Recommendations for Commodity Futures Delivery on the Johannesburg Stock Exchange.

KERNMANTLE GROUP

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1. Introduction

In 2009, I was asked to examine the operation of the futures contracts of the Johannesburg Stock Exchange by the National Agricultural Marketing Council. The issue at hand was the use of Location Differentials (LDs) in the settlement of physically-delivered futures contracts. After a review of the operation of the market and the contracts themselves, I concluded that the primary problems with the South African grain markets were not LDs, but instead were the lack of competition and transparency in cash grain markets and the prevalence of market power among end-users, particularly in the Western Cape. These factors prevented an active cash market from forming but LDs, being more visible and tangible, were treated as the scapegoat.

At the conclusion of the 2009 study, I made a number of recommendations and the majority were implemented. The central recommendation was to maintain the LD as it then existed. Since that time, the controversy surrounding LDs has not abated. The JSE contacted me in late 2018 to consider updating the 2009 report based on changes in the South African market since 2009. In early 2019, I spent two weeks in South Africa, interviewing stakeholders and collecting data on the grain markets. This report is the result.

My recommendations differ very little from those in the 2009 report. The structure of the South African grain industry has evolved, but it has not fundamentally changed in any ways that make the LD system less applicable now than previously. There is a better understanding of price behavior and the need for LDs in the South African futures markets by market participants. The ire is now directed at the method of calculation and the reference points. Similar to 2009, this dissatisfaction is misplaced. The energy of those dissatisfied with the LD system should be directed toward building a deeper cash market, educating farmers on how to keep and market more of their grain and building and participating in a system to disseminate prices received by farmers. These actions have the potential to change the relative balance of power between buyer and seller. The LD system simply serves the purpose of making the JSE futures contracts stable and useful to as many participants as possible.

2. Scope and Remit

2.1. The 2009 Investigation of Location Differentials

In 2009, Dr. Roberts was contracted by the National Agricultural Marketing Council (NAMC) to examine the delivery structure of futures contracts traded on in the South African Futures Exchange (SAFEX) division of the JSE. This study resulted in the production of the report "The Existence and Use of Location Differentials in SAFEX Cash Market Settlement," delivered on 23 February 2009 (Roberts 2009). After extensive analysis and interviews with members of all major components of the South African grains industry, it became clear that particular characteristics of the industry created the conditions that led to widespread enmity toward the LD system. Particularly, Roberts (2009) pointed to the "lack of [both] transparency and market power" in the South African grains market, whose effects were being erroneously ascribed to the LD system. This report is included in Appendix A.

Roberts (2009) made six recommendations:

A. Retain annual updating of LDs. [§8]
B. Do not implement a Cape Wheat contract, due to concerns about thin liquidity. [§9]
C. Keep the SAFEX delivery differential system as originally implemented. [§9.1]
D. Implement the recommendations of the NAMC (2008) report. [§9.2.1]
E. JSE should explore the implementation of a platform for the electronic trading of silo certificates. [§9.2.2]
F. Cash market transparency must be Increased. [§9.2.3]

Since 2009, the JSE has followed recommendations A, C, D[1], and E. In 2013, the JSE listed a Cape Wheat contract—wheat futures with a Western Cape reference point. However, the contract developed little liquidity and was delisted. The electronic trading platform for silo certificates in E was implemented as the Spot Basis Window (SBW) platform.

Since Roberts (2009), the dissatisfaction with the LD system seems to have declined, but only somewhat, with the points of contention being less that the system itself is flawed, but that the calculation of the LDs is inaccurate, the reference points no longer appropriate, and the growth of soya production and the emergence of a relatively robust (for South Africa) cash trading system undermining the arguments previously advanced for the maintenance of the LD system in Roberts 2009.

Industry and the JSE have likewise highlighted anomalies in current market behavior, namely the rapid build-up of carried inventories in the Western soya production areas, including inventories being carried from one marketing year to the next, as well as the increase of yellow maize inventories in silos near Randfontein—the location of a substantial amount of consumption.

In the interest of the South African grain system, therefore, I was contracted to examine the current system, examine changes since 2009, and answer the questions posed in the next section.

[1] The JSE has been working to introduce a Commitment of Traders Report but has encountered difficulty in maintaining anonymity of participants. As the JSE is actively pursuing the report, the author considers the recommendation accepted.

2.2. Scope

Dr. Roberts was enlisted by the Johannesburg Stock Exchange (JSE) to examine the design and operation of agriculture futures contracts. As detailed in email correspondence dated 17 October 2018, for the futures contracts on white maize, yellow maize, wheat, soya, and sunflower seeds, this investigation was to specifically examine:

- Do the findings and recommendations of the 2009 study still apply, if not, what changes were identified?
- Should the JSE consider changing the reference points for each of the commodity products based on the changes in processing capacity? This could imply a unique reference point per commodity;
- Should location differentials (LD) be applied to the JSE soya contract? Although a recent industry workshop did not support changing the contract to reference a single point, what are your opinions regarding future growth of this contract and the number of registered delivery points?
- What can the JSE do to improve participation by market participants of the spot basis functionality thereby improving transparency of basis premiums during the delivery month and
- Any recommendations regarding the current methodology used to determine the location differentials to improve its accuracy or the efficiency in the manner it is calculated.

2.3. Process

To create this report, the JSE organized meetings with organizations throughout the agricultural value chain in South Africa between 26 January 2019 and 6 February 2019. Organizations included in these meetings included Grain South Africa (meetings with farmers in Rietpoel and Mooresburg, and leadership in Pretoria), South African Oil Processors Association, Commodity Trading Funds, National Chamber of Milling, South Africa Cereals and Oilseeds Trading Association, Animal Feed Manufacturers Association, JSE Brokers, and the Agricultural Business Chamber.

In addition, I was granted access to market data as needed by the JSE and participants, including SBW end of day (EOD) trading data, contract specification data, and historical price, volume, and open interest data.

Subsequent to the trip to South Africa, I have received communications and statements by approximately 15 interested parties, which have also been considered and incorporated here.

3. The Economics of Futures Markets

3.1. Purpose[2]

The mid-19th century is the beginning of recorded history for today's futures markets. Prior to that, there were transactions that had many characteristics of what we today call futures contracts, but little detail of any organized markets and exchanges survives. What we do know is that the forces that eventually resulted in futures have existed since the first speculator undertook a journey to trade for goods in another place with the intention of returning to sell his wares. According to Working, "[o]nly in the grain trade at Chicago, however, was the demand for a means of hedging commercial risks then strong and persistent enough to permit this unconventional form of trade to survive the fluctuations in speculative interests, overcome conservative opposition, and live through the stormy period of experimentation necessary to put it on a firm footing."

At the core of futures trading is the desire among participants to transfer price risk among each other, along the way 'price discovery' occurs—the market determines the mutually expected price. Farmers want to fix their production price before incurring input costs. Processors can fix input costs to offer fixed prices to their customers. Speculators may be willing to assume the price risk in exchange for profits. Investment funds may want to diversify their portfolios. Early on, however, it was the desire on the part of farmers, processors, and speculators that created the demand for what eventually became known as the futures markets.

In their earliest incarnation, futures were not the instrument traded. Instead, commitments to deliver physical commodities in the future at a price fixed today were traded. These contracts are now known as forward contracts. Such contracts have existed as long as merchants undertook risky travels to procure and bring back desired commodities, whether Marco Polo travelling to China, or a merchant sailing to Egypt from Ancient Rome. In both instances, the merchant needed funds to outfit his expedition and purchase goods that could be used to barter. In order to do so, they presold some portion of the valuables that they would obtain. This is directly analogous to a modern farmer's choice to fix the price of grain before planting.

As is always the case in barter, when trading is limited to certain participants or goods, such as the merchant and financier and provisions and spices, efficient prices are difficult to achieve. If more participants can be brought into the process, then there is a greater pool available to purchase and sell the desired goods. It is difficult to pull in more participants if the terms of trade are all bespoke.

Modern futures markets are the descendants of these early trades. As we will see, to the greatest degree possible, futures contracts are highly standardized, in order to insulate all participants from any concern about their counterparty. Not only are futures standardized by quantity, quality, location, and time, but even by the risk of default of the other trader.

[2] The text of 3.1 is taken, verbatim, from Roberts' unpublished manuscript "Modern Grain Management."

Lorton and White[3] define a futures contract as "a legally binding commitment to deliver or take delivery of a certain quantity and quality of a commodity at a specific delivery point on a future date."

In order to understand better how a futures contract fulfills the roles of price discovery and risk transfer, we need to dissect this definition a bit. As a commitment, a futures contract is simply a contract to make or take delivery. It is not the sale or purchase of a tangible item. This is a source of frequent misunderstanding about futures—because futures are simply a commitment or contract, there is no physical limit to the number that can exist in a particular market. In order to facilitate trades by participants from around the globe, each futures contract must be very precisely standardized so that every trader know exactly what is being transacted. For that reason, the quantity and quality of the traded commodity must be specified. Corn futures for example, are for 5,000 bushels of #2 grade yellow corn, with maximum levels of damaged kernels and foreign matter specified. Location must be specified because the value of a commodity is inextricably linked to its whereabouts. Frequently, the value of an identical 1,000-bushel truckload of corn is $1.00 higher in New Orleans than in the interior of North Dakota. Therefore, locations must be specified. For corn, locations are along the Illinois River, for soybeans locations are along the Southern Illinois River, and for Soft Red Winter Wheat, locations are Toledo, and a 10-county surrounding area, and the Mississippi/Ohio Rivers north of Memphis to St. Louis and Cincinnati, respectively. Finally, as commodity values change over time, the time of delivery must also be standardized.

3.2. The Role of Delivery

Whether in the context of the current project, or in the context of similar research into futures markets, participants often wonder why there is so much emphasis on the delivery mechanisms of futures markets when only a very tiny fraction of all contracts are delivered compared to the vast amount of trading of the futures themselves. The answer is that the ability to transfer risk between market participants is only successful if the futures market price and the cash market price are reliably correlated. The mechanism that provides this correlation is the delivery process. For well-functioning physically delivered commodity futures, arbitrage between the cash market and futures market through physical delivery maintains the needed correlation between cash and futures to permit risk transfer and facilitate price discovery.

3.3. The role of differentials in futures delivery

When designing a physical delivery system for a futures contract, there are a number of parameters to be specified. The key concept in the contract design is the standardization of the product that is delivered to the assignee (futures long). The emphasis on value to the physical long is because *ex ante* delivery, the assignor (futures short) owns the product to be delivered and is therefore fully informed of all specifications of the product, whereas the assignee will only become aware of these specifications after assignment. Therefore, an ideal contract would be one in which there is no variation in location or quality or timing of delivery, ensuring perfect homogeneity among the delivered goods, and perfect and symmetric information about the delivered goods among market participants.

[3] Lorton, Sherry and Don White, "The Art of Grain Merchandising, Silver Edition." White Commercial Corporation, 2014.

Practically-speaking, futures for physical commodity are rarely amenable to such a high level of standardization. Agricultural commodities vary in quality due to growing, harvest, and storage conditions. In order to provide adequate volumes for delivery, they also frequently have geographically disparate delivery locations. This creates uncertainty in buyers as to the value of the delivered commodities and therefore discourages trading and pushes the equilibrium futures contract price downwards toward the value of the least valuable specification of good that can be delivered against the contract.

Because physical heterogeneity is fundamental to traded commodities, exchanges often apply premiums or discounts to physically-delivered commodities that deviate from the reference specification. This replaces physical homogeneity with financial homogeneity—compensating assignees who receive lower-value goods through delivery with a lower price to reflect this value.

3.3.1. Quality

Quality differentials are the most common form of differentials in commodity markets. Nearly all agricultural commodities are subjected to a governmental grading standard. Differing grades of the commodity often have substantially different values to end users. For this reason, futures contracts reference one particular standard, such as the JSE Bread Wheat contract, which trades grade B1 as reference, but grades B2 and B3 can be delivered at discounts to reflect their lower desirability. For the CME Corn contract, #2 yellow corn is the standard, but #1 can be delivered at a $0.015/bushel premium, and #3 can be delivered at a $0.02-$0.04 discount depending on specific quality measures.

