AGRICULTURAL COMMODITY FUTURES MARKETS IN SOUTH AFRICA

Deon Frank
Department of Economics, University of Natal, Pietermaritzburg

Abstract

The introduction of an agricultural commodity futures market in South Africa is considered. A futures market can be used by both buyers and sellers of a commodity to significantly reduce price uncertainty. Theoretical arguments are used to show that the futures and cash prices should be very close, if not equal, at expiration and that the current futures price should be a good forecast of the cash price at expiration. Speculators play an important role by providing liquidity to the futures market, but it is possible that they can distort prices. For a futures market to be a success in South Africa there needs to be a free cash market, adequate liquidity and well informed traders. A computer-based trading system is an improvement on the traditional floor trading system mainly because prices are more likely to reflect the underlying supply and demand conditions.

1. Introduction

South African agricultural policy is committed to reform based on free market principals. However, a move from controlled to freer markets will result in greater price uncertainty. Greater price uncertainty implies that agents face greater price risk and therefore need ways in which to hedge against this risk. A futures market in South Africa could provide such hedging opportunities.

This paper discusses various aspects of futures markets with special reference to South Africa. Because futures markets is a new topic in South Africa (see Van der Vyver and Van Zyl, 1989; Van der Merwe; 1990), some of the basic terminology and features of futures markets are discussed first. Section 3 discusses how to use futures markets to hedge against price risk. Exports can be hedged using a foreign futures exchange but this requires a simultaneous position in foreign exchange futures. Section 4 presents some important theoretical relationships between the futures price and the cash price and futures prices over time. These relationships only hold if the futures market is in equilibrium. Section 5 deals with the role speculators play in keeping futures markets in equilibrium and how important good information is to them. Section 6 deals with issues specific to the success of a futures market in South Africa. A free cash market, adequate liquidity and well educated traders is imperative for the futures market is to be a success. The last section of this paper argues for the introduction of a computer-based trading system over the more traditional floor trading system.

2. The basics about futures markets

This section provides a quick overview of some of the terminology used in connection with futures markets (Catania, 1989). Some of the more interesting aspects of futures markets are also discussed.

2.1 Definition of some terms

An unfortunate aspect of futures markets is the jargon that surrounds its activities. This jargon often mystifies and intimidates outsiders. This paper attempts to make minimal use of special terminology related to futures markets, but some is unavoidable.

Firstly, a definition of a commodity futures contract: A futures contract is a contract to buy, or sell, a particular commodity at some point in time in the future. The contract explicitly specifies the quantity and quality of the commodity, and the location where delivery will take place. The only thing that the contract does not specify is the price. Price discovery usually takes place on a trading floor at a commodity exchange, such as the Chicago Board of Trade. The Trading floor is where buyers and sellers of futures contracts come together and agree on a price at which to trade contracts. A trader who has sold futures contracts is known to have a "short position". A trader who has bought futures contracts is known to have a "long position".

Actual delivery of the physical commodity seldom happens. A trader can "close out" or "liquidate" his position by taking the opposite position. That is, a trader who is short a futures contract can either deliver the commodity on the expiration date or he can liquidate his position by buying back the contract. Alternatively, a trader who is long a futures contract can either take delivery of the commodity or he can liquidate his position by selling back the contract.

2.2 Margin requirement

When a trader takes a position he is required to make a deposit called "margin money". The margin money requirement usually ranges between 5 to 14% of the value of the contract, depending on how volatile the market is. If the market turns against a particular trader then he may be called upon to make additional margin deposits. This is called a "margin call". The reason for the margin money is to ensure the integrity of the futures market. Margin money enables the exchange to close out a trader's position at any time. Apart from margin money, no money changes hands at the inception of a futures contract. Only when a trader liquidates his position does the purchase price get subtracted from the sale price to give the profit or loss made on the transaction.

An amazing thing about a futures market relative to the stock market is the high leverage. In a futures market with a 10% margin requirement, only requires a R25 deposit to control a R250 asset.

Table 1: Short Hedge for Maize when the Futures Price Increases or Decreases.

	Price decrease	Price increase
November (planting time): Sell futures contracts	+250	+250
June (harvest time): Buy back futures contracts	-230	-270
Profit on futures	+20	-20
Sell maize on cash market	+230	+270
Net Price	+250	+250

In a share market the full R250 is required to control a R250 asset. Thus, the percentage loss or profit on any amount invested in a futures market is bound to be high.

