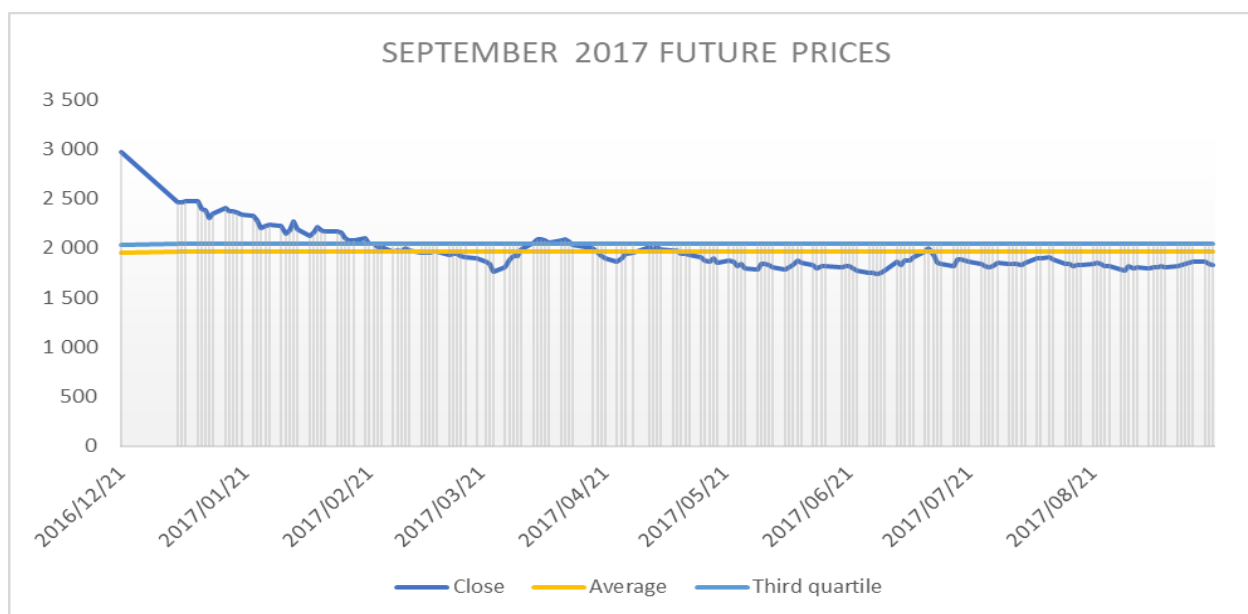


Figure 3-77: September 2017 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R1962.00 with the third quartile price-level calculated to be R2046.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of December 2016 to February 2017, while trading below or close to the third quartile level for the rest of the period.

3.2.4.9.1 September 2017 Future Max Price Check

Month	Ave. Price	Max. Check
Jan-17	2 370	1
Feb-17	2 111	0
Mar-17	1 920	0
Apr-17	2 003	0
May-17	1 900	0
Jun-17	1 799	0
Jul-17	1 867	0
Aug-17	1 838	0
Sep-17	1 827	0

Table 3-56: 2017 September Future Max Price Check Table

As can be inferred from the aforementioned, the September 2017 Future Month attained its highest price during the month of January 2017, for the period in which the aforementioned future traded.

3.2.4.10 2018 September Future data

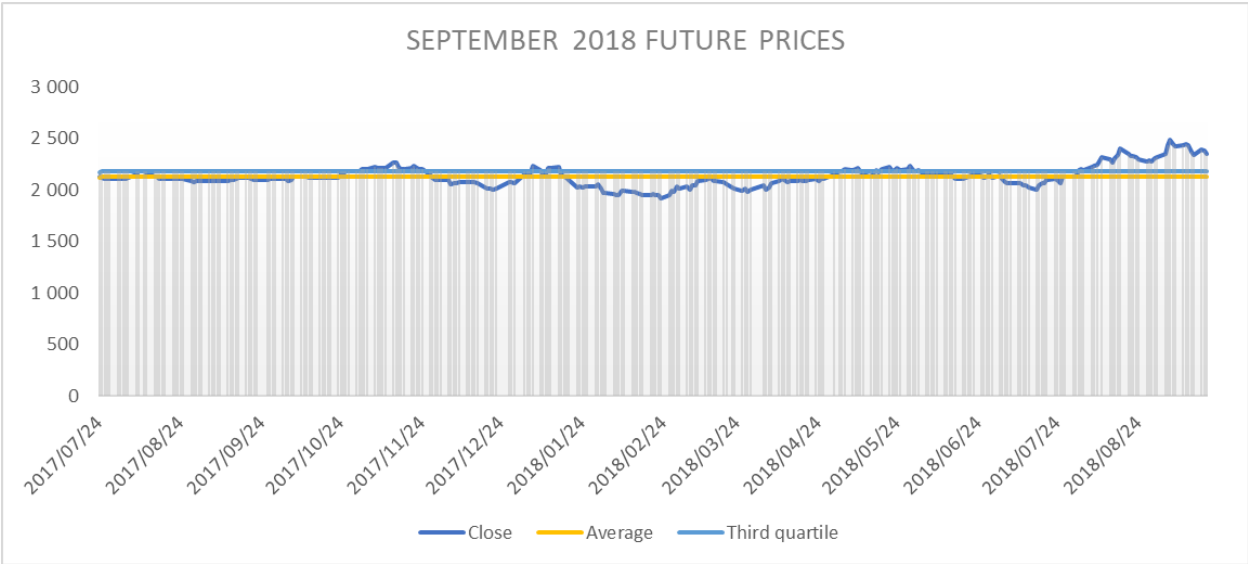


Figure 3-78: September 2018 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2130.00 with the third quartile price-level calculated to be R2184.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of July to August 2018, while trading below or close to the third quartile level for the rest of the period.

3.2.4.10.1 September 2018 Future Max Price Check

Month	Ave. Price	Max. Check
Jul-17	2 110	0
Aug-17	2 115	0
Sep-17	2 098	0
Oct-17	2 129	0
Nov-17	2 197	0
Dec-17	2 057	0
Jan-18	2 116	0
Feb-18	1 963	0
Mar-18	2 043	0
Apr-18	2 082	0
May-18	2 188	0
Jun-18	2 137	0
Jul-18	2 079	0
Aug-18	2 284	0
Sep-18	2 405	1

Table 3-57: 2018 September Future Max Price Check Table

As can be inferred from the aforementioned, the September 2018 Future Month attained its highest price during the month of September 2018, for the period in which the aforementioned future traded.

3.2.4.11 2019 September Future data

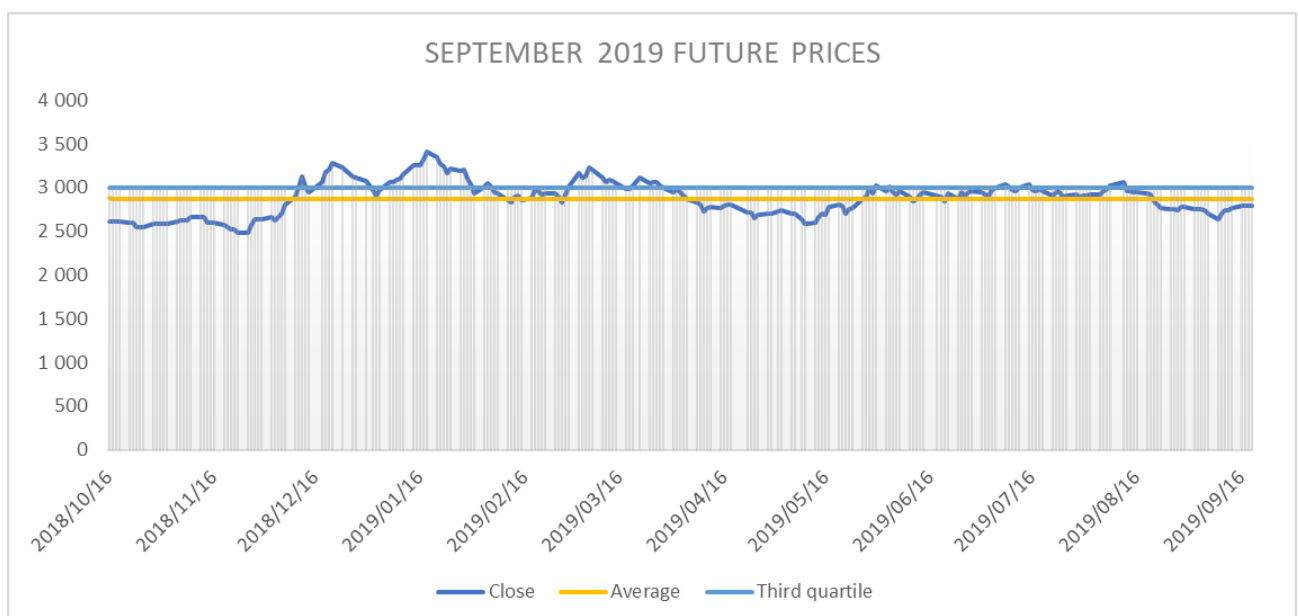


Figure 3-79: September 2019 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2879.00 with the third quartile price-level calculated to be R2998.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of December 2018 to January 2019, while trading below or close to the third quartile level for the rest of the period.

3.2.4.11.1 September 2019 Future Max Price Check

Month	Ave.Price	Max. Check
Oct-18	2 587	0
Nov-18	2 594	0
Dec-18	2 985	0
Jan-19	3 165	1
Feb-19	2 922	0
Mar-19	3 078	0
Apr-19	2 796	0
May-19	2 764	0
Jun-19	2 921	0
Jul-19	2 954	0
Aug-19	2 888	0
Sep-19	2 747	0

Table 3-58: 2019 September Future Max Price Check Table

As can be inferred from the aforementioned, the September 2019 Future Month attained its highest price during the month of January 2019, for the period in which the aforementioned future traded.