The use of quality differentials is extremely common in commodity futures, as often time the mix of grades actually produced is a function of weather, and so without the ability to deliver multiple grades, market participants might find that the quantities available for delivery are far less than expected. This potential creates a disincentive to use the market at all times for buyers, harming liquidity and thereby hurting the market's ability to function.

Were a market to permit multiple grades to be deliverable, but with no differential, sellers would stop delivering higher value product to the market, and buyers, knowing that they could be assigned any grade, but due to the availability of higher prices in the cash market for the higher grades, would come to expect to only be delivered the least valuable grade, designating that grade as the *de facto* reference commodity.

The use of quality differentials to permit the delivery of multiple grades has an additional benefit. In years in which weather results in significantly decreased production of a particular grade, it may leave the market vulnerable to a 'corner' in which one or more long traders hold their large positions to delivery, and there are not sufficient quantities to deliver against the long futures. As a result, prices are driven uneconomically high. Using quality differentials increases the quantities that can be delivered against short positions, making market corners more difficult to execute.

3.3.2. Location

Location plays a fundamental role in the value of a commodity. As commodities must often be transported significant distances between their points of production and their points of use, the market value at the point of use must be higher than at the point of production to incentivize transportation. In this way, commodities that exist in low-demand/high-supply areas are intrinsically worth less than those in high-demand/low-supply areas.

If a futures contract allows delivery in both high value and low value areas, but there is no recognition of that through a premium/discount system, then buyers will expect to receive deliveries from only the lowest value location, as sellers in high value locations will choose to deliver directly into their local cash markets. In this way, the delivery area will effectively shrink to the low value areas and they will become the de facto reference point for the contract.

3.3.3. Origin

To the extent that the origin of the commodity—typically this refers to its country of production—affects either its real or perceived value enough to change a buyer's preference for delivery, origins should also be assigned a premium or discount.

3.4. What is an ideal reference point for JSE commodity futures?

Location of the reference point is another point of contention. Many market participants questioned whether Randfontein is still the correct reference point. When the JSE commodity futures contracts were designed in the mid-1990s, Randfontein was the center of the grains milling industry in South Africa. Two-plus decades later, market forces have led to the production and consumption of grains to be much more dispersed than previously, and the collapse of the rail system has led to much higher transport costs, and less importance placed on high-quality rail access—another characteristic of Randfontein.

There is little published guidance on what an ideal reference point should be, but there are many characteristics that it should exhibit.

a) The reference point should be located within the commercial grain flow
b) The reference point should have ample grain storage
c) The reference point should have good transportation links to other areas of significant use and consumption.
d) Widespread ownership of storage at the reference point.

Many assert that reference points should be located closer to demand than supply, but there is no authoritative support for that view. Instead, it is better than they be located near concentrations of supply ***or*** demand, with efficient transport to the other, and sufficient silos at the reference point to deliver and store meaningful amounts of the commodity. Specific to the JSE contract, if a large proportion of silos are to remain registered, with delivery against the futures utilizing an LD, it is preferable that the reference point be near sources of demand, so that the LD is more reflective of the values of the commodity as it moves away from the demand source. Further, the reference point should not be overly influenced by the existence of a single processor at a point, and instead by the demand of multiple processors and the

location of multiple silos. Relocation of the reference point is a major change in the contract specification and should not be undertaken lightly or often.

These conditions all apply to any commodity futures market, but if delivery is to occur outside the reference point, as is the case in the current South African system, it raises the question as to whether the existence of the LD should influence the location of the reference point.

If all differentials were set correctly, and the value of grain delivered through the JSE were to be equalized, then there should be no reason to consider any factors in siting the reference point than those listed above. However, as the location differential is customarily a positive number that is subtracted from the JSE futures price, if this custom is to persist, then lends support for choosing reference points that are near, or at, the highest economic values. However, identifying such points remains difficult in South Africa due to the opaqueness of the cash market. A basic investigation of SBW trading indicates that the highest cash prices for white and yellow maize and wheat are paid in Gauteng, whereas for soya, it is KwaZulu Natal.[4] As Randfontein is located in Gauteng, this provides no evidence for moving the reference point for maize or wheat. For soya, the prices in KwaZulu Natal are a reflection that the port of Durban is located in that State, and that during this period, South Africa has been a net importer of soya. Moving the reference point to Durban, or near it, would move it away from the natural flow of soya, as a Durban location would only capture soya that is moving for import or export, which remains a very small proportion of total production.

3.5. Broad delivery area vs LDs

A fundamental tension exists in the structure of the JSE's physical delivery mechanism between having a large number of geographically dispersed registered silos with a location differential system, or a small number of registered silos without a location differential system. The latter arrangement is the most common for agricultural futures contracts around the world. The small delivery area maximizes the standardization of location among deliveries and eliminates any need for establishing location differentials. Reducing the size of the delivery area necessarily reduces the number of silos that are registered, and therefore, the capacity of the system to facilitate physical deliveries. Lack of capacity has often been cited as a contributor to the lack of convergence in the US Soft Red and Hard Red Wheat contracts. In the South African system, shrinking the number of delivery points and area that permit physical delivery would also reduce the number of farmers who have a guaranteed 'last resort' selling price of JSE-LD. This could adversely affect operational financing, as lenders would no longer have the guarantee of being able to directly market crops through the JSE. A further consideration is that, if there is actually significant market power among buyers, the lack of the JSE option will further concentrate the market but removing one guaranteed buyer at every registered silo in the country.

[4] These conclusions are very preliminary. In order to better identify whether the highest valued location for grains is not Randfontein, highly granular (at least daily) price data for the SBW and Senwes Basislink systems should be analyzed. To date, the JSE has not been able to produce such granular SBW data in a usable format.

3.6. What would happen without LDs?

Roberts (2009) addressed this question by hypothesizing about Sannieshof Maize.[5] In fact, the soya market is an example of the effects of removing location differentials. In the soya market, cheapest-to-deliver silos (such as Migdol and Schweizer Reneke) have seen large inventory builds, and constantly large redeliveries of silo certificates. Because the JSE delivery mechanism for soya has no location differential, owners of certificates have a guaranteed floor price of the JSE soya futures contract. Primary sources of soya demand are located in Gauteng or the Eastern portion of South Africa. Because the cost of transportation from these cheapest-to-deliver locations is greater than the cost to import soya and transport it inland, the market value of soya at these silos is lower than the traded price. Therefore, buyers who find themselves holding physical delivery certificates will choose to redeliver to the JSE rather than withdraw the soya and deliver it to a soya crushing facility.

Over time, build-up of inventories as cheapest to deliver silos will draw the traded price on JSE to the value of those silos and causing soya to trade at premiums in higher-value locations. This could impede the ability of farmers in those high-premium areas from obtaining financing. More damagingly, as the JSE futures contract effectively becomes a Northwest futures contract, it will deter buyers from participating in the JSE contract, reducing liquidity and increasing costs for market participants. As inventories build in these cheapest to deliver locations, quality may also degrade, further reducing buyers interest in trading in the JSE futures. Finally, these silos will fill up and stop being able to accept new deliveries, forcing local farmers to transport crop to further silos, where the entire process will start over again.

This cycle leads to a destabilization of the futures contract, as its value slides to the cheapest to deliver, stocks build up, and liquidity exits the market. Such an outcome will be harmful to all market participants.

3.7. The Ideal Differential System

If we take the arguments above as compelling justification for retaining a delivery system with many, widely dispersed registered silos, necessitating a location differential system, then what should the ideal location differential system look like?
An ideal location differential system would relegate the JSE physical delivery system to being less important; reducing the frequency and quantity that are delivered through the JSE. Instead, an ideal delivery system would be one in which the cash market is so robust, and JSE deliveries are so rare, that the values of LD are not known to any but a few, as delivery through the JSE becomes a 'last-resort' option for grain market participants.

As the JSE delivery process provides any market participant a put option, then the JSE-LD price must be below the market price at a given location, by enough that it is only attractive in unusual circumstances. Imagine that R150[6] is determined to be the optimum premium. In this case, we would analyse trading, and if we see premiums that are consistently more than, for example, R250, we would decrease the LD enough so that premiums are approximately

[5] See Roberts (2009) sections 5.5 and 6.2.

[6] Note that this is a thought experiment, so please do not fixate on the R150 level. It is only a placeholder.

R150. Likewise, if premiums are below, for example, R50, the location differential would be increased, to increase the premium. In this way, the cash market would determine prices, in concert with the JSE futures price, and the LD is only relevant if physical delivery must be made.

In such a system, it would no longer even be necessary for traders to be aware of the size of the Location Differential, as physical delivery would be rare, and therefore, cash prices, instead of being quoted as premiums to the JSE-LD would instead simply be quoted as discounts to the JSE. Such a system would allow the market to set the correct differentials and would likewise push more of the trading into the cash market and away from the JSE.

Significant practical problems mean that such a system, while instructive, cannot be implemented. First and foremost, this type of system would require data on the number and prices of cash market transactions, which do not exist. Second, as in Roberts (2009), this mechanism relies on a properly functioning competitive market, and though there are some signs that grain markets are more competitive now than in 2009, there is still not enough evidence that the South African market is truly competitive. These two reasons justify why such a model is at best only a thought experiment, but it can be instructive in contemplating the design of the market.

3.8. The uniqueness of the JSE contracts

When the SAFEX designed the initial futures contracts for the South African market in the mid-90s, the South African market was in a time of significant change, transitioning from the previous centrally-planned system to a market-based one. Under the centrally planned system, farmers delivered their crops to government owned silos and received the government-set price, and price was homogeneous across the country.

As Rod Blondin, former CEO of the South African Futures Exchange, and 'father' of the current system, wrote in personal correspondence:[7]

> *The first two futures contracts introduced on the Agricultural Markets Division (AMD) of SAFEX in the latter part of 1995 were the Chilled Carcass Beef Contract and the Potato Contract. The reason for this was that the beef and potato sectors were further down the path of deregulation than the grains sector. The Beef Contract was designed to be a deliverable contract but due to the difficulty of determining suitable cold storage deliverable locations and the inherent difficulties in ensuring delivery and as a result of pressure from both the demand and supply sides the contract was amended to cash settlement. The contract traded limited quantities but due to the cash settlement value allegedly being manipulated the contract lost all traction. The cash settled potato contract was designed with a much more rigorous and robust formula to determine the settlement value, but due to a total lack of support from the demand side, the contract never traded.*
>
> *The learning experience from these two contracts taught some valuable lessons in the design of the maize contracts which were introduced in early 1996. There was also no*

[7] Edited for clarity and brevity.

transparent cash market against which to settle a cash settled maize contract and therefore it was agreed that a physically delivered contract should be designed in conjunction with all the market participants.

The model of multiple delivery points with location (transport) differentials was the result of the following factors:

- *Maize storage (largely well-constructed concrete silos) was almost exclusively in the hands of the then Agricultural Cooperatives […] On farm storage was minimal.*
- *One of the first tasks of the General Manager of the AMD was to determine delivery locations to support the maize contract.*
- *SAFEX decided that the number of delivery points should be limited to 5 or 6 locations and requested the large maize cooperatives to put forward one delivery point each.*
- *The members of the cooperatives, predominantly producers, could not decide on a single delivery point on the basis that it would be unfair to the farmers who were located at the furthest distance from the designated silo. The cooperatives all wanted to nominate several delivery points to make it 'more fair' to all their members.*
- *SAFEX agreed to multiple delivery points on the following conditions:*
    - *There needed to be agreed conditions and rules under which a delivery point could be registered as a delivery location for the maize contract. These related to both the owner and the actual storage point and included inter alia capital adequacy, relevant insurance, relevant expertise, storage capacity, out loading capacity and infrastructure. All delivery points were required to have a rail siding to facilitate rail out loading of product. Accounting and inspection procedures were also agreed to.*
    - *SAFEX formed a committee on which silo owners were represented to determine an annual maximum daily storage rate that would be levied on all product held on a SAFEX warehouse (silo) receipt as the SAFEX traded price represented a free alongside silo price. Any outstanding storage would be accounted for on the basis of the agreed annual daily storage rate.*
    - *In recognition of the difficulties that arose from pan geographic pricing and the need to address the fairness argument, it was agreed that every registered delivery point would be subject to a location differential (representing transport costs) from a designated "central reference" point.*
    - *The "central reference" point was designated as Randfontein on the basis that it represented the single largest milling point in South Africa and that because of that it was connected by rail to all the major silos in South Africa. It must be noted that in 1995 almost 80% of maize was transported by rail and it was relatively simple to determine location differentials based on the rail transport tariff schedule.*

As of 2019, the JSE agricultural futures contracts are very unusual in that a very large proportion of silos are listed for delivery, and they are spread throughout the production area. Agricultural futures contracts in all other markets only allow delivery in relatively concentrated areas, to reduce the variability of value of deliveries to assignees. The JSE wheat contract is perhaps the most extreme example. Northern South Africa (the area roughly to the north and east of the Orange River) contains approximately 60% of the milling capacity in the country, but only 30% of its production. As a region, it is very dependent on imports from the area south of the Orange River, and from imports from the world market. In contrast, Southern South Africa (south of the Orange River) produces 70% of the nation's wheat but has only 40% of its milling capacity. Therefore, it relies upon exports to Northern South Africa. Yet the JSE has silos listed for delivery in both regions.