2.3 Price limits

Commodity exchanges sometimes limit on daily futures price movements. For example, the limit on the Corn futures contract at the Chicago Board of Trade is ten cents per bushel ($500 per contract) above or below the previous day's settlement price. Price limits are set to prevent the price from changing too rapidly in a volatile market. By forcing some time to pass before the price can move further the daily limits give traders time to react to rapid price changes. If the large change in prices is because of a sudden change in the underlying supply and demand conditions then the price may continue to change "locked to the limit" until equilibrium is once again reached. If, on the other hand, the sudden price change is not market related then speculators should notice the disequilibrium and will counteract the price change and restore equilibrium. The role of the limits is to allow speculators time to notice that the market is out of equilibrium and to avoid excessively large price swings.

2.4 Zero sum gain

The futures market is known as a zero sum gain market. Zero sum gain means that for every winner there is a looser. Experienced speculators with the best information make gains only at the expense of less experienced, worse informed speculators. Sellers of contracts loose what buyers gain when there is a price increase and buyers loose what sellers gain when there is a price decrease. This contrasts with the stock market where shares may pay dividends and may appreciate in value because the intrinsic value of the issuing company is increasing.

3. Hedging using futures contracts

Futures markets allow traders to hedge against price risk. Given uncertain prices traders can enter into contracts on the futures market thereby eliminating much, if not all, of the price risk (see Catania, 1989). The best way to describe hedges is by way of examples. These examples assume that an active futures market already exists in South Africa. Although there are many different hedging strategies, only a simple short hedge, a simple long hedge and hedging exports on a foreign commodity exchange are described. The last part of this section mentions why the Maize Board has a particularly difficult task hedging South Africa's Exports.

3.1 Short hedge

Say that a farmer, at planting time in November, anticipates having 50 tons of maize for sale at harvest-time in June. The November futures price is R250 per ton. To lock in this price the farmer sells futures contracts for 50 tons of maize that expire in June.

Come June and harvest time, the farmer now has the right to deliver the 50 tons of maize and receive R250 per ton. Alternatively, he may liquidate his short position by buying back the futures contracts. Say that, over this period, the futures price has declined to R230 per ton and that the cash price is also R230 per ton (The expiration date futures price and the cash price should be equal for reasons explained in Section 4.1). It only costs the farmer R230 per ton to buy back his contracts, therefore he makes a profit of R20 per ton on the futures market. He then sells his maize on the cash market for R230 per ton and realizes a net price of R250 per ton. Table 1 summarizes these transactions. So, whether the farmer makes delivery or liquidates his position he still sells his maize for R250 per ton. Table 1 also shows what happens if the futures price increases to R270, instead of decreases. The farmer makes a loss on the futures market which is compensated for by a higher cash price.

3.2 Long hedge

The opposite to a short hedge is a long hedge which is entered into by a trader who anticipates buying the commodity in the future. Say that a feedlot operation, in November, anticipates needing 50 tons of maize in June. The November futures price is R250 per ton. To lock in this price the feedlot buys futures contracts for 50 tons of maize that expire in June.

Come June, the feedlot now has the right to take delivery of 50 tons of maize and pay R250 per ton. Alternatively, the feedlot may liquidate its long position by selling back the futures contracts. Say that, once again, over this period, the futures price has declined to R230 per ton and that the cash price is also R230 per ton. The feedlot sells back the contracts for R230 per ton, making a loss of R20 per ton on the futures market. It then buys maize on the cash market for R230 per ton and realizes a net price of R250 per ton. Table 2 summarizes these transactions as well as for a futures price increases to R270. When the futures price increases the feedlot makes a profit on the futures market which is counteracted by a higher cash purchase price.

3.3 Hedging exports on a foreign commodity exchange

This section will demonstrate how a foreign commodity exchange can be used to hedge local production for export. The hedging strategy makes use of commodity futures as well as foreign exchange futures. This example, of course, assumes that rand-dollar foreign exchange futures exist.

Table 2: Long hedge for maize when the futures price increases or decreases.