3.2.4.12 2020 September Future data

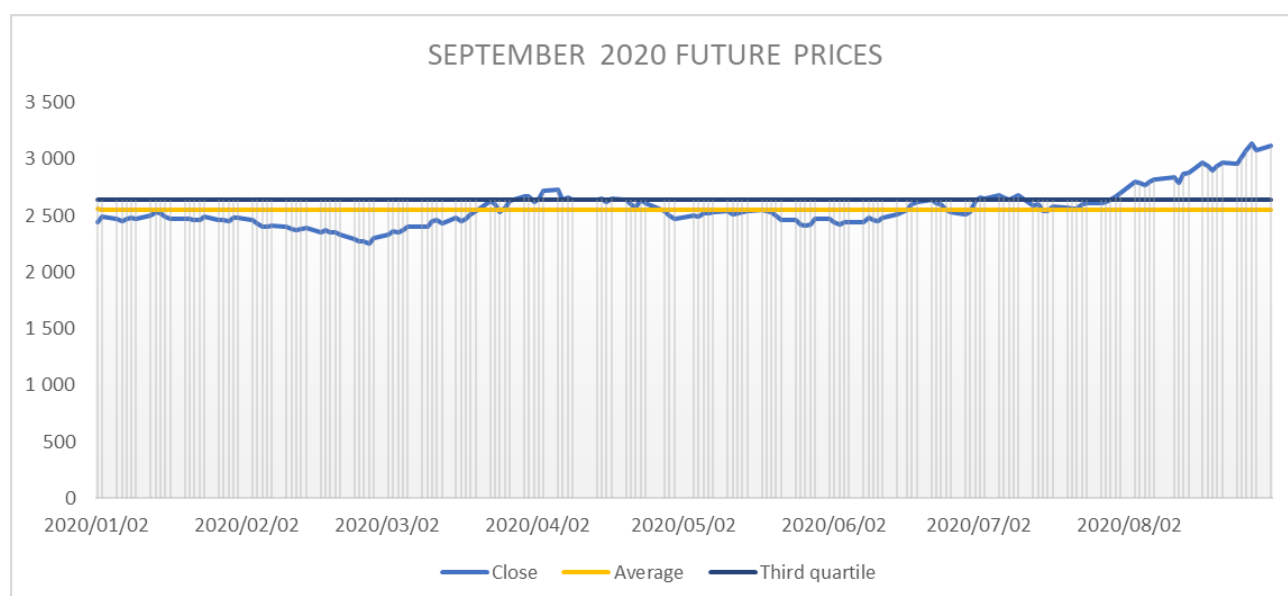


Figure 3-80: September 2020 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2560.00 with the third quartile price-level calculated to be R2637.00. It can be inferred that daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of August and September 2020, while trading below or close to the third quartile level for the rest of the period.

3.2.4.12.1 September 2020 Future Max Price Check

Month	Ave. Price	Max. Check
Jan-20	2 476	0
Feb-20	2 358	0
Mar-20	2 487	0
Apr-20	2 620	0
May-20	2 499	0
Jun-20	2 514	0
Jul-20	2 620	0
Aug-20	2 922	1

Table 3-59: 2020 September Future Max Price Check Table

As can be inferred from the aforementioned, the September 2020 Future Month attained its highest price during the month of August 2020, for the period in which the aforementioned future traded.

3.2.4.13 Summary for September Future Data

3.2.4.13.1 Continuous September Future Graph

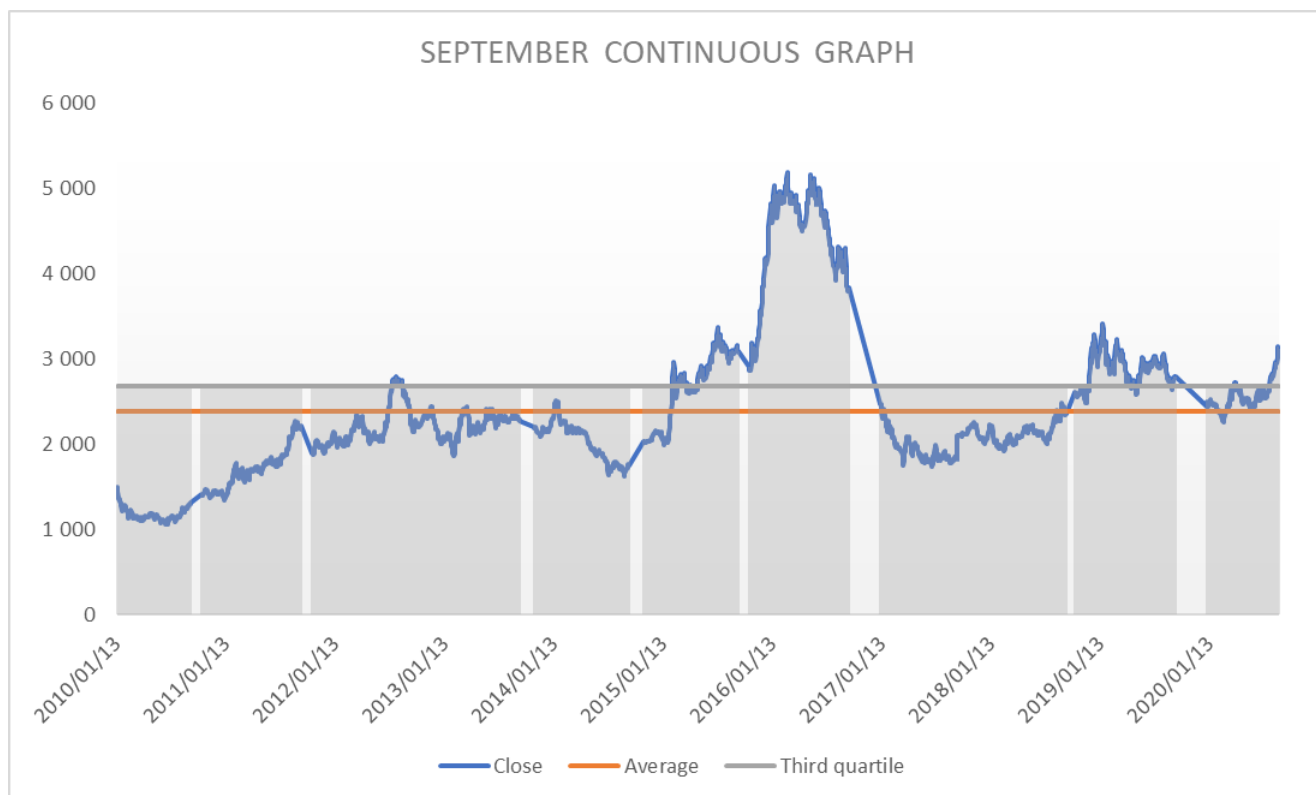


Figure 3-81: Continuous September Future Price Graph

In terms of the above figure, a clearly discernible trend may be inferred. September future prices tend to increase from the beginning of a period to the last trade date, with highest prices being attained either in August/September or onward toward January. Despite the 2016/2017 period, September Future prices have a general inclination to increase toward the end of a year and toward the beginning of a new period in January. Average and third quartile levels are indicative of the period and only shown for purposes of comprehensiveness.

3.2.4.13.2 Historic September Future Max Price Check

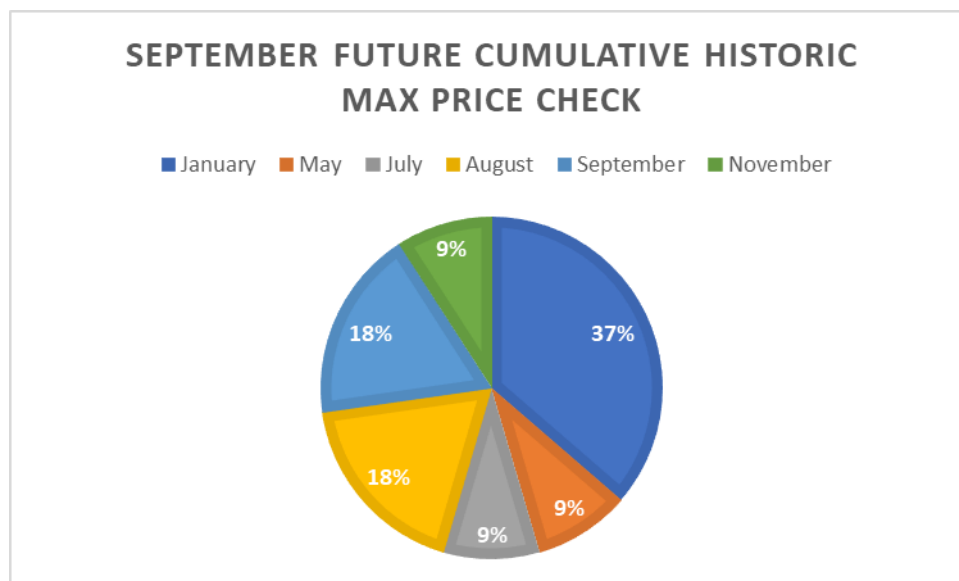


Figure 3-82: September Future Historic Max Price Check

As can be inferred from, September future prices attained the highest levels during the month of January, for 37% of the time. Cumulatively, September prices also attained the highest levels during the months of August and September, at 36%. It can therefore be argued that there is a majority even split between the months of January and August and September cumulatively. This, in essence, means that a person wishing to hedge produce in the September future has a significant chance of attaining the highest seasonal price by hedging during the aforementioned months, which in turn renders a 50% chance, respectively, of attaining the highest levels with regard to the three-month-split purported herein. It is therefore evident that a producer wishing to sell in the September future month should focus on either January or on August and September respectively – the latter two months, being viewed cumulatively.

3.2.5 Historical SAFEX December Future data

3.2.5.1 2010 December Future data

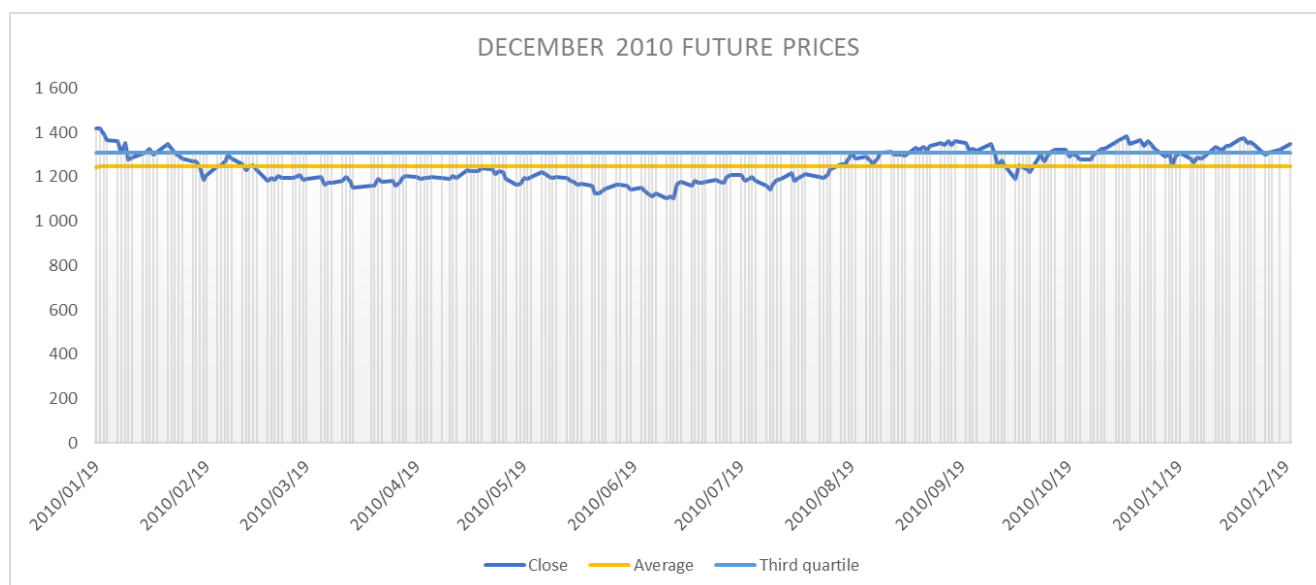


Figure 3-83: December 2010 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R1248.00 with the third quartile price-level calculated to be R1310.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of January 2010 and intermittently from September to December 2010, while trading below or close to the third quartile level for the rest of the period.