4. What has changed since 2009?

During this investigation, the question was frequently asked what has changed since 2009 that warrants a reexamination of the JSE futures markets. While many of the fundamentals of the markets that were observed in 2009 remain, there have been significant developments, both positive and negative that warrant a reexamination.

4.1. Soya market

In 2009, soya production in South Africa was both very small and very geographically concentrated. The JSE soya contract did exist, and saw modest trading, but there was no expectation that SA soya production and area would expand as rapidly as it had. However, global demand for animal protein has been growing rapidly for the past two decades, as population and income growth increase at unprecedented rates. At the same time, new varieties of soya have come to market that are better adapted to SA growing conditions, and more and more farmers have realized the agronomic benefits of incorporating a legume into rotation with maize or wheat.

The expansion of the number of hectares of soya being planted has naturally expanded the geographical footprint over which soya has been planted. In 2009, soya production was concentrated in small areas in KwaZulu Natal, Mpumalanga, and Western Free State. As area has grown since 2009, it has expanded westward, as far Migdol and Schweizer Renneke. Likewise, the number of listed silos has also expanded, both in quantity and across the production area. As the soya market was initially so geographically concentrated, no LD system was enacted. Roberts (2009) recommended one be enacted "if the JSE believes it necessary."[8]

GrainSA holds up the soya market as an example of success and asserts that it is a well-functioning market. These claims are based on the emergence of larger and more common premiums being offered to soya farmers. GrainSA argues that the lack of LDs forces premiums to be paid in order to move soya from surplus to deficit regions, and therefore provides support for the contention that LDs should be removed in all JSE contracts.

The emergence of premiums as being more common (again, unfortunately, the size and frequency of premiums paid to farmers is unverifiable) in soya is a natural consequence of the futures contract being traded on the basis of the 'cheapest to deliver' point—the far western areas. In this case, the value of soya in areas farther east is higher, and so premiums will occur more commonly.

The emergence of premiums leads opponents of the LD system to cite soya as a model contract that proves that LDs are unnecessary for JSE futures contracts. This contention is misguided. Over the past two years, large amounts of soya stocks have built up in far western silos, seeing continual re-delivery in the JSE delivery system, an indication that the inventories are unwanted by the market, and the traded futures price is above the market value of these stocks. Since silo certificate holders retain the option to redeliver the

[8] Author's note: This is the one conclusion from the 2009 report that I regret. In hindsight, I should've made a forceful recommendation for the implementation of LDs in soya futures.

commodity to the exchange, and soya has no LD, unless the value of the soya held under certificate is equal to or greater than the value traded on the JSE, redelivery will occur.

These stock builds and repeated redelivery are problematic for a number of reasons. First, the buildup of inventories in the far west means that with each futures expiration, a greater proportion of the inventories delivered to the JSE are from the west, and therefore, assignees are increasingly likely to receive western certificates. This process becomes self-reinforcing until the contract becomes a western soya futures contract, driving out eastern producers from participating, decreasing traded volumes, and ultimately reducing the utility of the futures contract for either price discovery in the areas of most production (the East) and risk management, as the price is tracking the value of the 'stranded' soya in the Western silos. The second issue that the accumulation of stocks in the West creates is that without flow of soya through these silos, the quality of stored grain will degrade. While this is not directly a problem for the JSE, as it is the silos that guarantee grain quality, if large quantities of grain do remain stationary and degrade, it further dampens interest in participating in the JSE soya futures, reducing volume and the contract's effectiveness for price discovery and risk management.

4.2. Maize redeliveries

Similar to the situation in the Far Western silos for soya, high redeliveries have also been observed for maize into silos very near Randfontein, in particular, those silos with differentials below R100. While the exact cause of this build is not easy to prove, it is theorized that this is due to three factors: (1) The remaining, very large, mill located in Randfontein has inadequate dumping facilities, leading to long and unpredictable waits to off-load, and (2) because of (1), shipping companies will not accept any load without a minimum of R100 or R120 fee, even for a silo such as Aureus, that is located only 7km away, with a LD of 86. For this reason, it would typically be more economical for the RF-located mills to source from silos with LDs of at least R120, as the maximum price of grain to the buyer is limited to JSE-120+120 for a silo with an LD of 120, whereas for a nearer silo, the cost would be JSE-86+120. These prices do not include any premiums, and are therefore a worst-case scenario, but they illustrate the issue created by the 'price floor' allegedly existing for shippers.

4.3. Drought in 2016

In 2016, South Africa suffered a very severe drought that greatly reduced yields of white & yellow maize, wheat, and soya. During this period, there were imports of white maize into South Africa that were delivered against JSE futures positions. Although such foreign origin deliveries had been allowed since 2003, there hadn't been the difference in South African and international prices to justify importation and delivery of white maize into the JSE. Because there had not been previous deliveries, many traders believed that they were not permitted. This is erroneous—such imports had not been made but had been possible. But many processors did subsequently relay that although the imported maize met the contract specifications, it was materially different than South African white maize, and they judged it inferior. This is a case where the specification of the contract may not leave assignees indifferent among commodity delivered through the JSE.

4.4. Financial Stress on Farmers

South Africa is a relatively small grains producer that is open to the trade in global markets. As such, commodity prices are highly volatile, owing to changes in global supply and demand, as well as changes in currency valuations. Between droughts in recent years and low global commodity prices, many farmers have had multiple consecutive years of negative profits, leading to draining of their working capital and land equity. These increasingly precarious financial positions mean that operating finance is even more critical to farming, and even more difficult to acquire.

4.5. Development of JSE Spot Basis Window

Based upon the recommendations of my 2009 report, the JSE introduced the Spot Basis Window contract in 2013. The SB market allows for the electronic trading of silo certificates, promoting transparency in the cash market for grains, particularly any premiums that are paid to purchase certificates from specific silos. To date, volumes traded on the Spot-Basis contract remain relatively low.

4.6. JSE Cape Wheat Market

The JSE launched the Cape Wheat Futures market in 2012. Instead of using Randfontein as the reference delivery point, the Cape Wheat contract used Paarl as the futures delivery point, and location differentials were implemented to listed silos, based on the cost of transportation to Paarl. Silos in the Western Cape could be listed as delivery locations for either or both contracts. By 2014, the JSE delisted the Cape Wheat contract, due to very low trading. While no definitive explanation for the failure of the contract exists, many market participants cited a lack of interest from wheat end users, and therefore sellers and speculators all eventually exited the market.

Implementation of a Cape Wheat futures has long been requested by growers in the Western Cape, and it was explicitly addressed in Roberts (2009). At that time, I had significant concerns about the viability of such a contract, as it would split liquidity from the existing JSE Wheat contract, potentially harming both of them through higher transactions costs. The design of the 2012-2014 contract meant that its introduction was not guaranteed to split the market liquidity. Existing participants, whether or not they were located in the Western Cape, could continue to trade the RF Wheat contract. This undoubtedly preserved the RF Wheat contract, but also contributed to the difficulty of the Cape contract gaining a foothold in the market. The only time that it would make sense for traders to shift from RF to the Cape contract would be if the spread between the two contracts was significantly less than the Western Cape location differential for the RF contract.

5. Developments in South African Grain Markets: 2009-2019.

5.1. SBW and Senwes Basislink Have Increased Transparency in Physical Prices

A primary problem in the South African crop market is the lack of transparency in the market for cash grains. Roberts (2009) highlighted this issue repeatedly, as the lack of information about cash grain transactions greatly impedes the study of other characteristics of the cash grain market. Based on the recommendations of Roberts (2009), the JSE implemented the Spot Basis contract, an electronic market for the trading of silo certificates. The existence of the SBW does shed some light on the value of grain certificates in excess of the futures price minus the transportation differential. Unfortunately, participation in the SBW market is quite low, whether by farmers specifically, or market participants in general.

In recent years, SenWes has created a somewhat similar system for the trading of silo certificates, which could shed more data on the relative value of grain at stored at different locations, but once again, it is not guaranteed that any of those premiums are being offered to farmers; by the time that the premiums are paid, the grain may be in the hands of traders.

5.2. JSE-LD Remains the Cash Price Benchmark

While the lack of cash price transparency makes it difficult to independently verify any claims about the size or frequency of premiums paid to farmers, there is a general consensus among farmers and traders that (1) premiums are more often paid in the Free State and KwaZulu-Natal, (2) premiums are very rarely paid to farmers in the Western Cape, (3) the existence of premiums is sporadic in all markets.

The ability to deliver grains against futures contracts at nearly all silos in South Africa mean that farmers have a 'put option'—a guaranteed minimum price that they will receive for their grain. The put option price also serves as a floor price in supply and demand analysis. The behavior of premiums is critical to understanding how important this floor price is to the South African grain market. In a competitive market, price floors are only relevant if they are above the market equilibrium price. When price floors exceed the market price, then transactions occur only at the floor price, i.e. the floor price is 'binding.' When transactions occur in the South African grain market only at JSE-LD, then this is an indication that this floor price is above the equilibrium price, i.e. it is 'binding.'

That overestimated LDs are preferable to underestimated LDs is an application of error analysis—comparing the relative costs of errors in decision-making to help guide the decision. In the course of this investigation, multiple parties have expressed their reservations about the method in which the LDs are estimated by the JSE, believing that the JSE's methods are prone to manipulation due to the small sample size and the use of survey estimates rather than actual transport prices.

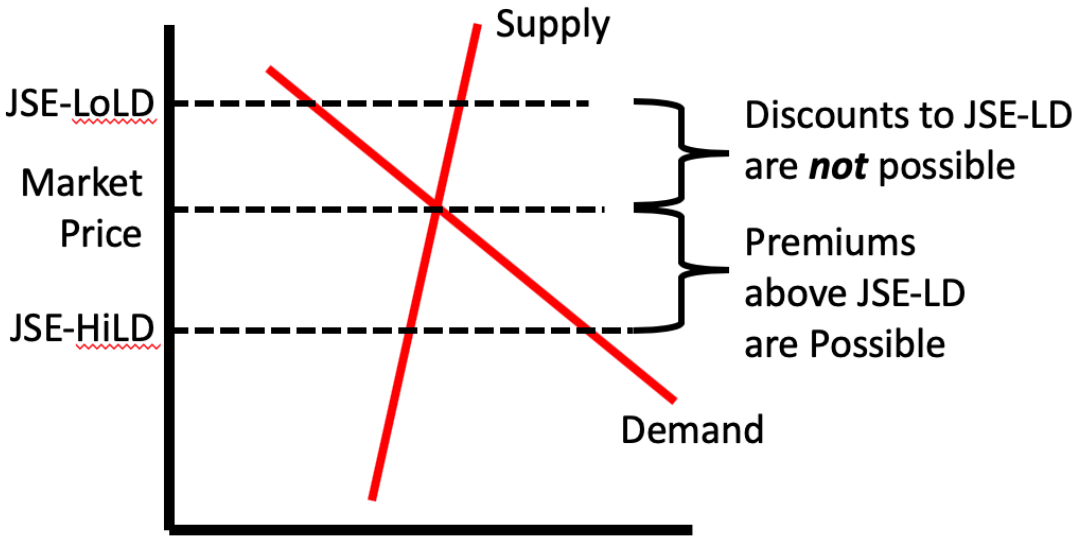

FIGURE 1: IMPACT OF OVER- VS. UNDER-ESTIMATION OF LDS

Figure 1 depicts the impacts of over- and under-estimated LDs. If we imagine that some underlying competitive equilibrium price exists in the local cash market (Market Price), then then if the LD is overestimated, it results in a JSE-LD price that is below the market price. This is not problematic, as premiums can be paid, which could permit the market to reach its competitive price. However, if the LD is underestimated, the result is a price above the competitive market equilibrium (JSE-LoLD). A buyer that is assigned a silo certificate in this instance would realize more value by redelivering the certificate on the JSE (i.e. selling the futures and then delivering the certificate to settle) than by actually utilizing the underlying commodity.[9] This is because the delivery option that all holders of certificates for registered silos mean that they have a guaranteed selling price at JSE-LD, and would therefore never accept a discount to JSE-LD if the option to deliver exists. Likewise, overestimating LDs is less problematic as this should create an arbitrage opportunity for parties to purchase at JSE-LD and transport to a place nearer the reference point and deliver there and earn the difference between the LD and the transport cost.