3.2.5.1.1 December 2010 Future Max Price Check

Month	Ave.Price	Max. Check
Jan-10	1 354	1
Feb-10	1 281	0
Mar-10	1 201	0
Apr-10	1 185	0
May-10	1 208	0
Jun-10	1 142	0
Jul-10	1 180	0
Aug-10	1 251	0
Sep-10	1 324	0
Oct-10	1 282	0
Nov-10	1 322	0
Dec-10	1 337	0

Table 3-60: 2010 December Future Max Price Check Table

As can be inferred from the aforementioned, the December 2010 Future Month attained its highest price during the month of January 2010, for the period in which the aforementioned future traded.

3.2.5.2 2011 December Future data

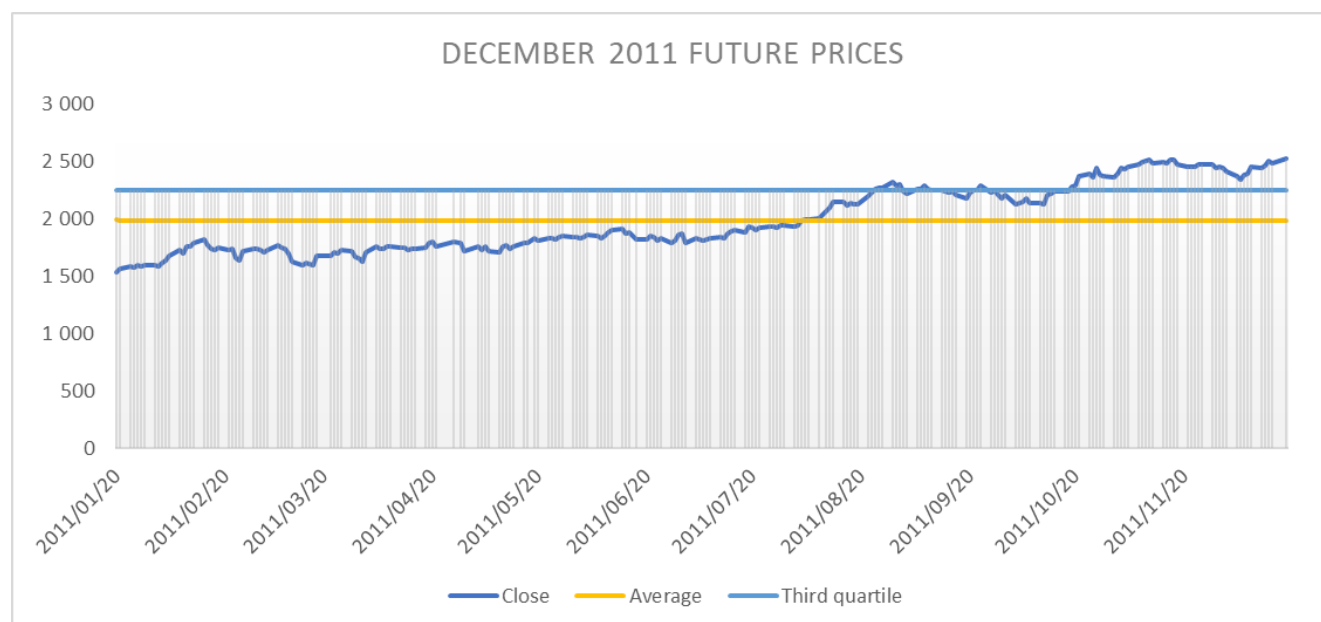


Figure 3-84: December 2011 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R1990.00 with the third quartile price-level calculated to be R2244.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of October to December 2011, while trading below or close to the third quartile level for the rest of the period.

3.2.5.2.1 December 2011 Future Max Price Check

Month	Ave. Price	Max. Check
Jan-11	1 577	0
Feb-11	1 711	0
Mar-11	1 681	0
Apr-11	1 749	0
May-11	1 786	0
Jun-11	1 844	0
Jul-11	1 876	0
Aug-11	2 130	0
Sep-11	2 233	0
Oct-11	2 252	0
Nov-11	2 466	1
Dec-11	2 429	0

Table 3-61: 2011 December Future Max Price Check Table

As can be inferred from the aforementioned, the December 2011 Future Month attained its highest price during the month of November 2011, for the period in which the aforementioned future traded.

3.2.5.3 2012 December Future data

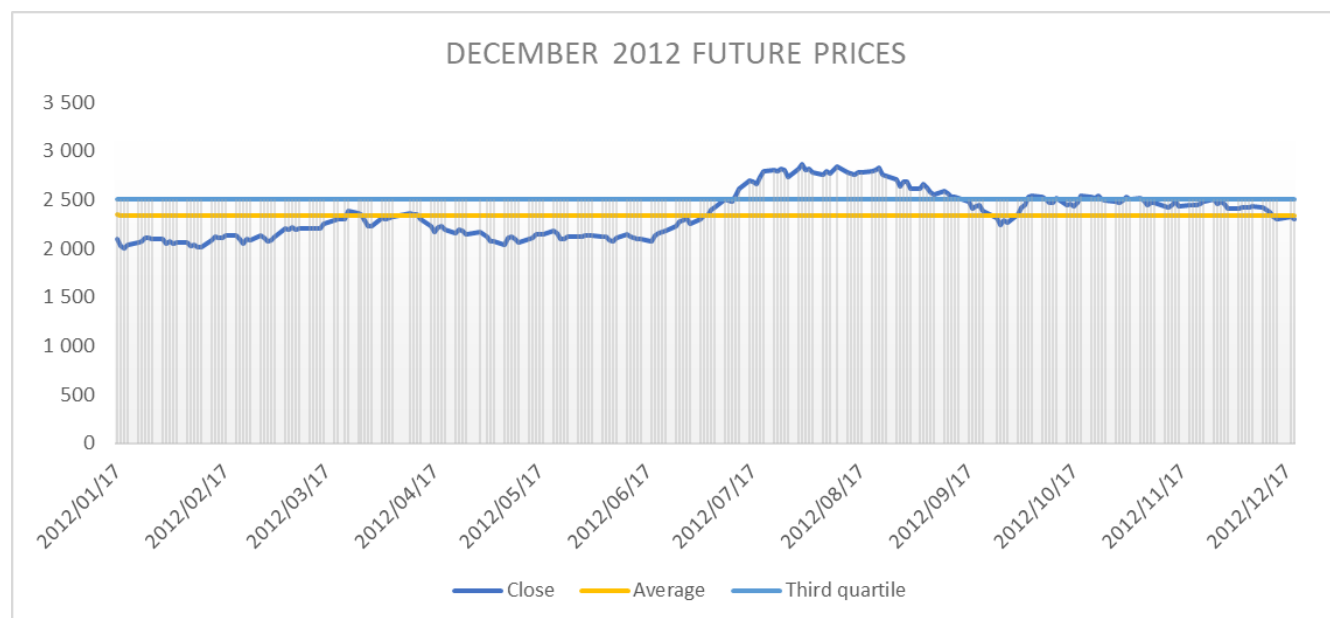


Figure 3-85: December 2012 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2356.00 with the third quartile price-level calculated to be R2509.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of July to September 2012, while trading below or close to the third quartile level for the rest of the period.

3.2.5.3.1 December 2012 Future Max Price Check

Month	Ave. Price	Max. Check
Jan-12	2 068	0
Feb-12	2 082	0
Mar-12	2 242	0
Apr-12	2 252	0
May-12	2 117	0
Jun-12	2 158	0
Jul-12	2 621	0
Aug-12	2 760	1
Sep-12	2 475	0
Oct-12	2 488	0
Nov-12	2 466	0
Dec-12	2 379	0

Table 3-62: 2012 December Future Max Price Check Table

As can be inferred from the aforementioned, the December 2012 Future Month attained its highest price during the month of August 2012, for the period in which the aforementioned future traded.

3.2.5.4 2013 December Future data

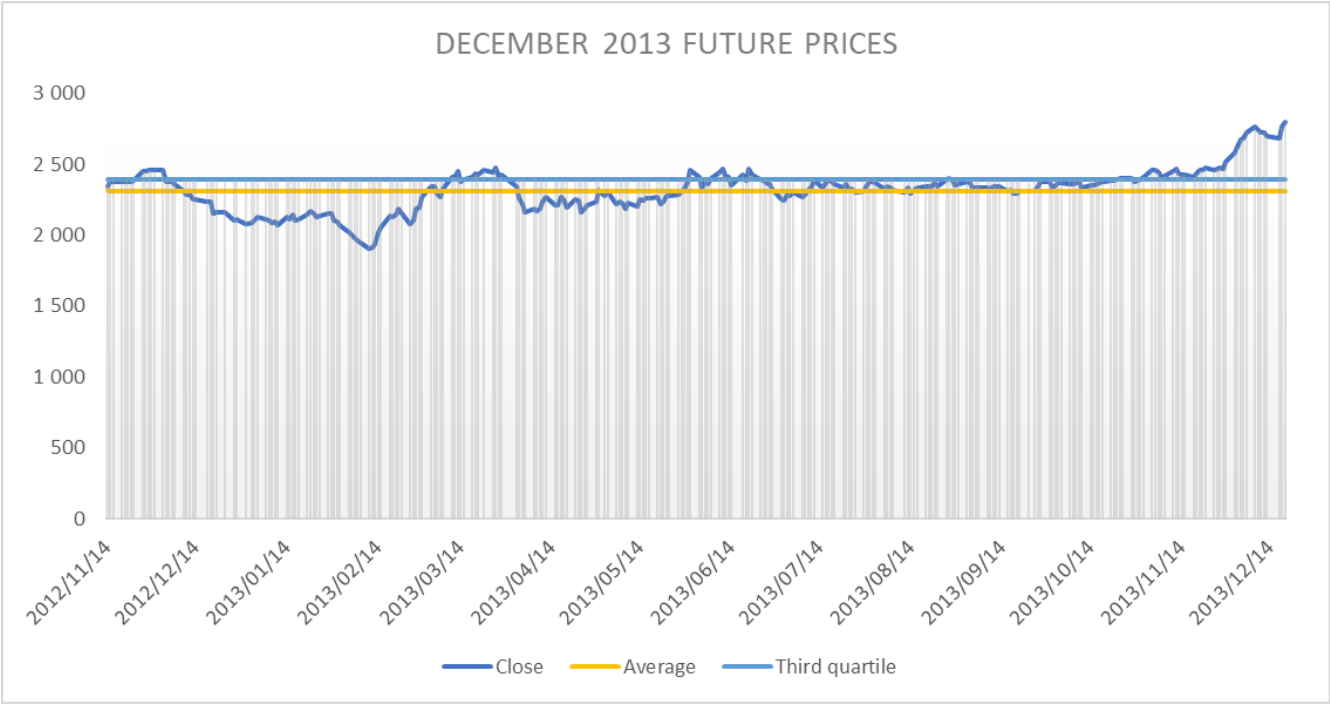


Figure 3-86: December 2013 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2319.00 with the third quartile price-level calculated to be R2393.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for a brief period in December 2012, followed by the months of November and December 2013, while trading below or close to the third quartile level for the rest of the period.

3.2.5.4.1 December 2013 Future Max Price Check

Month	Ave. Price	Max. Check
Nov-12	2 405	0
Dec-12	2 254	0
Jan-13	2 120	0
Feb-13	2 056	0
Mar-13	2 387	0
Apr-13	2 228	0
May-13	2 269	0
Jun-13	2 395	0
Jul-13	2 325	0
Aug-13	2 347	0
Sep-13	2 334	0
Oct-13	2 372	0
Nov-13	2 450	0
Dec-13	2 706	1

Table 3-63: 2013 December Future Max Price Check Table

As can be inferred from the aforementioned, the December 2013 Future Month attained its highest price during the month of December 2013, for the period in which the aforementioned future traded.

3.2.5.5 2014 December Future data

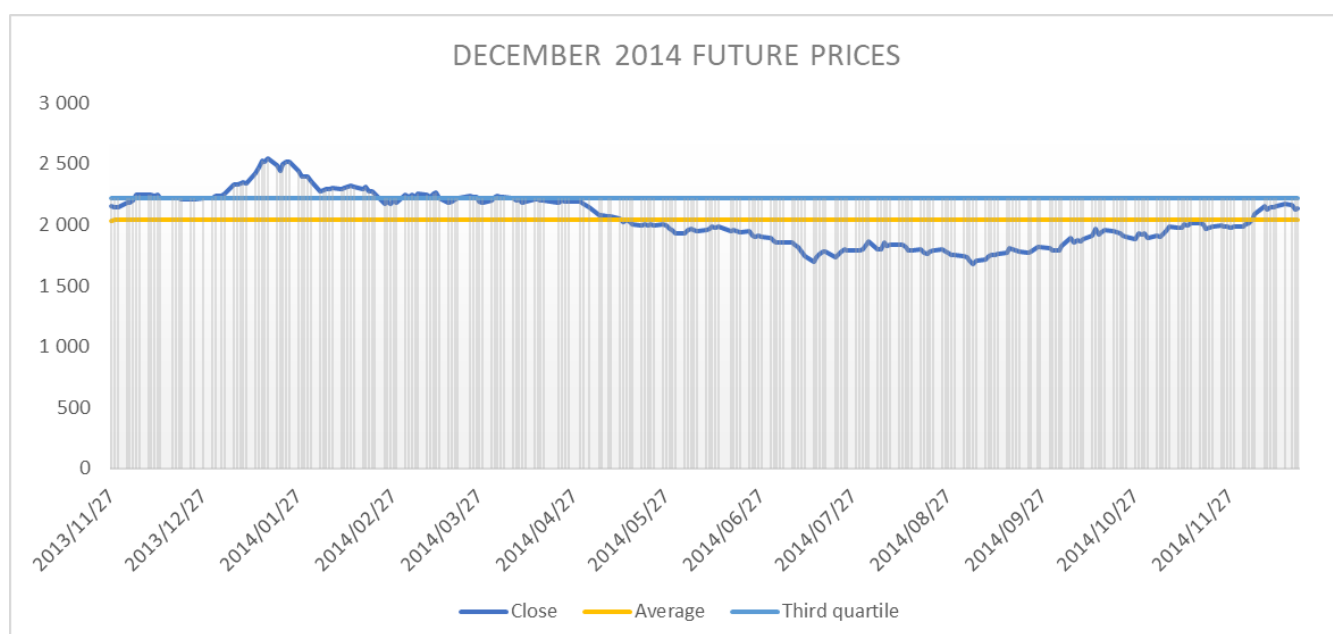


Figure 3-87: December 2014 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2044.00 with the third quartile price-level calculated to be R2218.00. As can be

inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of December 2013 to January 2014, while trading below or close to the third quartile level for the rest of the period. It should be noted that the prices increased toward the end of the period (December 2014) and traded only slightly beneath the third quartile level.

3.2.5.5.1 December 2014 Future Max Price Check

Month	Ave. Price	Max. Check
Nov-12	2 149	0
Dec-13	2 222	0
Jan-14	2 415	1
Feb-14	2 267	0
Mar-14	2 225	0
Apr-14	2 203	0
May-14	2 022	0
Jun-14	1 945	0
Jul-14	1 795	0
Aug-14	1 799	0
Sep-14	1 763	0
Oct-14	1 898	0
Nov-14	1 977	0
Dec-14	2 103	0

Table 3-64: 2014 December Future Max Price Check Table

As can be inferred from the aforementioned, the December 2014 Future Month attained its highest price during the month of January 2014, for the period in which the aforementioned future traded.

3.2.5.6 2015 December Future data

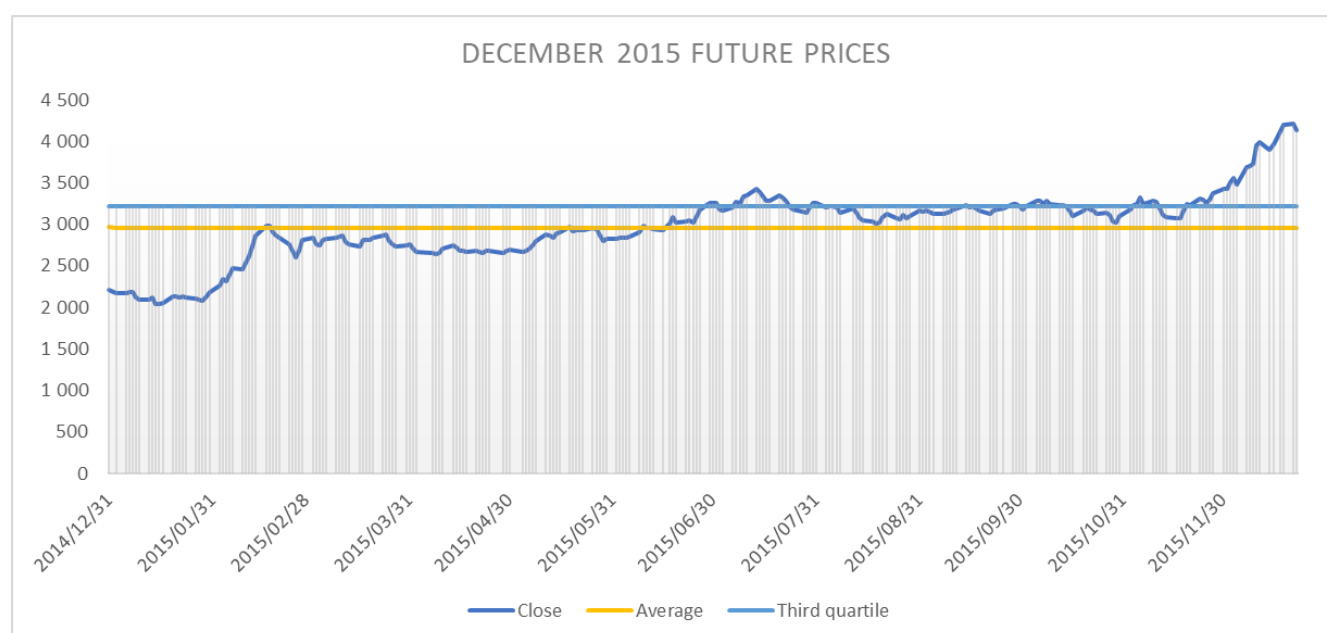


Figure 3-88: December 2015 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2975.00 with the third quartile price-level calculated to be R3214.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of June to July 2015 and November to December 2015, while trading below or close to the third quartile level for the rest of the period.

3.2.5.6.1 December 2015 Future Max Price Check

Month	Ave. Price	Max. Check
Jan-15	2 120	0
Feb-15	2 656	0
Mar-15	2 802	0
Apr-15	2 680	0
May-15	2 853	0
Jun-15	2 996	0
Jul-15	3 265	0
Aug-15	3 116	0
Sep-15	3 179	0
Oct-15	3 179	0
Nov-15	3 235	0
Dec-15	3 836	1

Table 3-65: 2015 December Future Max Price Check Table

As can be inferred from the aforementioned, the December 2015 Future Month attained its highest price during the month of December, for the period in which the aforementioned future traded.

3.2.5.7 2016 December Future data

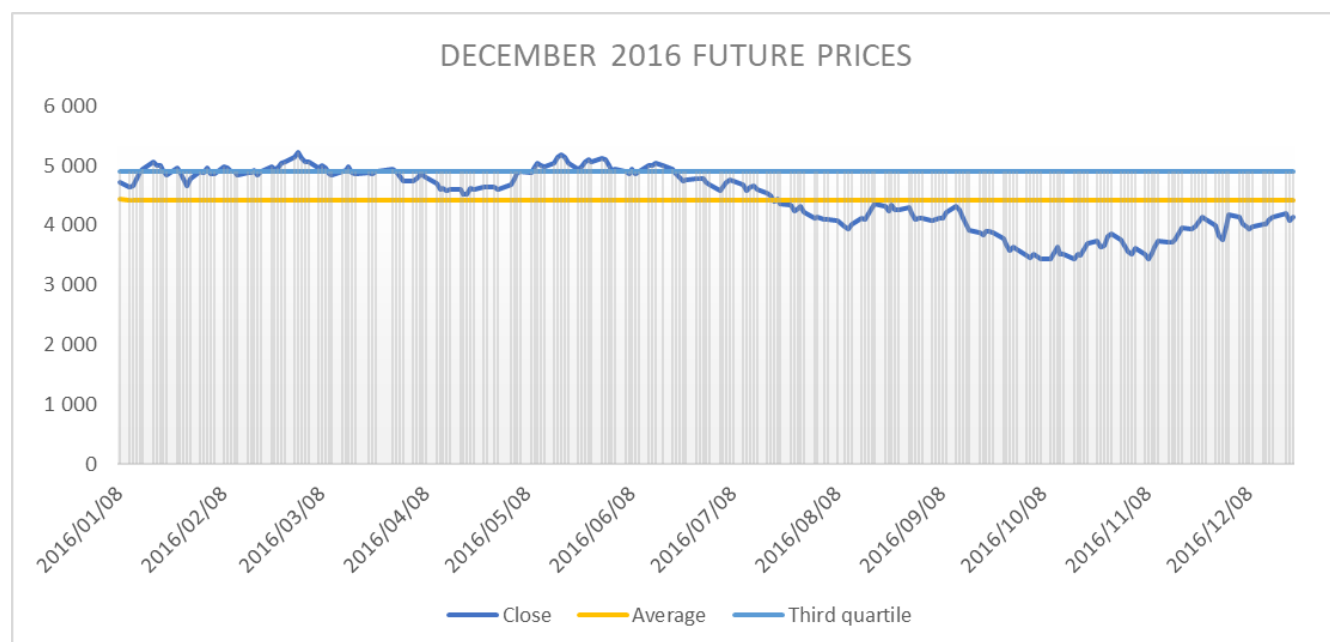


Figure 3-89: December 2016 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R4440.00 with the third quartile price-level calculated to be R4898.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of March 2016 and May to June 2016, while trading below or close to the third quartile level for the rest of the period.