This interference with the competitive equilibrium is a primary objection of market participants in South Africa. If the floor price is frequently binding, then transactions occur at the floor, and this creates no incentive for a more transparent market to develop. This argument has merit. One may also observe that if the equilibrium price is only slightly above the floor price, it may be rational to continue to bid the floor price, as the cost of advertising and managing very small premia may outweigh the benefits of offering the premia. None of this is evidence as to why the Location Differential System should be abolished or reformed in such a way to reduce the size of the Location Differentials.

[9] When JSE-LD is significantly higher than the market equilibrium, large inventory builds at those silos are the result. This is precisely what is currently occurring in western silos storing soya.

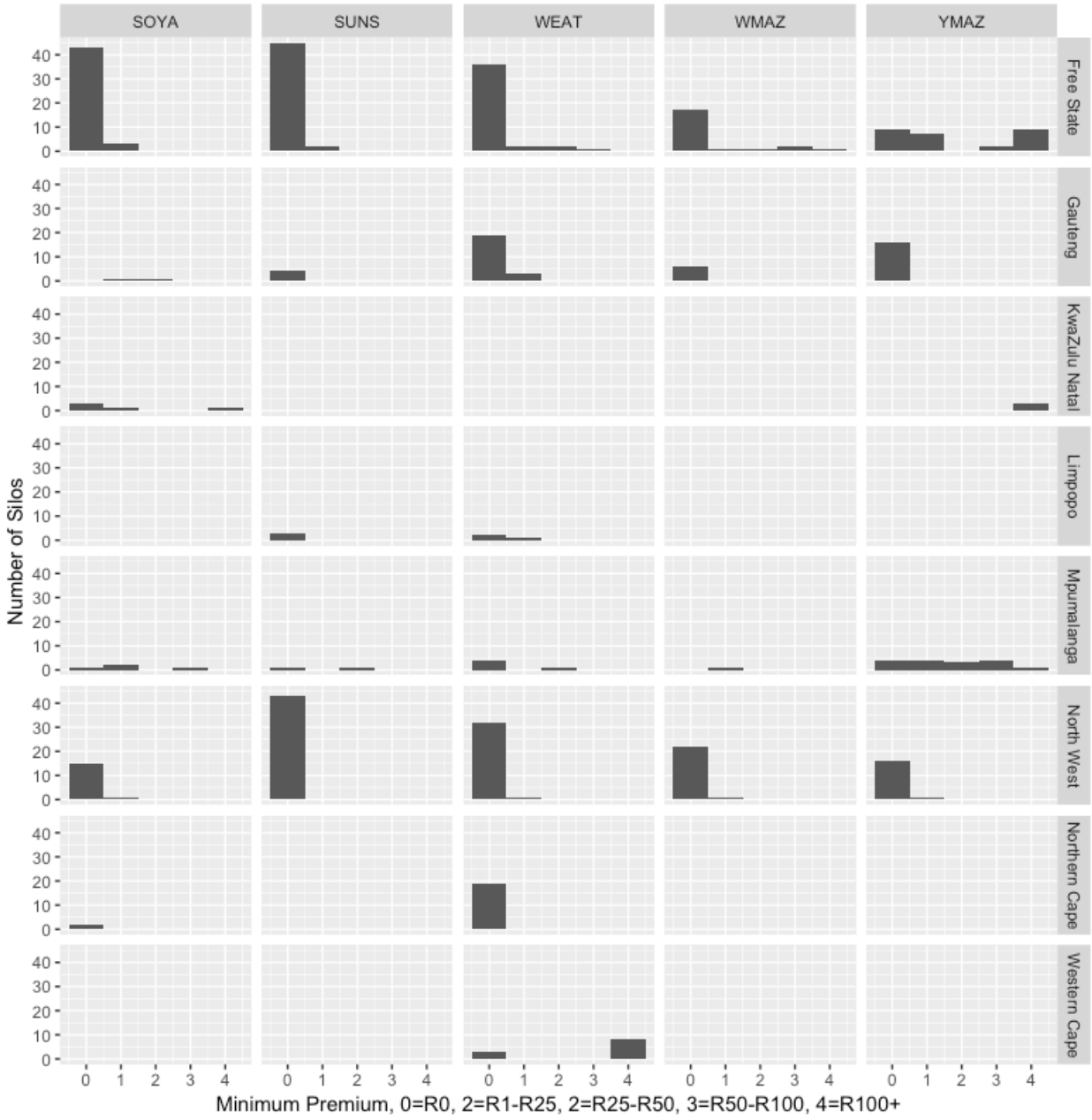

FIGURE 2: SILOS OFFERING PREMIA BY COMMODITY AND PROVINCE, 2018

There are two reasons that the common assertion that shrinking or eliminating LDs will make farmers better off is incorrect, both addressed in the 2009 report. First, a reduction of LDs below transportation costs will adversely affect the cheapest-to-deliver calculation and therefore affect the reference value at which the futures contract trades. Second, if buyers have sufficient market power to move cash prices away from their equilibrium values, eliminating LDs is likely to reduce the prices paid to farmers, as buyers are no longer limited by the JSE-LD put option on prices, and then could potentially drive prices even lower.

These two concerns are somewhat at odds, however. If there is little market power, but current LDs are creating binding price floors, then the policy that will most improve market efficiency would be to ***increase*** LDs, pushing the price floors below the market price, and forcing a cash market to form. Alternatively, if market power is the dominant force in futures markets in South Africa, modest reductions in LDs may be appropriate as a counterweight to

overly-powerful buyers and end-users. There is no clear way to demonstrate which is more important. However, some of the recommendations of this report, if implemented, should induce changes in the behavior of prices and market participants that could inform the balance between these forces.

As discussed above, SBW trading is not a fully accurate window into premiums paid to farmers, but it does indicate the prevalence and relative size of premiums paid in the 'wholesale' market for silo certificates. Figure 1 shows the number of silos in 2018 for whom all SBW trades were above 0, divided by crop and state. Free State and Mpumalanga have the largest proportion of silos that have paid premiums.

5.3. JSE-LD Remains the Benchmark for Agricultural Lending

A common observation in 2009, and again in 2019, is the role of JSE contracts in obtaining operating finance for crop production. During both the 2009 and 2019 interviews, many farmers pointed out that they were largely unable to directly buy or sell the JSE contracts, as they were forced to sign over ownership of their harvest as collateral to receive loans to purchase inputs such as seed and fertilizer.

This situation is crucial to consider in contemplating changes to the structure of JSE futures contracts. If changes made to the contracts result in a systematic decline in the value of the contracts, for example by rearranging the 'cheapest to deliver' option, or by reducing the collateral value of the contracts, such as by reducing the number of registered silos, then that will impair farmers' ability to obtain financing under the current practices.

This must not be a bar to change; many countries operate without such financing practices, and South Africa could likely evolve to a different set of financing options were it forced to. But with the weakened state of South African farm finances, the transition from the current regime to a new regime could be very damaging.

6. Recommendations to the JSE

6.1. Maintain Location Differentials in Wheat, Maize, and Sunflowers.

I recommend that location differentials be maintained for JSE Wheat, White & Yellow Maize and Sunflower futures contracts. The current system works well for providing price discovery and risk transfer. As in every system, there are compromises owing to the particulars of the local market, but there is no evidence that alternative market structures would improve operation of the South African grain market. This recommendation and its underlying reasoning is identical to my 2009 recommendation to maintain location differentials.

I considered but rejected the alternative of elimination of LDs while maintaining the current set of registered silos. Elimination of LDs would create very large differences in the value of silo certificates for buyers, increasing uncertainty, decreasing the level of futures prices as they adjust to a new cheapest-to-deliver location, and reducing liquidity. Such changes would harm all participants in the JSE futures markets, with no compensating gains.

I considered but rejected the alternative of the elimination of LDs, combined with a radical concentration of registered silos. Under this alternative, LDs would be eliminated and only a relatively small number of silos would remain registered, and they would all be located within 50-100km of each other. Such a system would greatly simplify the physical delivery operations of the JSE and would permanently solve the LD controversy. I rejected this solution for two reasons: (1) the role that delivery plays in operational financing and (2) the role of market power in South Africa.

Both in 2009 and 2019, many farmers and farmer representatives pointed out that they were unable to participate in the JSE markets as they are forced to sign over their grain in order to obtain input financing, and that their silo certificates are assigned to the banks as soon as delivery is made. When asked what would happen in the absence of the delivery option at nearly all local silos, few respondents could answer. I believe it is inevitable that the market would adjust, and financing would nonetheless be provided, but such a change would unequivocally reduce the security of collateral against which banks are loaning operational financing and therefore would create confusion, added costs, and lowered credit availability until such adjustments were made, which could potentially be 1-2 years. Given the precarious state of farm balance sheets in South Africa, the risks associated with this disruption outweigh any potential benefits.

Market power remains present in South African cash grain markets. While there are indications that market power has declined north of the Orange River, there is no reason to believe that market power has declined in the South. In the presence of market power, removing the delivery option at most local silos would give buyers even more ability to artificially depress cash prices. While farmers may feel disadvantaged by their local LDs, and they rarely actually deliver through the JSE, they are all aware that they have that option, and that delivery option provides a floor to the market price. I do not believe that eliminating LDs and radically reducing registered silos is inherently unreasonable. They would constitute 'shock therapy' to the market that would force the emergence of a basis trading system 2-5 years in the future but could also bankrupt a large number of farms in the meantime. To the extent that market power is concentrated in the hands of end users in South Africa, such a

change would also increase their ability to artificially depress prices paid to South African farmers. For these reasons, making such a change is not in the best interest of the South African grain industry.

I considered but rejected the elimination of LDs in JSE Wheat, Maize, and Sunflower futures. Eliminating LDs in these contracts would align their structure with that of Soya. However, the Soya physical delivery mechanism itself is currently failing to clear the market. As detailed above, large inventories are building at far distant silos, destabilizing the market and ultimately will lead to the delisting of distant silos and therefore a reduction in confidence in the South African futures market.

I considered but rejected the creation of a 'Durban Maize' contract, that would use Durban as the reference point. I rejected this alternative for two reasons. First, Durban's role as a locus for price formation is only significant during periods of either extreme surplus or shortage, when large amounts of grain are being imported or exported.[10] During other periods, when the markets are not clearly trading at import or export parity, such a contract would be of little use and likely garner little volume. The second reason for rejecting such a contract is, as was experienced in the Cape Wheat contract, adding an additional contract would split the liquidity available to the market, and weaken the desirability for both contracts, harming all market participants.

6.2. Implement Location Differentials for Soya and Sorghum

I recommend that LDs be gradually phased[11] in for JSE Soya and Sorghum futures contracts. The phase-in of LDs in soya and sorghum will create the discounts needed for buyers to move long-stored soya out of the far western silos, and level the value of silo certificates across all registered silos.