3.2.5.7.1 December 2016 Future Max Price Check

Month	Ave. Price	Max. Check
Jan-16	4 846	0
Feb-16	4 933	0
Mar-16	4 948	0
Apr-16	4 659	0
May-16	5 005	1
Jun-16	4 883	0
Jul-16	4 521	0
Aug-16	4 171	0
Sep-16	3 961	0
Oct-16	3 580	0
Nov-16	3 770	0
Dec-16	4 062	0

Table 3-66: 2016 December Future Max Price Check Table

As can be inferred from the aforementioned, the December 2016 Future Month attained its highest price during the month of May, for the period in which the aforementioned future traded.

3.2.5.8 2017 December Future data

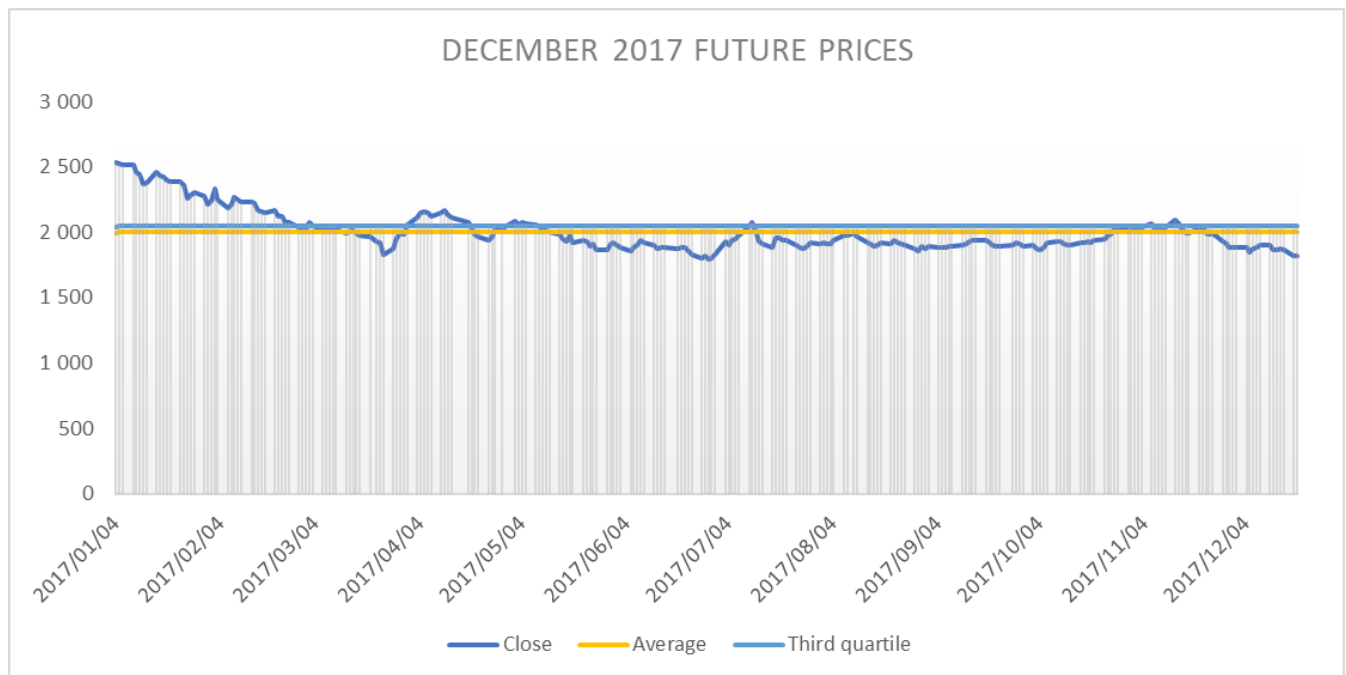


Figure 3-90: December 2017 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2005.00 with the third quartile price-level calculated to R2049.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of January to March 2017, while trading below or close to the third quartile level for the rest of the period. It should be noted that 2017 was the year with the highest (largest) crop ever recorded in South Africa, hence the depressed prices. Once more, despite the month of December 2017 being below the third quartile level, the price briefly pierced the third quartile level in November 2017.

3.2.5.8.1 December 2017 Future Max Price Check

Month	Ave. Price	Max. Check
Jan-17	2 396	1
Feb-17	2 176	0
Mar-17	1 991	0
Apr-17	2 073	0
May-17	1 974	0
Jun-17	1 867	0
Jul-17	1 939	0
Aug-17	1 919	0
Sep-17	1 904	0
Oct-17	1 936	0
Nov-17	2 005	0
Dec-17	1 867	0

Table 3-67: 2017 December Future Max Price Check Table

As can be inferred from the aforementioned, the December 2017 Future Month attained its highest price during the month of January, for the period in which the aforementioned future traded.

3.2.5.9 2018 December Future data

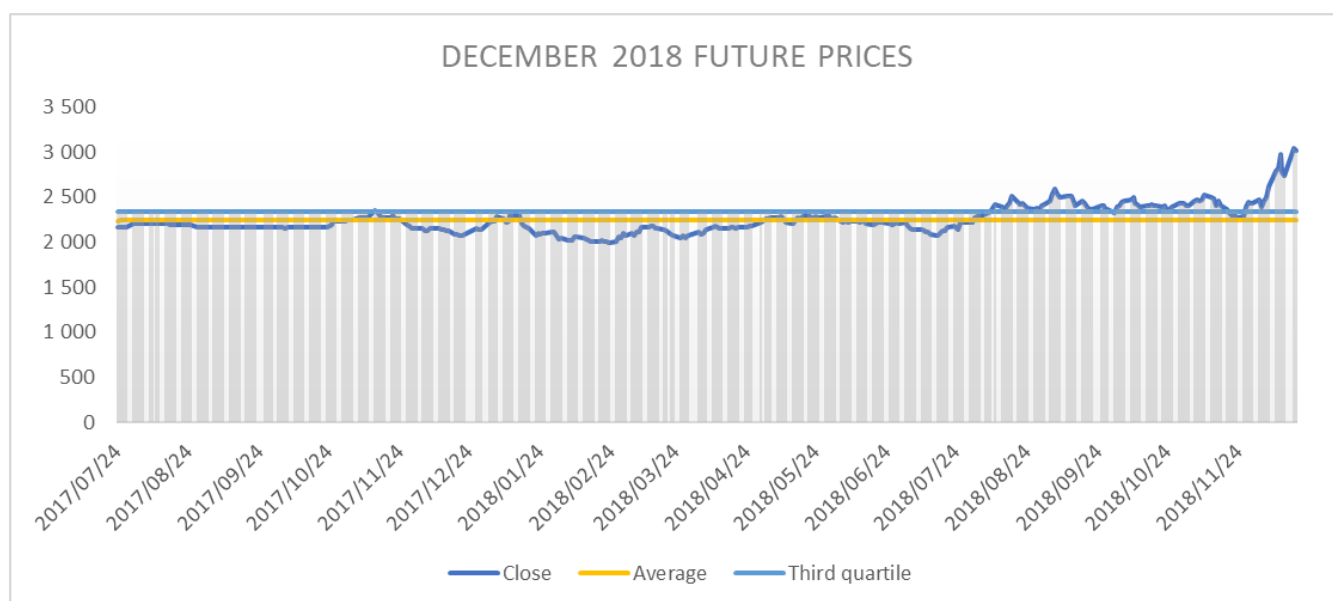


Figure 3-91: December 2018 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2247.00 with the third quartile price-level calculated to R2335.00. It can be inferred that the daily close prices traded above the third quartile level (within the upper-most 25%

of the seasonal price band) for the months of August to December 2018, while trading below or close to the third quartile level for the rest of the period.

3.2.5.9.1 December 2018 Future Max Price Check

Month	Ave. Price	Max. Check
Jul-17	2 175	0
Aug-17	2 172	0
Sep-17	2 163	0
Oct-17	2 218	0
Nov-17	2 197	0
Dec-17	2 106	0
Jan-18	2 096	0
Feb-18	2 019	0
Mar-18	2 068	0
Apr-18	2 177	0
May-18	2 279	0
Jun-18	2 209	0
Jul-18	2 196	0
Aug-18	2 385	0
Sep-18	2 377	0
Oct-18	2 396	0
Nov-18	2 374	0
Dec-18	2 892	1

Table 3-68: 2018 December Future Max Price Check Table

As can be inferred from the aforementioned, the December 2018 Future Month attained its highest price during the month of December 2018, for the period in which the aforementioned future traded.

3.2.5.10 2019 December Future data

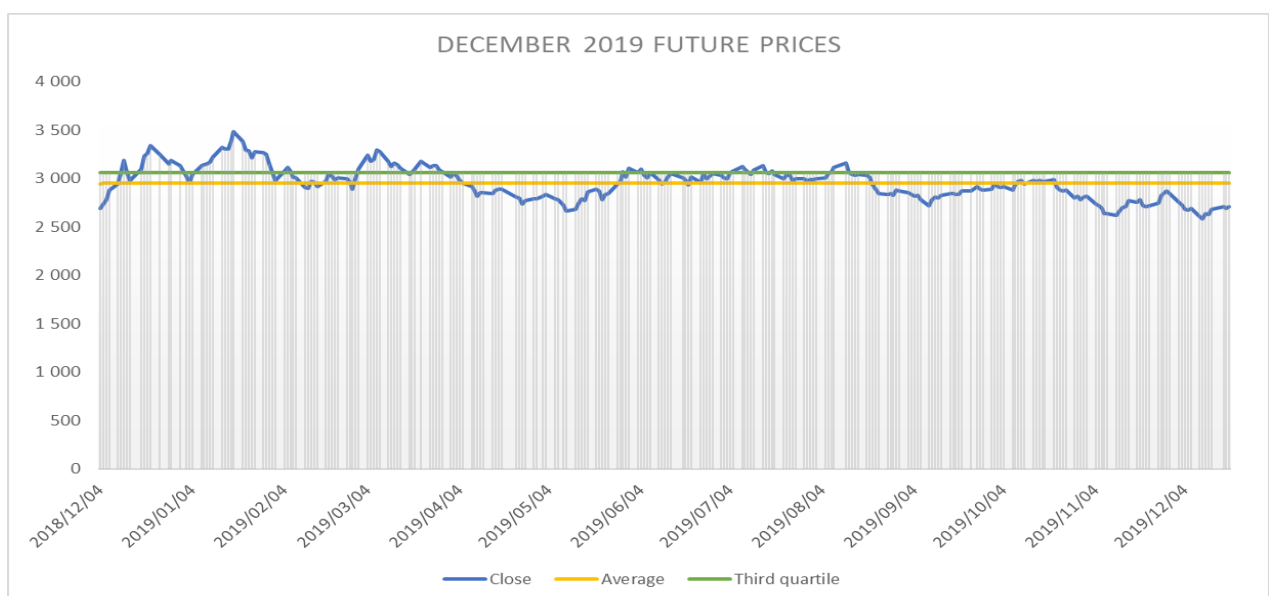


Figure 3-92: December 2019 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2956.00 with the third quartile price-level calculated to R3060.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of December 2018 to February 2019 and again between March and April 2019, while trading below or close to the third quartile level for the rest of the period.

3.2.5.10.1 December 2019 Future Max Price Check

Month	Ave.Price	Max. Check
Dec-18	3 055	0
Jan-19	3 218	1
Feb-19	2 989	0
Mar-19	3 145	0
Apr-19	2 877	0
May-19	2 847	0
Jun-19	3 012	0
Jul-19	3 041	0
Aug-19	2 979	0
Sep-19	2 835	0
Oct-19	2 912	0
Nov-19	2 738	0
Dec-19	2 675	0

Table 3-69: 2019 December Future Max Price Check Table

As can be inferred from the aforementioned, the December 2019 Future Month attained its highest price during the month of January 2019, for the period in which the aforementioned future traded.

3.2.5.11 2020 December Future data

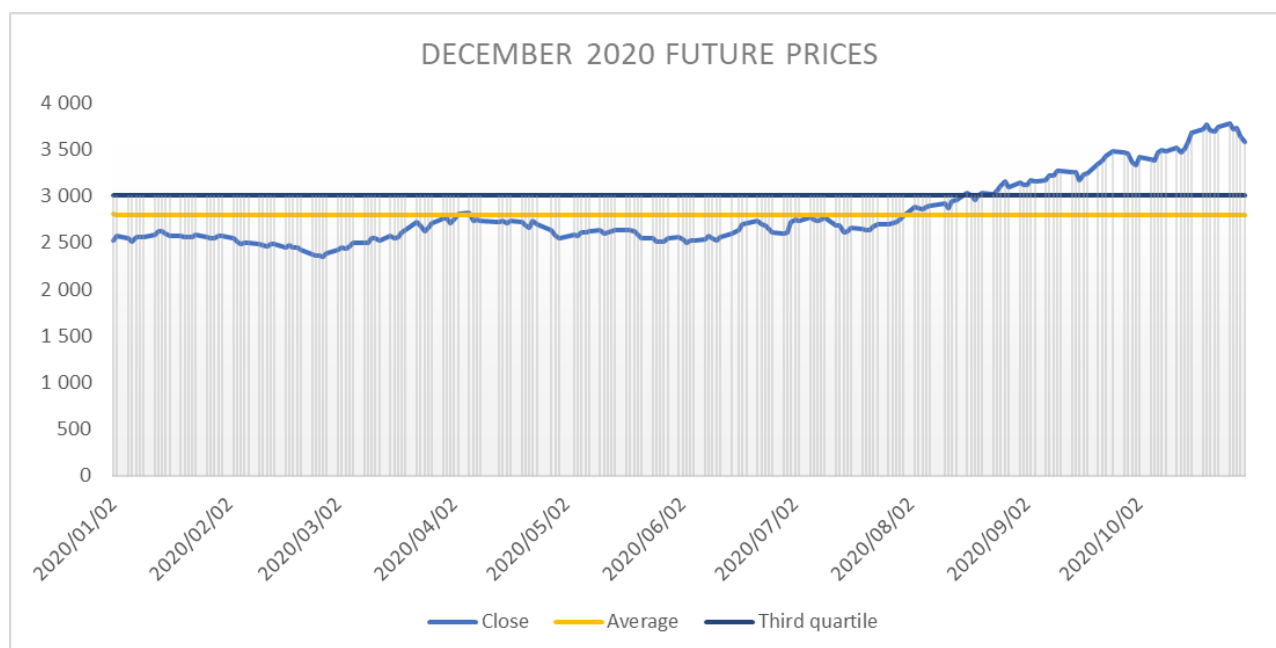


Figure 3-93: December 2020 Future Price Graph

With regard to the aforementioned figure, the average price for the period was calculated to be R2807.00 with the third quartile price-level calculated to R3004.00. As can be inferred from, daily close prices traded above the third quartile level (within the upper-most 25% of the seasonal price band) for the months of September to November 2020, while trading below or close to the third quartile level for the rest of the period. It should be noted that the data set used herein, is incomplete as it does not contain the November and December data for the year 2020. However, the current December 2020 future traded at R3546.00 on Friday 4 December 2020.

3.2.5.11.1 December 2020 Future Max Price Check

Month	Ave. Price	Max. Check
Jan-20	2 567	0
Feb-20	2 453	0
Mar-20	2 578	0
Apr-20	2 708	0
May-20	2 587	0
Jun-20	2 600	0
Jul-20	2 703	0
Aug-20	2 985	0
Sep-20	3 276	0
Oct-20	3 582	1

Table 3-70: 2020 December Future Max Price Check Table

As can be inferred from the aforementioned, the December 2020 Future Month attained its highest price during the month of October 2020, for the period in which the aforementioned future traded. It should, however, be noted that, as aforementioned, the December 2020 future currently trades at a level of R3546.00, which is not substantially lower than the October maximum price attained, yet substantially higher than the third quartile level.

3.2.5.12 Summary for December Future Data

3.2.5.12.1 Continuous December Future Graph

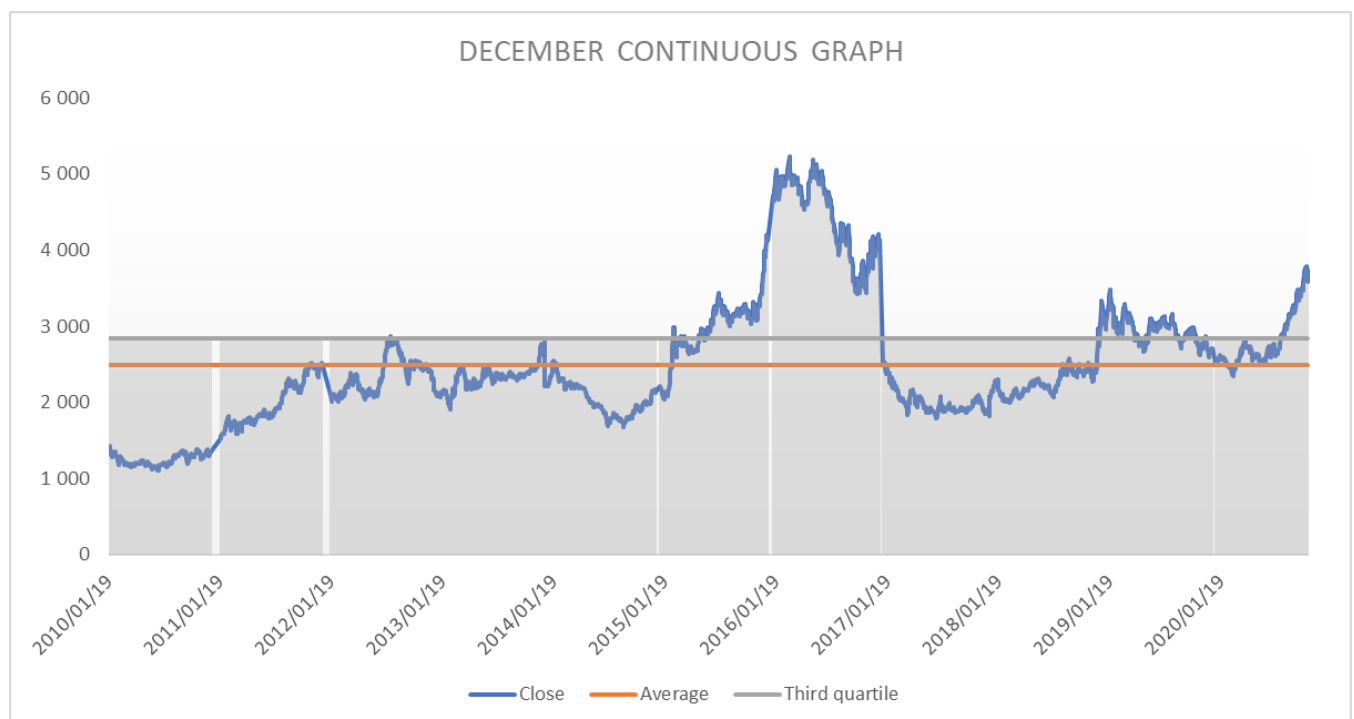


Figure 3-94: Continuous December Future Price Graph

Once again, despite the period of 2016 to 2017, a clear discernible trend can be ascertained. Prices for December futures tend to increase from the beginning of each period toward the end thereof, as is the case between the years 2010 to 2014, and 2017 to 2020. These general ‘increases’ however, tend to fluctuate between periods. A producer who therefore wishes to hedge in the December future, should not do so too early on in each period.