I considered but rejected the alternative of leaving the system without LDs. I rejected this option as the lack of LDs in Soya has resulted in excess soya inventories building up in far Western silos, and a shift of the cheapest-to-deliver contract toward those silos. As they have filled to capacity, market buyers have begun to question the quality of those inventories, creating a vicious cycle of inventory builds. The JSE has already indicated that without any changes, these silos will likely be delisted. However, if these Western-most silos are delisted, that will not cure the situation, it will only transfer the situation to the next-furthest silos, at which it will begin again. As long as there remains a large difference between the values to buyers of crops stored at different locations, inventories will continue to build at the cheapest-to-deliver silos, and the market will not reach stability until enough silos have been delisted that the value of certificates across remaining registered silos is similar.

[10] Note that this is not simply when imports or exports are high, but when imports and exports *through Durban* are high. Such a contract would be irrelevant to any imports or exports that occur through other ports in South Africa.

[11] It is not clear how fast or in exactly what manner these LDs should be phased in. As these changes will not be able to start until the 2020 harvest, I recommend that LDs be partially introduced in 2020, and fully introduced in 2021. As to the method of the phase in, I recommend that LDs be capped at 50% of their maximum value in 2020, rising to 100% in 2021. For example, if the maximum LD for soya-registered silos is R300 in 2020, then for that year only, no LD should be greater than R150.

I considered but rejected recommending reducing the number of listed silos and limiting them to a small geographic area for Soya and Sorghum. Such a system would greatly simplify the physical delivery operations of the JSE and would permanently solve the LD controversy. I rejected this solution for two reasons: (1) the role that delivery plays in financing and (2) the role of market power in South Africa.

Both in 2009 and 2019, many farmers and farmer representatives pointed out that they were unable to participate in the JSE markets as they are forced to sign over their grain in order to obtain input financing, and that their silo certificates are assigned to the banks as soon as delivery is made. When asked what would happen in the absence of the delivery option at nearly all local silos, few respondents could answer. I believe it is inevitable that the market will adjust, and financing will nonetheless be provided, but such a change would unequivocally reduce the security of collateral against which banks are loaning operational financing. Given the precarious state of farm balance sheets in South Africa, the risks associated with this disruption outweigh any potential benefits.

Market power remains present in South African cash grain markets. In the presence of market power, removing the delivery option at most local silos would give buyers even more ability to artificially depress cash prices. While farmers rarely deliver directly through the JSE, they are all aware that they have that option, and that provides a floor to the market price. As stated in the 2009 report, "If market participants currently have market power in the presence of the differential system such that they can unilaterally dictate prices then they would also have such power in the absence of differentials."

6.3. Maintain the current LD calculation

I recommend that the JSE retain the current method and frequency of calculating the LDs. All parties to the discussion agree that no single calculation will ever be accurate at all times and in all situations. Many parties observe that the use of surveys of transportation companies in the current calculations has the potential to create conflicts of interest, as companies might be incentivized to estimate that transportation costs are higher than they actually are. Such systematic overestimation of transport costs would result in overestimation of the LDs. This objection is problematic as (1) overestimation of LDs is preferable to underestimation and (2) the LD does not actually set transportation rates—if the LD is overestimated, then arbitrage possibilities exist for parties, including farmers, to deliver grain to higher LD silos at profits above JSE-LD.

I considered but rejected the alternative that the JSE require shippers to honor the freight quotes used in the LD calculations. The JSE has neither authority nor ability to force the transport companies to honor these quotes.

I considered but rejected the alternative that the JSE utilize price data that shippers provide to SAGIS or other Government agencies. As neither SAGIS nor other agencies collect such data, I rejected this suggestion. Were such data collected and available, the JSE should incorporate it into its LD models as appropriate.

I considered but rejected the alternative that the JSE create an economic model of grain transportation in South Africa and utilize its estimates in LD calculations. I rejected this

alternative because transportation models are notoriously difficult to calibrate and update and require copious amounts of actual transportation price data. Lacking any government effort to collect such data, there is no ability to calibrate the model, and therefore little reason to believe that it would generate better results than the current methods.

6.4. Implement a Redelivery Differential

I recommend that the JSE implement a Redelivery Differential if concerns about manipulation can be addressed. A Redelivery Differential would impose a second differential on silos. Silos that experience a very high level of redelivered silo certificates for a given futures maturity would be assessed a Redelivery Differential at the close of that maturity window. If the high rate of redeliveries continues in the subsequent period, then the RD would be increased. If the redeliveries declined sufficiently, then the RD would be decreased. Redeliveries are a signal that the JSE-LD price is above the value of the commodity to the assignee. Some level of redeliveries is normal; a buyer might be assigned a certificate in a far-removed location, for example. But very high levels of redeliveries are an indication that the market cannot clear at that location at the current JSE-LD price. In deciding to implement a Redelivery Differential, the JSE must ensure that opportunities for manipulation are not created. Currently, only a relatively small proportion of physical trading goes through the JSE, but all of the physical tons could be priced using JSE prices. Therefore, a trader might choose to redeliver a large number of contracts, causing a redelivery differential to be applied, but that large number of contracts might be quite small compared to the total amount of crop stored in the silo. An example of implementation would be if the number of redeliveries exceeded a certain level, then the RD of that silo would increase by R5, and the RD would be updated after each futures maturity.

I considered not recommending a Redelivery Differential as I am not sure that market power and manipulation can be sufficiently mitigated.

6.5. Expand the Randfontein Reference Zone

If and only if a Redelivery Differential is implemented, I recommend that the JSE expand the current reference point to a reference zone. Implementation of a reference zone would mean that multiple silos near Randfontein all operate at a location differential of 0, and LDs for other registered silos will be computed as the lowest transportation cost to any silo in the reference zone. This zone should contain between 4-10 silos which are economically similar in value. Such a zone will permit actual arbitrage of the Location Differential system that is not possible today. This will not fix the stocks buildup currently occurring in the silos near Randfontein, as the silos that currently have transportation costs less that the minimum transport charge will be unchanged after the implementation of such a change. This is why the Redelivery Differential is required.

I considered but rejected recommending the implementation of a reference zone regardless of the existence of a Redelivery Differential. Implementation of a reference zone without any other changes would exacerbate the current situation at silos near to Randfontein. These silos have LDs of less that R120, which is the minimum transport charge, and therefore it is more economical to transport grain from silos further away, causing inventories to build at these

close-in silos. If these LDs were changed from 70-120 to 0, this situation would become worse, not better.

I considered but rejected leaving the system as currently constructed. There currently exists no way to arbitrage the Location Differential from a distant point all the way to a silo with no Location Differential.

6.6. Reference Location for Soya should be Reconsidered.

I recommend that alternative reference locations should be considered for soya. As widespread cultivation of soya has only begun in the 21st century, it's processing capacity is still being built, and the flows of the oilseed are still evolving. Whereas for corn and wheat, Randfontein remains a significant point of demand, even if it is much less than previously, there is much less soya demand in Randfontein, placing it farther from the commercial flow. However, it is difficult to recommend where the reference location should be set without a better understanding of the geography of all of the supply, demand, and transportation links in the economy.

6.7. Origin discounts should be implemented in all commodities.

I recommend that origin discounts be implemented in all traded commodities. Origin discounts reduce the value of imported crops that are delivered against futures contract obligations. Foreign origin commodities may exhibit different characteristics than commodities of domestic origin. For the sake of this uncertainty, there should be an origin discount applied that is of sufficient size to discourage but not prevent foreign origin deliveries, particularly in times of very tight market conditions.

I considered but rejected recommending against foreign origin discounts. The lack of origin discounts would weaken the role of JSE contracts as South African grain futures contracts. Buyers should know that there is a very high likelihood that any deliveries made through the JSE are of SA origin and be compensated in the event that it is not.

I considered but rejected recommending that no foreign origin grains be permitted to be delivered to the JSE. I rejected it as in times of drought, the ability to import foreign grains provides an important defense against market corners, and is preferable to market squeezes, corners, or declarations of *force majeure.*

6.8. Anonymity of Electronic Trading

I recommend that the JSE move to eliminate broker identification on the trading platform. One of the South African grain market's most pressing needs is increased transparency. To the extent that identification of brokers is advertised, particularly in SBW trading, it creates the potential for trades to circumvent the JSE and be made directly between counterparties. This undermines the liquidity in the market. Additionally, there is no other electronic exchange that reveals traders' identities. However, making such a move is likely to undercut the volume of JSE brokers, who are responsible for much of the marketing to and education of market participants. If this recommendation is adopted, the JSE should carefully consider ways to maintain these efforts on its behalf.

6.9. Increase Access to Futures and SBW Quotes

I recommend that the JSE make access to slightly delayed futures and SBW quote and trade data freely and easily available. Many futures exchanges offer 15-minute delayed quotes freely on their website. Such quotes are important for industry participants that are not actively trading in the markets, such as lenders, journalists, and service providers. Combining such quotes with the ability to graph recent prices is even more valuable. Providing similar access to SBW trades is just as important. While the low liquidity and trading volume of the SBW contracts makes providing delayed quotes less meaningful, providing substantive end of day data, as well as historical data, is important not only to potential users, but also to researchers seeking to understand the operation of the market.

6.10. Incentivize Greater SBW Volumes

I recommend that the JSE work to increase volume in the SBW contract, whether through incentives, or launching of SBW forwards, or any other innovative measures. The SBW provides the only small measure of transparency into the cash market in South Africa. To the extent that the JSE can incentivize farmers and traders to increase its utilization will benefit all of South Africa by pushing toward a more competitive market.

7. Other Recommendations

These recommendations fall outside the scope of the JSE's role in the South African commodity markets but are important points of action for the South African grain market to collectively work together to achieve.

7.1. Rail and Road Improvements

I recommend that the South African agricultural and commercial community redouble their efforts to encourage the government of South Africa to invest in transportation infrastructure. Poor infrastructure is like sand in the gears of a machine: every interaction becomes more weighed down by the frictions associated with moving goods from one place to another. Even in the short span between 2009 and 2019, the decline in commodities moving by rail is noticeable, and has had a measurably negative impact on the livelihoods of farmers and the affordability of food for consumers. By one estimate, the amount of grain transported by rail has declined from 60% in 2009 to 20% currently. Road transport is much more costly than rail, and the tariffs are much harder to observe, making calculation of the LD more difficult.

7.2. Mandatory price reporting of grain and transport

I recommend that the South African agricultural community seek mandatory price reporting of grain and transportation prices. As repeatedly mentioned in Roberts (2009), South African grain markets suffer from a profound lack of transparency. While this has improved somewhat in the intervening decade, it still falls far behind other international markets. For this reason, a mandate to report all grain purchase prices and quantities to SAGIS or a similar organization, and the dissemination of properly aggregated statistics would provide the markets with a significantly improved ability to understand the actual transactions occurring in the markets and would reduce opacity.

7.3. GrainSA should facilitate and encourage 'crowdsourcing' of grain premiums

I recommend that GrainSA should create an app to collect and distribute cash grain sale information. Such an app would accept reports of physical grain sales, including quantity, premium, silo, buyer, and any other important characteristics. This data then should be aggregated only enough to anonymize it and made available to those who report. GrainSA then should leverage its membership and publicize the program as one way to shed light on the behavior in the actual market, as well as potentially counteracting market power.

7.4. Concentration Among End-Users Must Be Addressed

There remains too much concentration among end users in South Africa. Particularly in the Western Cape, the number of end users is too few to provide effective competition for crops. This does not owe to the number of actual buyers, as those are mostly intermediaries, but to the number of actual mills and end-users.

7.5. The Import Levy Implementation Must be Improved.

I recommend that market participants collaborate to reduce uncertainty surrounding the import levy. Multiple meeting participants noted the added amount of uncertainty and volatility added to the markets by the timing of changes to the import levy in South Africa. All parties in the Industry should cooperate in proposing an alternative that meets the statutory intent but is implemented in a more transparent and mechanical manner, to help the market incorporate expected changes in prices in a more gradual manner.

8. Conclusion

As was the case in 2009, Location Differentials have become the focus of much misplaced dissatisfaction. There is a fundamental tension in the design of the physical settlement process between having many registered silos and recognizing the potential for widely varying values of commodities stored in different silos. The only way in which these tensions can be reconciled is an explicit system of differentials between registered silos, to attempt to level the value of grains to potential physical assignees in contract settlement. With a large number of registered silos, spread across a wide area, the necessity of a location differential system is irrefutable. The current situation in soya is physical evidence of this necessity. Therefore, the current system must be maintained, and implemented in soya.

On how the differentials are calculated, it is clear that the quoted differentials will rarely, if ever, be exactly correct. However, there were no alternatives proposed that are both currently implementable by the JSE and superior to the current system. As transport tariffs are neither collected nor published by SAGIS or other agency, mandatory-reported tariffs cannot be utilized. Mathematical models must be calibrated to the actual market, and that can only be performed using actual transport price data, which itself must be gathered through survey. I do believe that if there were mandatory reporting, it would make the market healthier, and should be a priority of the industry. In the meantime, until a clearly superior method can be found, I recommend that the current system remain in place.

The next point of common contention is the location of the reference point for calculation of the location differentials. In 1995, when Randfontein was selected, it was the natural choice as the reference point for the South African grain industry. In the intervening 24 years, milling has dispersed throughout the country, mostly moving westward toward the production areas. Whereas when the futures contracts were created, upwards of 60% of milling capacity was in Gauteng, it is now closer to 25%, with Free State containing the largest share. However, Free State is also much larger than Gauteng, and it is unclear what relatively concentrated area in Free State has a greater share than Gauteng. I believe that this issue is one that deserves more study and a highly detailed understanding of the economic geography of the grain industry in South Africa. Until such a study can be conducted, I recommend retaining Randfontein as the reference point for Location Differential calculation.

Finally, as before, the South African grain industry remains plagued by opaque and potentially uncompetitive cash grain markets. It is in the best interests of all participants, but particularly the JSE and GrainSA to work together to increase transparency in cash trading in South Africa. GrainSA should seek to crowdsource prices and release them to the farm community. The JSE should work to create as much volume as possible in the SBW contract. Together, they should work to enact statutory measures for the collection of grain prices and transport costs.

The South African market has significantly matured in the past ten years, but obstacles remain. With good faith and a commitment to improving the very unique market and market opportunities that South African farmers have, the nation's grain industry will continue to grow and improve.

9. Appendix A: Roberts (2009)

The Existence and Use of Location Differentials in SAFEX Cash Market Settlement

Final Report to the National Agricultural Marketing Council

Matthew C. Roberts, Ph.D.

2/23/2009

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1 Introduction

In 2008, the National Agricultural Marketing Council (NAMC) released its findings into the operation of the Agricultural Products Division of the Johannesburg Stock Exchange. The 2008 study was prepared at the request of Grain SA. One of the issues that Grain SA requested be examined was the location differential system implemented by the JSE in settling the white and yellow maize and wheat futures contracts. The 2008 report concluded, with regards to the location differential system,

> "As an interim the NAMC also recommends:
>
> i. that the transport differential is maintained for the interim
> ii. that an investigation is launched into how it is determined and whether it actually serves its purpose
> iii. that the state of competition of the wheat market in the Western Cape is investigated by the Competition Commission" (p. 26)

This report was commissioned in February of 2009 to fulfill item (ii), namely that the views of market stakeholders be collected and the advantages and disadvantages of the location differential system be evaluated with the goal of recommending an ultimate decision.

Between 9 February and 12 February, interviews were conducted with representatives of Grain SA, the Chamber of Milling, the JSE, former Agricultural Cooperatives, and grain traders on the subject of location differentials and the grain market in South Africa. On 13 February, the workshop referenced in the 2008 report was held at NAMC, with a broad cross-section of stake holders. During that presentation, observations of the South African grain market's structure and operation were discussed, as well as the assumptions to be used in evaluation of the location differential system. Following the final meeting, a number of participants have offered additional comments, clarifications, and questions via email; these, too, have been used to inform this report.

Whilst the terms of reference of this report are quite narrow, the 2008 report specifies that 'an investigation is launched into how [the transport differential] is determined and whether it actually serves its purpose,' the lack of transparency and the perception of market power in the South African grain market so influenced this study that they cannot go without mention and some discussion.

It is obvious to all that there is limited transparency in the South African cash grain trade. Bids for grain are made on a 'custom' basis by telephone, and are neither released nor reported in any manner. Farmers are left unaware of the prevailing price for their production without the expenditure of considerable effort. This lack of transparency clouds the economic signals that cash grain prices should transmit to farmers, which reduces agricultural efficiency. This lack of transparency prevents perceptions of unfair pricing or non-existent premiums to SAFEX from being dispelled, which may be even more damaging to the health of the grain trade in South Africa. Concentration among grain users and silos is another factor that came up in every discussion, often without prompting. An important dimension to reaching a long-term understanding and solution of the location differential issue is helping all of the stake-holders to understand the difference between location differentials, market transparency, and market concentration, and understanding how these three issues do, and do not, interact. **Much of the antipathy toward the location**

differential system is misguided. Market participants blame the location differential system for preventing transparency and the formation of a more robust cash market. This report will address those criticisms in a later section. The central point to be made regarding the interplay of these three issues is that without transparency, the effects of market concentration are nearly impossible to assess. But for the long-term health of the South African grain industry, the effects of market concentration and the lack of transparency are an order of magnitude greater than any that can reasonably be ascribed to the existence of location differentials.

In summary, this report finds that in grain market whose futures markets are well functioning (as this report believes SAFEX to be) and whose cash markets are highly transparent and competitive, the existence of location differentials is largely irrelevant. Basis levels in the cash market will adjust to their existence or elimination. However, all parties agree that the South African cash grain market is neither highly transparent nor competitive.[1] Under these circumstances, any benefits to the elimination of the differential would be greatly outweighed by the costs. Therefore, ***this report unambiguously recommends that SAFEX maintain the current differential system in the maize and wheat futures contracts, and continues to calculate the differential in the current manner***. Additionally, this report recommends:

- That the remaining recommendations of the NAMC(2008) report be carried out.
- That SAFEX explore the creation of an electronic exchange to permit the trading of silo certificates, in the hopes of facilitating a more robust and transparent cash market,
- That the South African industry recognize the benefits to a transparent cash market, and work towards increasing transparency, whether through
    - mandatory weekly cash market reporting, similar to the Agricultural Marketing Service reports of the United States Department of Agriculture,
    - legislation requiring public bids.

2 Procedure for this report

As recommended in the NAMC 2008 report, input from stakeholders on the topic of location differentials was sought. During the week of 9 February, interviews with major stakeholders in the grains industry were conducted throughout South Africa. Each of the interviews were conducted to gather facts and opinions on the operation of the location differential and the benefits and costs of its elimination. No formal agenda or question list was used. Meetings were held with Brisen Commodities, the Chamber of Milling, Grain SA, the JSE, KAAP AGRI, Sasko, and University of the Free State Agricultural Economics Faculty. On 13 February, a final meeting was held at NAMC in Pretoria to discuss the results of the interviews, the basis for final recommendations, and comments and questions about the writing of this report. All participants were invited to take part in the final meeting, representatives of Brisen Commodities, the Chamber of Milling, Grain SA, the JSE, and KAAP AGRI were able to attend. Since that final meeting, participants have also sent further comments and questions via email that were used in the drafting of this final report.

[1] See section 4.3 for a formal definition of 'competitive market.'

3 Structure of South African grain industry

3.1 Silo capacity and placement

The Marketing Act of 1937 put in place the system of marketing boards that ruled South African agriculture until the passage of the Agricultural Marketing of Products Act in 1996. It was during this period that the majority of the modern infrastructure of South Africa's grain industry was built. In a centrally-planned, single-marketer grain industry, infrastructure would naturally be built to maximize efficiency for that system. Silos were sited to minimize the overlap of grain catchments, and cooperatives were geographically organized. Milling capacity was sited and sized to match local demand.

With the repeal of the marketing board system, this existing infrastructure results in a severe dearth of competition in the local cash grain market. Any given farmer might have at most two or three silos nearby, and they are likely all owned by the same cooperative, which is now no longer a cooperative, but a for-profit business. Those silos likely have only one or two major millers nearby to which they can sell grain without incurring large transport costs. The net result is that there is very little competition for grain in the cash market; farmers have only a few options for selling their grain. Further, over time, the capacity of the rail system has decreased, greatly reducing the amount of grain shipped by rail, increasing the amount shipped by truck, and therefore increasing the average cost of grain transport.

4 The SAFEX location differential controversy

4.1 SAFEX location differentials

When the SAFEX introduced the maize and wheat contracts, Randfontein was chosen as the reference delivery point as it contains a concentration of milling capacity as well as very good rail links to the rest of South Africa. The use of a reference location in futures market design is well-accepted and understood. In order to facilitate trade between all market participants, the futures contract must be standardized as to grade, quantity, and location. However, in order to increase the attractiveness of the SAFEX grains futures contracts and to increase the areas that can deliver through the SAFEX contract (the 'grain catchment' of the exchange), any silo in South Africa can become 'listed,' i.e. capable of being used to initiate delivery against a SAFEX contract. SAFEX instituted a location delivery system in the design of the contract. When a holder of a maize or wheat contract declares his intent to deliver against the contract, the amount that the holder receives is adjusted by the location differential. This differential is an estimate of the transportation cost from the delivery silo to Randfontein. Just as the seller receives SAFEX-LD (SAFEX futures price minus the location differential) for delivering his grain, the buyer pays SAFEX-LD.

4.2 The Location Differential Controversy

Since 2002, the existence of the location differential system for SAFEX contracts has been repeatedly discussed in the Agricultural Products Division of the SAFEX. The NAMC 2008 report was itself the result of a request by Grain SA to study the operation of the SAFEX APD, including the location differential. According to a memorandum written to the APD advisory committee by Grain SA for the 21 August 2008 meeting, Grain SA requests the discontinuation of the location differential system for two reasons:

1) Maturity of the cash market, trading of the basis and premiums needs to be prioritized.
2) Unnecessary intervention in the free market and fair competition.

As pointed out by the Chamber of Milling in the interview for this study, the Agricultural Products Division has considered the matter of the location differential system seven times since May 2003. It is widely acknowledged that much of the controversy stems from farmers in the Western Cape and the North-West that feel disadvantaged by the system. It is unlikely to be a coincidence that these areas have the largest wheat and maize differentials, respectively.

4.3 Differentials, Market Power, and Market Transparency

According to Mankiw, a perfectly competitive market for a good or service has three characteristics: 1) There are many buyers and sellers in the market, 2) the goods or services offered by the sellers are largely the same, and 3) firms can freely enter and exit the market. These three assumptions result in a market in which all buyers and sellers are price-takers, i.e. they cannot influence the price individually, there exists a market price at which each participant chooses whether to buy, sell, or do nothing, but their actions do not affect the market.

A firm has market power when it can directly influence prices or quantities in a market, i.e. it is not a price-taker. This can occur because there is only one seller in a market (monopoly) or if there are only a small number of sellers in a market (oligopoly). Likewise, market power can exist for buyers, a monopsony is a market with only one buyer, and an oligopsony is a market with a small number of buyers. It is critical to understand that market power does not mean collusion. When an oligopoly or oligopsony exists in a market, the very fact that there are so few players means that each player will attempt to anticipate the actions of other players in the market before making their own decisions, as each participants' decisions affects the decision of other participants. In particular, the SA grain milling market is an oligopsony, in which a very small number of firms controls a very large proportion of the milling capacity. Likewise, the silo industry is a oligopoly at the national level, in which a small number of firms controls all of the storage space, and is likely a monopoly in most regions, as all silo space is controlled by one firm in that region. During interviews with the Chamber of Millers and SASKO, when attendees were asked why they do not post grain bids publicly, or post prices that have been paid, they each responded that to do so would reveal their needs and their positions to their competitors, who could use that information against them, by, for example, increasing cash bid prices in their area if they are in need of grain. This very statement speaks to the notion that the cash grain market in South Africa is not perfect—the buyers must be aware of the signals that their actions send to competitors. In a perfectly competitive market, buyers and sellers do not care that their competitors know their needs or actions, because there exist so many buyers and sellers that the needs of any one player don't matter to the market. Please note once again that market power does not mean collusion.