3.2.5.12.2 Historic December Future Max Price Check

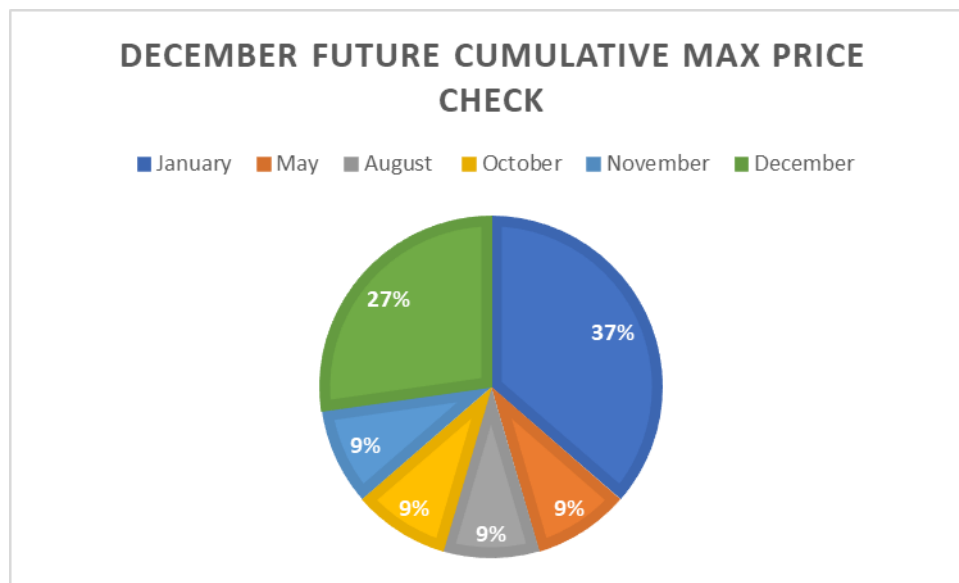


Figure 3-95: December Future Historic Max Price Check

In terms of the aforementioned graph, it is clear that December futures tend to reach its highest levels during the month of January for 37% of the time. The problem with a January hedge, however, is that producers usually do not know whether their crops would realise as early as January in the new year, as the crops would still be subject to a three-month period before turning 'ripe' to harvest. Prices, however, have reached its highest levels for 27% of the time during the December months, which means that a producer could still hedge in December for delivery of the produce in December and/or January, before the last trade date of the December future, which usually is around the 24th of December. If one also factors in November, the December futures reached its highest levels for 36% of the time between the months of November and December. A producer wishing to hedge in December (without knowing how the harvest would realise) may sell his stock during November and/or December, thereby realising prices well above (or close to) the third quartile level for the period. The producer who are already carrying stock in January (beginning of new period), and wish to sell their produce at a later stage, may well hedge during the month of January, as the majority of highest prices are attained January (37%).

3.2.6 Base-price index

The information regarding base-prices used below was supplied by Unigrain, and pertains to the delivery of WM1 at two different locations, being Premier milling in Nigel and Kroonstad and Eendag Meule in Bothaville, for the 2020 and 2021 period, as negotiated by Unigrain with each entity respectively.

Due to confidentiality, Unigrain did not supply actual prices, but rather an index with its base calculated for the winter harvest months (June to August) set at 100. This means that any values above 100 indicate a 'more expensive' base-price (therefore a larger subtraction from SAFEX prices to attain an ex-farm price), and conversely, any value below 100 indicates a 'less expensive base-price' which means a higher ex-farm price realised by the producer.

3.2.6.1 Base-price comparative index for Premier-milling

Jul-20	100
Aug-20	100
Sep-20	76
Oct-20	59
Nov-20	52
Dec-20	45
Jan-21	38
Feb-21	45
Mar-21	35
Apr-21	40

Table 3-71: Premier base-price comparative index for the 2020-2021 period

As can be ascertained from the aforementioned table, base-price deductions are the largest during the winter harvest months of July and August 2020 at an index value of 100. As time progresses, however, base-price deductions are reduced toward a value of 40 for delivery of WM1's during April 2021. November, December and January each have a respective index-value of 52, 45, and 38, with the index-value for March calculated to be the lowest at a value of 35.

What this data tells us, is that as the supply of WM1 decreases from its peak during the winter harvest months, toward the late summer and autumn months, so too makes the

base-price deductions, as millers become more inclined to pay 'premiums' for the acquisition of WM1.

Therefore, a reduction of base-price deductions of 50% to 60% is evident in the seven to eight months following the winter harvest months.

The researcher made the following assumption to put this into perspective on the premised upon internal Vlakvlei Boerdery data. The average base-price deductions Vlakvlei Boerdery received during the winter harvest months of this year (2020) was approximately in the order of R270.00 per ton, of which R140.00 per ton was transport costs. Therefore, the effective base-price deducted to determine Vlakvlei Boerdery's ex-farm price was $(R270.00 - R140.00 = R130.00)$.

Therefore, the index-value of 100 = R130.00 for the Winter harvest months. This, in turn, means that a January index-value of 38 = $(R130.00 / 100 \times 38 = R49.40)$, which in essence renders a positive base-price difference of $(R130.00 - R49.40) = R80.60$ per ton.

This amount does not, at first glance, seem to be material, yet when compounded over 20 thousand tonnes, becomes a significant value (approximately R1.6 million). This simple mathematical example excludes spot- and futures- market price changes and only pertains to base-prices which, as aforementioned, are deducted from the SAFEX price the producer receives to render actual or ex-farm prices received by the producer ('boerprys').

3.2.6.2 Base-price comparative index for ‘Eendag-meule’

Jul-20	100
Aug-20	100
Sep-20	74
Oct-20	63
Nov-20	63
Dec-20	53
Jan-21	42
Feb-21	47
Mar-21	39
Apr-21	32

Table 3-72: Eendag base-price comparative index for the 2020-2021 period

The premise of the discussion regarding base-price deductions have been explained above in Base-price comparative index for Premier-milling, and shall the discussion pertaining to Eendag not be done in such detail, though ‘Eendag-meule’'s base-price is approximately similar to that of Premier-milling.

3.2.6.3 Base-price summary

As can be ascertained from the aforementioned data, base prices move in a downward (positive) manner from the peak of WM1 supply, during the Winter harvest months, toward its lower/lowest levels toward the late summer and autumn months in the following year. This entails that producer would realise better ex-farms prices simply by ‘carrying’ their produce from the Winter harvest months toward the late summer and/or autumn months and selling their respective produce during that period.

This ‘conclusion’ regarding the aforementioned comparative base-prices, does not take cognisance of interest costs and other sundry costs such as storage and other costs, and only pertains to the premise and/or principle ascertained from the above data pertaining to base-prices.

As had been alluded to in chapter 2 and its paragraphs *supra*, the author created an equation that takes cognisance of actual ‘carry-costs’ associated with carrying produce post-harvest, with discerning between nominal and real costs and to determine which ‘future-prices’ would render nominal profits at a later stage, as had been indicated in Equation 2-3: *Post-harvest, nominal profit equation.*

3.3 SUMMARY

Chapter 3 provided the analysis and results of the study. The analysis included an overview of multiple year of SAFEX pricing and price variations during the season. These results will be put to practice on Chapter 4 where the proposed new model for the marketing of maize in South Africa is proposed. Chapter 4 is also the final chapter of the study.

It should be noted that all SAFEX data used herein, as well as all exchange rate data had been acquired from the SAFEX website, with the following reference, being: (South African Futures Exchange, 2020)

CHAPTER 4

CONCLUSIONS, SUBSEQUENT PROPOSED MARKETING MODEL AND FUTURE STUDIES

4.1 EMPIRICAL CONCLUSIONS

Various conclusions have been drawn from the empirical analysis conducted in Chapter 3 supra, the latter which shall be summarised herein below:

4.1.1 Conclusions with regard to the Spot Market analysis

4.1.1.1 *Correlation between the R/\$ exchange rate and Spot Market prices*

In terms of the aforementioned empirical analysis, it has been found that a statistically significant positive correlation exists between the exchange rate and local WM1 price movements, with specific reference to *loco* prices, though it can be inferred that said positive correlation also extends to future's prices.

A positive correlation coefficient of 0.726 exists between said exchange rate and local WM1 price movements, which suggest a strong positive statistically significant correlation between the factors, signifying the material extent of external factors (such as the R/\$ exchange rate) on our local prices, as had been indicated in Figure 3-29: Correlation between White maize price movement and the R/\$ exchange rate for the years 2007 to 2019

It would therefore be advisable that producers (including Vlakvlei Boerdery) take due cognisance of exchange rate movements, and is it further advised that the model and/or exchange rate tracker developed by (Van Wyk, 2019) in Figure 2-6: Historical R/\$ exchange rate was used to determine whether the South African rand is underbought or oversold relative to the U.S. dollar, as a movement in the R/\$ exchange rate in either direction may have a significant impacted upon local prices.

4.1.1.2 Historical Maximum Price Check for the period 2007-2019

As had been found in Figure 3-30: Historical Maximum Price Level Check, Pie Graph the majority of highest Spot market prices were attained January for 38% of the time. The second-highest number of maximum prices were attained in December, with 23% of the time. However, if one were to take November, December and January into account, the highest prices were attained during these three months for 69% of the time.

4.1.1.3 Seasonal price-band movement and subsequent third quartile levels for the period 2007-2020

Upon examining the various spot-market price graphs for the period, it has been found that prices traded above to or close to the third quartile level for the months of November to January for approximately 70% (9 out of 13 years) of the time.

For purposes of grain marketing, due cognisance should also be taken of seasonal price-band movements and said movement's position relative to the third quartile levels. As had been indicated earlier on in this document, Valkvlei Boerdery's grain marketing strategy should be to sell its produce at levels above the third quartile seasonal levels, which would entail that its grain is (mostly) sold within the highest 25% of the seasonal price-band, thereby ensuring that it always sells its grain as 'seasonal best' levels. In practice, however, it is quite difficult to constantly attain the 'highest' prices, because we do not have access to "next week's paper, today", and hence the strategy to seek to sell at prices above third quartile levels as opposed always seeking and awaiting the highest prices, (and often missing them), should be followed.

4.1.2 Conclusions with regard to the Futures Market analysis for March-, May-, July-, September- and December Futures

4.1.2.1 March Futures maximum prices

According to historical March futures data in Figure 3-43: March Historic Futures Max Price Check, March future prices achieved maximum levels in December for 26% of the time, in January and February for 17% of the time respectively and in November for 8% of the time. This entails that producer who have carry-over stock, may hedge during the months of November to February for delivery of their WM1 in March.

4.1.2.2 March Futures seasonal price-bands and third quartile levels

In terms of the empirical study conducted in Chapter 3 *supra*, March future seasonal prices traded close to, or higher than the third quartile level for each period, for November to January for approximately 80% of the time (8/10 years). This entails that producers who are 'carrying' stock may sell their produce for delivery in March during the months of November to January, with an 80% chance of selling their produce within the highest 25% of the seasonal price band, thus at higher levels than the seasonal third quartile level.