But this market power also contributes to a vicious circle in the South African cash grain market. Namely, the oligopsonistic structure of the market means that buyers do not want to reveal any information to their competitors, such as prices being paid for grain, as those are indications of the firms' relative need for cash grain. But without any information on the cash prices being paid for grain, it is impossible to accurately estimate the impact of either the location differential system, or of the market power itself. In repeated conversations with stake-holders, it is clear that the real concerns actually center around market power. Even the discussions of the location differential

system, many saw it as a tool of market power, an excuse for grain buyers to unfairly discount grain. But it must be again reiterated that the location differential system is almost entirely separate from issues of transparency and market power. The only way in which the location differential discussion is related to market transparency is that the lack of transparency makes it much more difficult to evaluate the true effects of location differentials.

5 Economics of Commodity Markets

In order to fully understand the effects of the location differential system, and to draw conclusions about its continued existence, some review of the economics of commodity markets is in order. Besides the definition of a competitive market (above), a clear understanding of five other issues is required: 1) that 'free market' is not the same as 'competitive market', 2) the difference between market price and economic value, 3) the value of location in commodity pricing, 4) the role of futures markets, and 5) that futures prices reflect the worst case delivery scenario. Without a clear understanding of these five concepts, it is impossible to understand the effects of location differentials.

5.1 The difference between a free market and competitive market

The term 'free market' is often used as an ideal, implying markets free of outside, especially government, interference. The implication is that markets that are less distorted will operate more efficiently, and so to reduce or eliminate interference will improve the functioning of markets. This use of free markets demonstrates a fundamental misunderstanding of economics. The reduction of regulation in markets only improves efficiency under very specific circumstances, namely, that the markets are perfectly competitive and that all costs of production (such as pollution, for example) are accounted for. If the markets are imperfect, a reduction in regulation may actually make the markets less efficient, not more. This is clearly seen in regulation of pollution and anti-trust, in which government intervention can actually improve economic functioning.

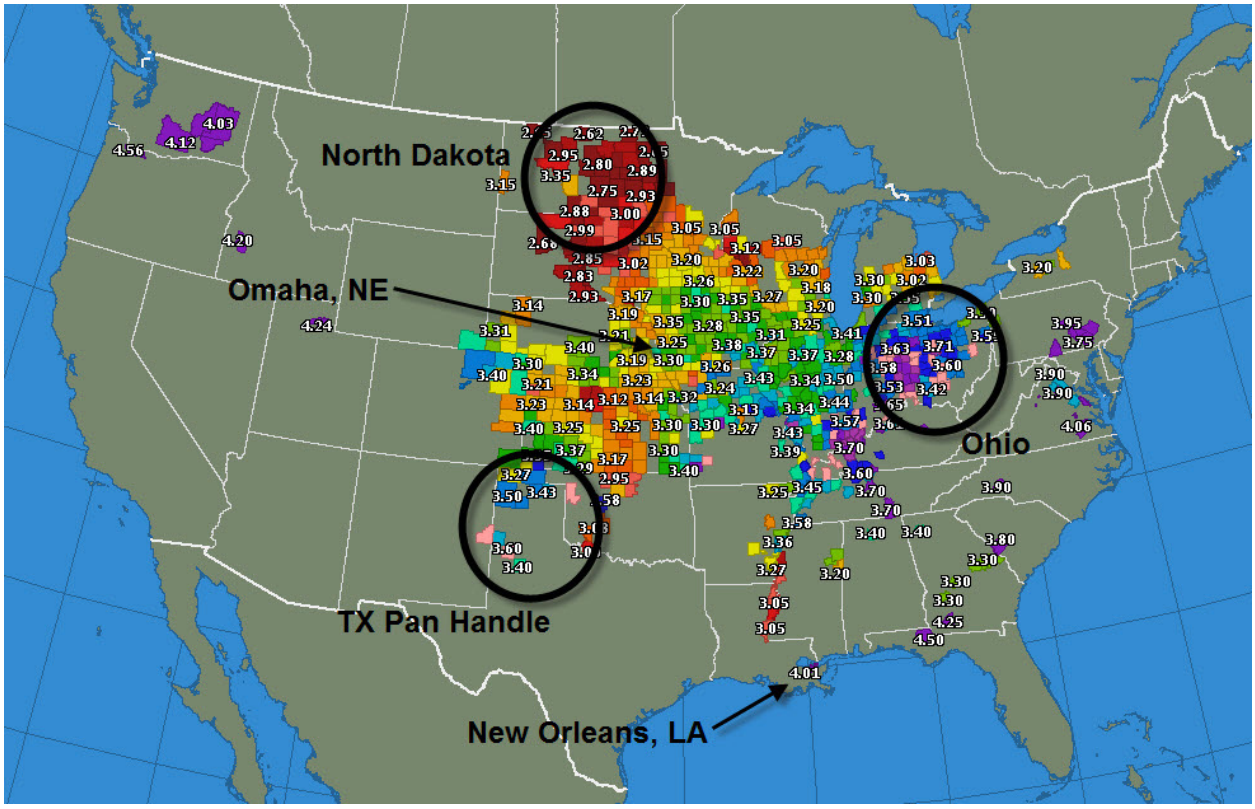
5.2 Market Price vs. Economic Value

For this report, market price will be used to refer to the price at which transactions in a market actually occur. However, in imperfect markets, the market price may be different than the price that would be transacted in a perfectly competitive market. In economic parlance, that price is typically known as the 'socially optimal equilibrium price.' For this report, the price at which grain would be bought or sold if the market were perfect will be referred to as the economic value of the grain. In a market in which buyers have market power, the market price will be lower than the economic value. Again, note that market power does not mean collusion.

5.3 The value of location in commodity pricing

The picture below was taken from www.dtn.com on 21 February 2009. It is a map of the continental United States with an overlay of cash bids for yellow maize, as collected by DTN. Notice that in the US, the value of yellow maize varies quite a lot. At New Orleans, LA, the current cash bid price is $4.01/bu (~R1560/t), while in Omaha, NE, the price is $3.25/bu. (~R1270/t), hence a R390/t difference. The distance between these two cities is 1,312km. Note also that while the US is a large net exporter of maize, and most of that maize is exported through New Orleans, that the pattern of prices do not systematically move lower as one move away from New Orleans. Notably, prices in the Texas Pan Handle and in Ohio are quite high, due to high levels of demand in those areas, though

there is very little maize production in the Pan Handle, but quite a lot in Ohio. This graphic is meant to demonstrate that the value of a commodity is intimately linked to its location. The identical commodity placed in two different locations can have vastly different values. Many economists who study commodity markets treat locations in the exact same manner as quality, or level of processing: a fundamental characteristic of the commodity that can have a significant impact on its price.



In general, commodity prices are highest where the demand is largest and supply is smallest, such as in the Texas Pan Handle, or in New Orleans at the port. Conversely, commodity prices are lowest where the demand is smallest and supply is weakest, such as North Dakota, where current cash bids for yellow maize are $1.40/bu (R546/t) lower than at New Orleans. In the context of South Africa, wheat produced in the Western Cape is located in an area in which supply substantially exceeds demand, whereas wheat produced in northeastern Free State is in the opposite situation: demand substantially exceeds supply. This results in the economic value of wheat being higher in the Free State compared to the Western Cape, and this has nothing to do with grade or quality, this difference in economic value is simply a reflection of the value of location in commodity pricing.

5.4 The Role of Futures Markets

Futures markets exist to make the cash commodity markets, and the overall economy, operate more efficiently. The two ways in which futures achieve this are price discovery and risk transfer. Price discovery is the process in which the myriad actions of buyers and sellers determine the price for a commodity at which the amount produced equals the amount consumed. Futures markets facilitate this by offering a standardized contract on the commodity to trade. Futures contracts are standardized in quantity, location, grade, and maturity. This standardization, when combined with the existence of a clearinghouse to eliminate counter-party risk, means that parties from around the

world can participate in the futures market for purchase and sale, bringing more liquidity into the market, and allowing more market players to participate in the price discovery process.

Futures markets increase economic efficiency by facilitating the transfer of risk from one party to another. Farmers are the original owners of price risk in agricultural production; they grow the crops that are later marketed. If they want to reduce their risk, or if intermediaries want to reduce their risk, a mechanism must exist for the inexpensive transfer of price risk from those who want to reduce risk to those who are willing to take on more risk for (the possibility of) profit. Because futures markets are leveraged, i.e. buyers and sellers of futures need only a small fraction of the value of the commodity as a performance bond (margin), futures greatly reduce the cost of transferring risk. Further, because the markets are standardized, buyers and sellers know precisely what it is that they are buying or selling.

Both of these roles require convergence—that cash market prices and futures market prices converge to equality as the futures contract expires. Convergence is crucial to the functioning of futures markets, as it demonstrates the link between futures prices and cash market prices. In a physically settled market such as SAFEX, convergence is guaranteed by arbitrage. If, as a futures contract expires, cash market prices are significantly less than the futures price, then traders can purchase cash commodity, sell futures, and deliver the cash commodity against the futures contract, earning a risk-free (arbitrage) profit. This selling of futures and buying of cash will continue until the sales drive the futures prices low enough, and the purchases drive the cash prices high enough, that arbitrage profits are no longer available. Without convergence, there is no guaranteed link between the cash and futures market, and futures lose their usefulness for both price discovery and risk transfer. But to ensure convergence, the exchange and the design of the contract must permit sufficient quantities of commodity to be delivered when necessary, in order that enough arbitrage can occur to force convergence. For SAFEX, and any exchange, part of this design must be to make sure that there are enough delivery points, and enough grain near those delivery points, and that all of those delivery points can be economically engaged in the delivery process, so that sufficient arbitrage can occur to ensure convergence.

5.5 Futures Prices Reflect the Worst Case Delivery Scenario

For a physically delivered futures contract, such as SAFEX maize and wheat contracts, the price of the futures, at expiration, ultimately converges to the 'worst case delivery scenario.' The reasoning behind this is quite clear, for those who have bought a futures contract, the most that they will be willing to pay for that contract is the value to them of the worst case delivery, because they do not know, in advance, from which silo they will have grain assigned to them. For any price above that 'worst case scenario,' the elevator could purchase grain more cheaply directly from the silo itself. If there were but one buyer in a market, the worst case scenario would likely be easy to determine; when there are more than one, then the futures price will converge to the highest-valued worst case scenario of all participants. This is a fundamental point to understand, as it demonstrates that the cash and futures markets do not exist separately.

6 Economics and the SAFEX location differential

Based upon the organization of the South African grains industry and the economics of futures markets introduced in previous sections, some inferences can be drawn about the operation of futures in South Africa.

6.1 SAFEX futures must be physically delivered

Because there is no competitive and transparent cash market from which to draw transactions prices, SAFEX cannot become a cash-settled market in which futures positions that are held to maturity are settled through an exchange of currency. These types of markets need a price against which to settle, which is typically based upon some average commodity price over a prespecified region and time period. But no such average could at present be calculated in South Africa.

6.2 Where is the worst case delivery scenario?

If the location differential system were removed, most market participants agree that for the SAFEX wheat contract, the worst case delivery scenario would be Graafwater—a silo in the far northern Western Cape. While this location might not be worst for every participant, the majority of participants believed that it would generally represent the worst case delivery scenario for the industry as a whole for wheat. For yellow maize, Sannieshof is a likely candidate for the worst case delivery scenario. For the remainder of this report, these two locations will be assumed to be the worst case scenarios—the analysis of the market is not affected if these are not the worst case scenarios, but to simply decide on two will make the explanation clearer. In any event, the important point to understand is that in the absence of location differentials, the SAFEX contract will represent the worst case delivery scenario—for the sake of argument, the SAFEX maize contract will become a Sannieshof contract, and the SAFEX wheat contract will become a Graafwater contract.

With the location differential in place, the worst possible case delivery scenario is no longer clear. No consensus emerged as to what location is currently the worst case delivery scenario. A careful analysis of SAFEX deliveries could shed much light on which location is the worst case scenario for South Africa with the differential system in place, as that location should represent a disproportionate number of deliveries. However, that there is no clear answer indicates that the location differential system 'evens the playing field' as the system of discounts changes the relative value of deliveries at different points. With a R420 discount, Graafwater may no longer be the worst case delivery scenario. With the R240 discount at Sannieshof, it too may no longer be the worst case scenario.

6.3 In Perfectly Competitive Markets, Differentials Would Not Matter

If the SA cash grain market were perfectly competitive, then the level of location differentials would not matter, as the basis levels at each location would adjust to the location differentials (or lack thereof), and cash market price levels would remain unchanged. What would change is the level at which SAFEX trades—as discussed above, SAFEX prices reflect the worst possible delivery scenario. As location differential levels, so will that worst case scenario, so that the price at which SAFEX trades will change. Again, with a perfectly competitive cash market, there would be no net change in the actual level at which cash transactions occur, only a change in the level of SAFEX and the basis levels.

In a perfectly competitive market, the removal of the location differential system wouldn't adversely affect the prices received by farmers in Graafwater and Sannieshof, or in any other location in South Africa. The greater the imperfections in the market, the more that farmers in Graafwater and Sannieshof, are helped and the more that farmers in other regions are harmed. If the SAFEX wheat and maize contracts reflect Graafwater and Sannieshof after differentials are removed, then those locations will have futures contracts effectively trading on their local market. This would benefit farmers in those cities as all of the price discovery and risk transfer benefits of futures contracts would be centered on those cities. However, the greater the imperfections in the cash market, the worse off the rest of the country would be, as the relationship between other cash prices and SAFEX prices would decline, reducing the usefulness of SAFEX for hedging for the great majority of farmers in South Africa.

7 Evaluation of Differential System

In this section, the arguments against and in support of the differential system will be individually discussed in light of the structural and economic observations already presented.

7.1 Arguments Against Differential System

7.1.1 Location Differentials Impede Development of a Free Market

This argument asserts that location differentials are an artificial impediment to the South African grain market, especially the cash grain market, and their removal would lead to a more efficient, better cash grain market in South Africa. This argument overlooks the fact that less-regulated markets are not always better markets. There is no argument that the South African grain market is oligopsonistic and lacks transparency, and is therefore definitely not perfect. For this reason, from an economist's point of view, there is no reason to expect that a less-regulated market is better than a more regulated market.

In fact, the Chicago Mercantile Exchange is preparing to introduce a location differential system for the Chicago Wheat contract, beginning with the July 2009 contract. For the past three years, convergence has been very inconsistent in the Chicago wheat futures contract. Three new delivery regions are being added to the contract to increase the amount of wheat that can flow through the exchange delivery system, and increase the amount of arbitrage possible. One of these regions is being added at a premium of $0.20/bu (R72/t) and another is being added at a $0.20/bu (R72/t) discount to the CME wheat futures price.

7.1.2 Location differentials Impede the Development of Cash Markets

This argument asserts that as long as the location differential remains in place, the South African cash grain market cannot develop. The differential system provides a crutch that the market can use in place of developing a robust basis-trading system. This argument can be evaluated by examining other markets in South Africa in which there are no differentials to see whether they have more fully functioning cash markets.[2] The SAFEX soya market has no location differential system, as when it was originated, soya was only grown in a relatively small region in South Africa. As soya growing has

[2] Note that this is yet another point at which the existence of a transparent cash market would greatly assist the analysis. Without such a market, there is no data premiums offered to sellers in those markets. Instead, only the opinions of market participants can be used.

spread geographically, the economic value of production in different areas should become great enough to see basis premiums arise in the cash market. However, the opinion of all interviewed for this study was that basis premiums were no more prevalent in soya than maize or wheat. Within the Western Cape, the location differentials are all the same, even though wheat in Graafwater clearly has a lower economic value, due to its location, than wheat near Cape Town. Therefore, within the Western Cape, effectively, there is no location differential. Yet once again, market participants do not commonly see basis premiums any more or less frequently than in any other market.

These two counter examples lead me to believe that the real impediment to realizing a competitive and transparent cash market is not the location differential system, though the observations in this section are hardly conclusive in the absence of actual price data.

7.1.3 Tool of market power

The final argument against the location differential system is that location differentials are a tool for the exercise of market power. That silos and mills use the differentials in setting their bids, and due to the oligopsony in the grain market, they do not have to compete for grain. Therefore, if the location differentials were eliminated, this tool for the exercise of market power would disappear, and the cash grain market would become more competitive. This argument overlooks the source of market power in the cash grain market: heavy concentration among buyers. This concentration will not be affected in the least by the elimination of the differentials. If market participants currently have market power in the presence of the differential system such that they can unilaterally dictate prices[3] then they would also have such power in the absence of differentials.

7.2 Arguments for Differential System

7.2.1 Adequacy and Continuity

Throughout the meetings with stakeholders, none asserted that the fundamental structure of the futures market was broken, or that SAFEX did a poor job of providing risk management. SAFEX provides a valuable tool to the SA grain industry. However, the constant discussion of elimination of or change to the differential system is a source of uncertainty to the market, which reduces the market's ability to facilitate risk transfer.

7.2.2 Operational financing

The ability to obtain operational financing, i.e. loans for seed, fertilizer, etc., is crucial for all agricultural enterprise, in which most or all of the costs are paid in advance. If the differential system is eliminated, the SAFEX futures price will fall to the new worst case scenario, for example Graafwater wheat and Sannieshof maize. In other words, the SAFEX prices themselves will actually fall by the differential to these two points, R420 for wheat and R106 for Sannieshof. To obtain input financing, lenders demand that farmers have minimum prices guaranteed for at least part of their crop to insure repayment. If SAFEX falls to a lower level, as it will in the absence of the location differential system, then the price level at which farmers can guarantee a market for their production will also fall, which will limit their ability to obtain input financing.

[3] Note that the author is not asserting that market power exists to the extent that buyers can unilaterally dictate prices, but many of those opposed to the differential system do assert this.

That lenders demand that farmers have guaranteed minimum levels of price and/or revenue is clear from the input finance markets in the US. In the US, banks will not lend to farmers unless those farmers have purchased crop insurance in amounts large enough to guarantee repayment of the loan. Even though the US has a rich history of local basis patterns, banks will not lend on that basis, only on guarantees of production revenue.

The discussion of this point has elicited some very strong responses, with some market participants very adamant that the reduction in SAFEX prices will have a real and significant impact on the ability of farmers, especially those growing wheat in the Free State, to obtain production financing. Other stake-holders believe that while these effects are real, they will not significantly affect grain production, and should therefore be ignored. Unfortunately, a more precise estimation of these effects is beyond the scope of this study[4] but this author believe that, especially to wheat producers outside of the Western Cape, they will be quite significant.

7.2.3 Increased Grain Catchment for SAFEX delivery

The discussion of what location is currently the 'worst case delivery scenario' made it clear that, with the location differential in place, there is no obvious answer for maize, and even in wheat, it is not always clear. However, once the location differential is removed, the worst case scenarios become much easier to identify. This indicates that if the location differentials are removed the catchment, or area from which SAFEX physical delivery will draw grain, will become much smaller, centered at these worst case scenarios. This would be a detriment to the entire market, as a reduced grain flow through physical delivery will mean a reduced ability of arbitrage to force convergence, decreasing the ability of SAFEX to efficiently discover prices and transfer risk. Further, a reduced grain catchment makes manipulation of the market easier, as fewer locations will be actively involved in the physical delivery process.

To reiterate, the primary reason that the Chicago Mercantile Exchange is increasing the regions in which silos may list for delivery for the wheat futures contract is to increase the size of the wheat catchment—to increase the amount of wheat that can be drawn through the physical delivery and arbitrage process, thereby improving convergence. In order to increase these regions, location differentials were required to prevent one location from dominating the delivery process, thereby undermining the primary rationale for expanding the delivery eligible areas.

7.2.4 This is the only transparency in the cash market

The current structure of the SAFEX provides the only (though admittedly quite limited) transparency that exists in the South African cash grain market. Assuming that he is located near a listed silo, every farmer in South Africa has the option to sell his grain on SAFEX at the prevailing price minus the location differential. If the differential system is eliminated, SAFEX prices will decline to the 'worst possible delivery scenario' and farmers in low differential (high economic value) areas will lose this option, *without any real gain in prices for farmers in the high differential (low economic value) regions*. While this level of transparency certainly falls well short of what is desirable, it does provide a 'floor' to the level of transparency in the market, and a guaranteed price for farmers who can deliver to a listed silo.

[4] A more precise evaluation is again hampered by the lack of a transparent cash market; making it difficult to estimate where the worst case delivery scenario is, as well as what premiums are currently being paid in different areas.

8 Conclusions

It is the opinion of this report that elimination of the location differential system will, at best, provide very few benefits to farmers, silos, or millers in South Africa, and may in fact cause significant harm to farmers, especially those in low differential areas, by reducing their ability to obtain input financing. Therefore, the current location differential system should be maintained for wheat and maize, and if the JSE believes it necessary, introduced for soya.

The opposition to the location differential system is based upon either a faulty understanding of the economics of commodity markets, or an unnecessary intermixing of the location differential system with the very real issues presented by the lack of transparency and market power in the South African cash grain market. When these issues are separated, the decision becomes quite clear. The elimination of location differentials will not improve either transparency or market power, and therefore, will not increase the efficiency of the cash grains market.

This report also recommends against more frequent updating of the location differentials. While years such as 2008 and 2009 present challenging environments in which to estimate the differentials, and the change in oil, and transport prices means that differentials may frequently become out of date, to change the differentials on a quarterly or semi-annual basis would be to change the value of a futures contract after that contract has begun trading. This would reduce the value of the futures for risk management, and should not be done. If the differentials are markedly different than the actual cash market transportation cost, then the market will adjust as different delivery points become the worst case scenario based upon the location differentials.

9 Recommendations

Based upon the study of the South African market and the SAFEX futures contract, a number of possible recommendations were considered. After much consideration and discussion, the following recommendations to the South African grain industry are made. One recommendation that is not made deserves special mention. The reintroduction of the Cape Wheat futures contract was specifically discussed and considered, however, after evaluation of the amount of wheat produced in South Africa compared to the Western Cape, and examination of other markets, it is not clear that such a futures contract could offer enough benefits to the market to justify splitting the liquidity of the current SAFEX futures contract. Therefore, this final report does not recommend reintroduction of a Cape Wheat contract.

9.1 Retain the differential system as it is currently designed and constructed.

The current SAFEX location differential system provides benefits to the operation of the futures and cash market, and should be maintained. Location differentials are, in any event, relatively common in other commodity futures exchanges, for reasons of maximizing the potential for physical delivery. One very instructive exercise is to compare location differentials to quality differentials; in economic terms, there is no distinction between them, they are simply systems in place to increase the applicability of the futures contracts to grain of different values.

9.2 Other Recommendations

These are recommendations that do not directly bear on the topic at hand, location differentials, but would likely improve the functioning of the South African grain market.

9.2.1 Reiteration of NAMC 2008 Recommendations

Certain of the recommendations of the 2008 NAMC report also bear directly on the topics of transparency and market power, and therefore are highlighted here for additional emphasis. These changes would be, or facilitate, improvements in the operation of the South African grain industry:

- To look at ways in which information and access to information in the market are improved.
- The introduction of a commitment of traders report by the JSE.

9.2.2 SAFEX explore the introduction of an electronic exchange for silo certificates

The lack of transparency and competition for cash grain are the major flaws in the South African market. The existing infrastructure means that competition will likely remain somewhat limited, but an electronic market, especially one backed with by the clearinghouse of the JSE, could help to improve transparency in the South African grains market.

9.2.3 Market Transparency Must be Increased

The lack of clear cash market signals distort the price incentives offered to those in the grain industry. In order to clarify those signals and provide farmers the opportunity to sell their grain in a competitive market, there must first be more transparent pricing. There are a number of ways in which this transparency could occur. The electronic exchange proposed above would provide a great deal of transparency if sufficient transactions pass through it. Other avenues to consider are legislative, in Canada, as a condition of becoming a licensed merchandiser, all silos must post daily prices. In the US market, the Department of Agriculture, through its Agricultural Marketing Service, has weekly price reports for numerous locations for grains, oilseeds, and livestock. The mandatory livestock price reports were enacted precisely to increase transparency in the US livestock markets. Increased transparency would not guarantee the formation of a competitive cash grains market, but it would at least make data available that could be used to evaluate the extent and effect of market power in the cash markets, as well as finally answer whether premiums were already being paid in the SA cash grain market, and with what frequency.

References

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