4.1.2.3 May Futures maximum prices

According to historical May futures data in Figure 3-56: May Historic Futures Max Price Check, May future prices achieved maximum levels in December for 34% of the time, in January for 34% of the time and in February for 8% of the time. This entails that producer who have carry-over stock, or who plan on harvesting early, may hedge during the months of December and January for delivery of their WM1 in May, thereby attaining a probability of 64% of selling their produce within the top 25% of the seasonal price band.

4.1.2.4 May Futures seasonal price-bands and third quartile levels

In terms of the empirical study conducted in Chapter 3 *supra*, May future seasonal prices traded in close proximity to, or higher than the third quartile level for each period, for the months of November to January for approximately 60% of the time (6/10 years). This entails that producers who are 'carrying' stock, or who wish to harvest early may sell their produce for delivery in May during the months of November to January, with a 60% chance of selling their produce within the highest 25% of the seasonal price band, thus at higher levels than the seasonal third quartile level.

4.1.2.5 July Futures maximum prices

According to historical July futures data in Figure 3-69: July Future Historic Max Price Check, July future prices achieved maximum levels in January for 28% of the time, in December for 9% of the time, while also attaining highest prices during the months of June, July and August cumulatively for 54% of the time. It can therefore be inferred that July Future prices are highly dependent on the realisation of the harvest, with any under-supply affecting July Futures prices positively during the winter harvest months. This,

however, makes it difficult for producers to hedge their produce pre-harvest, during the summer planting months, as the relative levels of said hedging that may be done during the summer months will only become apparent upon the realisation of the harvest, usually by the end of March/beginning of April for each period. It is, therefore, irrespective of the status of the carry-over stock of the producer, a risk to hedge in the July-future by virtue of short-selling, as relative price-levels may only become apparent at a later time, as aforementioned.

4.1.2.6 July Futures seasonal price-bands and third quartile levels

In terms of the empirical study conducted in Chapter 3 *supra*, July future seasonal prices traded in close proximity to, or higher than the third quartile level for each period, for the months of November to January for approximately 60% of the time (6/10 years). This entails that producers who are 'carrying' stock, or who wish to hedge pre-harvest may sell their produce for delivery in July during the months of November to January, with a 60% chance of selling their produce within the highest 25% of the seasonal price band, thus at higher levels than the seasonal third quartile level, though relative levels may only become apparent upon realisation of the harvest, usually by the end of March/beginning of April for each period. Upon examination of July Future's third quartile levels, January can be considered as the best month to execute a pre-harvest marketing strategy for delivery of maize during July.

4.1.2.7 September Futures maximum prices

According to historical September futures data in Figure 3-82: September Future Historic Max Price Check, September future prices achieved maximum levels in January for 37% of the time, in September for 18% of the time, and in August for 18% of the time, therefore producers wishing to sell their produce in September may either hedge pre-harvest during January, or post-harvest during August and September.

4.1.2.8 September Futures seasonal price-bands and third quartile levels

In terms of the empirical study conducted in Chapter 3 *supra*, September future seasonal prices traded in close proximity to, or higher than the third quartile level for each period, for March to April for approximately 80% of the time (8/10 years). This entails that producers who are 'carrying' stock, or who wish to hedge pre-harvest may sell their

produce for delivery in September during the months of March to April, with an 80% chance of selling their produce within the highest 25% of the seasonal price band, thus at higher levels than the seasonal third quartile level.

4.1.2.9 December Futures maximum prices

According to historical December futures data in Figure 3-95: December Future Historic Max Price Check, December future prices achieved maximum levels in January for 37% of the time, and in December for 27% of the time and November for 9% of the time. One should take care to note that a December hedge in January, would entail delivery of produce only in the December following said January hedge, therefore, producers who carry stock and wish to deliver said stock in December and/or January, can only hedge using the December future preceding December's last trade date. Therefore, if a producer wishes to sell and deliver his stock in December, said producer might hedge said grain in November or December.

4.1.2.10 December Futures seasonal price-bands and third quartile levels

In terms of the empirical study conducted in Chapter 3 *supra*, December future seasonal prices traded close to, or higher than the third quartile level for each period, for the months of September to December for approximately 80% of the time (8/10 years). This entails that producers who are 'carrying' stock, may sell their produce for delivery in December during the months of September to December, with an 80% chance of selling their produce within the highest 25% of the seasonal price band, thus at higher levels than the seasonal third quartile level.

4.2 PROPOSED MARKETING MODEL

As had been mentioned earlier herein, the purport for Vlakvlei Boerdery's marketing strategy is to sell their produce post-harvest, whilst also attaining prices that are within the top 25% of the seasonal price band, therefore prices in excess of the third quartile level.

Like most other Agribusinesses, a healthy cash-flow is of utmost importance for the effective functioning of Vlakvlei Boerdery, hence the need to market a portion of the yearly

harvest for delivery during the winter harvest months for purposes of attaining income during those months.

The following marketing model for Vlakvlei Boerdery has therefore been devised:

1. Make use of pre-harvest hedging for delivery in July and/or September for approximately 1/3rd of the harvest. These pre-harvest hedges can be conducted either by virtue of short-selling in the market or by way of purchase of put options. Put options are initially quite expensive, but a producer's exposure to risk is limited to the initial cost of the option. Purchasing a put option enables the producer to implement a 'floor price'. Therefore, in the event of SAFEX prices decreasing below such a 'floor price-level,' the producer would still receive said minimum price. Should SAFEX prices increase above said 'floor price-level' the aforementioned future options become effectively redundant, save for the protection it renders from extreme decreases in prices.

Pre-harvest hedging for delivery in July should be done, according to paragraph 4.1 *supra*, January preceding July. Pre-harvest hedging for delivery in September should be done between March and April preceding September. The benefit of pre-harvest hedging for delivery in September is the fact that producers would still reach prices in excess of the third quartile level, later on in the season (March to April). By that time, the harvest would be realised, and the producer would have a very good idea of the ultimate yield per hectare, and subsequent tonnages that would render 1/3rd of the harvest. May Futures may also be considered, yet May Futures traded within the third quartile level for the months of November to January, which is still several months in advance of the ripening of the harvest. Pre-harvest hedging in May, without being able to deliver in May, could necessitate the incurrence of additional costs to roll said futures onwards to July or September. May futures attained its highest price-levels in the month of April for 8% of the time. Therefore, a producer may deliver his produce during the month of May (loco market) if a better price can be attained than in July or September.

2. The rest of the harvest should be carried-over toward December and January, with an eye on delivery thereof between the months of December and January. This

carry-over stock can then be carried with/without hedging same. Our analysis of the Spot market months indicates that prices in close proximity to, in excess of the third quartile level can be attained by selling produce between the months of November to January. However, out of the experience, producers may also opt to hedge their produce in a December future, for delivery in December, which may then be rolled out to a March future, for delivery in January. If the producer wishes to hedge using a December future, it is advisable to hedge said produce between September and December. If said hedges need to be rolled out to March, it would be advisable to do so toward the end of November and December, as our analysis suggests that March traded in close proximity to or in excess of the third quartile level during November to January, preceding March delivery.

3. It should be borne in mind that each season is unique and that South Africa has become prone to droughts of late. Vlakvlei Boerdery should therefore work towards having to hedge as little as possible during the pre-harvest months and carrying as much stock as possible post-harvest. As can be seen from the 2015/2016 and 2018/2019 data, years of drought have a positive and volatile effect of prices, especially during the summer planting months. Spot prices for December 2015/January 2016 increased to levels in excess of R4500.00 per ton, and again, in December 2018 to levels in excess of R3000.00 per ton.
4. If Vlakvlei Boerdery were able to structure its cash flow in a manner in which it need not hedge its produce pre-harvest but can carry its whole harvest post-harvest, substantial profits can be made when the next drought strikes. Its core strategic objective should therefore be to carry as much of its produce post-harvest, thereby creating an opportunity to realise substantial profits should a drought encouraged 'price spike' occur.
5. Due cognisance should also be taken of the fact that base-prices tend to decrease from the transition of the Winter harvest months toward the late summer months and early autumn months, as had been found in Chapter 3, which said reductions in base-prices also contribute significantly toward the realisation of higher profits by carrying stock post-harvest.

6. A flexible marketing strategy shall therefore be used herein, and initially said flexible strategy should make use of both pre-harvest and post-harvest marketing, with the combination thereof shifting toward a fully flexible post-harvest marketing model.

The proposed model is presented in tabular format on the next page.

Table 4-1: Vlakvlei Boerdery's proposed marketing model

Sequence of implementation	Pre-harvest / Post harvest hedge	Date of delivery	Tonnages to be sold	Period of implementation	Hedging method
First	Pre-harvest; flexible strategy	July / September	1/3 rd of the annual harvest	July hedges to be done in January of each year. September hedges to be done in the months of March to April	Short-selling in the market and/or the purchase of put options.
Second	Post-harvest; flexible strategy	December and January	Remainder of annual harvest	Spot market selling to be done in the months of December and January. Future hedging by virtue of December futures to be done between September and December. March hedging to be done at the end of November / beginning of December	Cash month selling, or by virtue of short selling

4.3 FUTURE STUDY

This study came to various conclusions, which have been discussed at length in the summaries of Chapter 3, and the subsequent conclusions of Chapter 4. One of the key conclusions of this study, however, is the existence of the strong positive statistically significant correlation between the R/\$ exchange rate and local WM1 price movements.

This study, however, did not analyse American corn prices and futures, which are traded on the Chicago Board of Trade (CBOT) market. It would therefore be of significant importance to examine American spot market and futures prices like this study, to ascertain whether any material and discernible trends exist, as this is one factor impacting upon the daily calculated parity movements in our local market, with the exchange rate being the second.

Any discernible American trends can shed further light on our local price movements and assists us in determining which months render the highest prices for specific local future and spot market months.

In addition, thereto, this study also did not examine daily traded volumes, and if any correlation therein exists that impact our local prices. As had been mentioned in Chapter 2, some authors have openly pondered whether our local market (SAFEX) is not overly speculated in. Only by examining daily traded volumes, and by combining said analysis with the RSI (Relative Security Index), would trend (if any) be ascertainable that could shed light on speculative trends (if any) in the market, to use the speculation by others as a driver of the realisation of prices above the third quartile levels.

This concludes this study and mini-dissertation.

**I thank you for taking the time to moderate and examine this
document.**

Gloria in excelcisi Deo

Eer aand die Heer in die Hoogste.

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APPENDIX 1: LANGUAGE EDITING LETTER



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Tuesday, 08 December 2020

To whom it may concern

Re: Confirmation of language edit, typography and technical precision

The MBA dissertation by FK Maré, "Developing a post-harvest marketing model for maize in South Africa" was edited for language, typography and technical precision. The referencing and sources were checked and comply with the Harvard guidelines specified by the 2020 NWU Reference guide.

Final, last-minute corrections remain the responsibility of the author.

Antoinette Bisschoff

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Precision ... to the last letter