	Price decrease	Price increase
November: Buy futures contracts	-250	-250
June: Sell back futures contracts	+230	+270
Profit on futures	-20	+20
Buy maize on cash market	+230	+270
Net Price	+250	+250

Table 3 presents three scenarios. Scenario 1 considers a price increase on the foreign commodity futures market. Scenario 2 considers a weakening of the exchange rate and Scenario 3 considers a simultaneous decrease in the futures price and a strengthening of the exchange rate.

Table 3 presents the price received per ton given that exports are hedged or not hedged. The hedging strategy involves selling futures contracts for both the commodity and the foreign exchange at planting time. At harvest time these contracts are bought back and the profits or losses incurred on the futures market exactly balance out changes in the cash export price and the exchange rate. Can foreign commodity futures markets be used to hedge against local price uncertainty? This depends, of course, on how well the local price is correlated with the export price. If they are highly correlated then the foreign futures market can be used. The correlation between the local price of maize and the world price of maize is discussed in Section 6.2.

3.4 Optimal hedging strategy when output is uncertain

The hedging strategy for a farmer is straight forward if his output quantity is certain. However, output quantities in farming are seldom certain. If a farmer hedges his expected output then he will be exposed to price risk on any quantity in excess of or short of the amount which he may produce. This adds another dimension to the optimal hedging strategy problem and is beyond the scope of this paper (see Rolfo, 1988; Karp, 1987).

The Maize Board, which administers South Africa's imports and exports of maize, faces a particularly difficult hedging problem. The first complication is that South Africa is usually a net exporter, but in some years it is a net importer. The second complication is that exchange rate fluctuations add another source of risk. A simple strategy of hedging expected exports by the Maize Board may be ineffective and doubly risky for those years when production falls short. A hedge of just expected or average exports will mean that in a good year only a small proportion of total exports will be hedged. In a bad year, when maize has to be imported, the hedge turns out to be doubly risky. If the price has increased then loses are made on the futures market and the cash market. If the price has decreased then profits will be made on both markets.

4. Theoretical price relationships

In this section some theoretical arguments are used to derive important relationships between the futures price and the cash price and intertemporal futures prices. The primary theoretical tool used in this section is the "no arbitrage opportunities" assumption. Arbitrage is defined as the making of riskless profits from exploiting price differences across markets. Arbitrage opportunities imply that markets are out of equilibrium since as soon as the arbitrage opportunities arise, traders will step in and exploit the opportunities, bringing the markets back into equilibrium once again. In the discussion that follows the expiration date and the delivery date are assumed to be the same day.

The first price relationship that is examined is the one between the cash price and the futures price. This relationship is particularly important at the expiration of the futures contract. The second price relationship is the relationship between the current futures price and the expiration date futures price.

4.1 Futures and cash price relationship

The futures price and the cash price are closely related and tend to be highly correlated. This section presents theoretical arguments explaining this relationship. The difference between the cash price and the futures price is known as the "basis".

The first relationship is that futures and cash prices tend be equal at the expiration of the futures contract. To see this, consider the arbitrage opportunities that would arise if they were different. Say the cash price is greater than the futures price. Traders could then buy futures contracts, take delivery immediately and sell on the cash market, realizing a profit of the price difference. If the cash price is less than the futures price then buying on the cash market, selling futures and making delivery would yield arbitrage profits. Therefore, given that arbitrage opportunities do not exist, the cash price and the futures price should be equal on the expiration date.

In practice this exact relationship may not exist though, usually because of the risk that the cash market will not be able to absorb these large transactions without a price change. Traders may prefer to close out their futures positions than run the risk of having to deal with a large cash transaction.

The second theoretical price relationship to consider is that the futures price, at any point in time, should exceed the cash price by what it would cost to store the commodity until expiration. Clearly, if the basis were far in excess of the storage costs then traders could sell futures, buy the physical commodity, store it until expiration and then make delivery. This would yield a profit of the basis less storage costs. This is strictly speaking not an arbitrage profit since there is risk involved in storing the commodity.

Table 3: Short hedge in commodity futures and foreign exchange futures for maize exports

	Scenario 1		Scenario 2		Scenario 3	
	Maize market ($)	Foreign exchange market (R)	Maize market ($)	Foreign exchange market (R)	Maize market ($)	Foreign exchange market (R)
Planting Time	100	2.80	100	2.80	100	2.80
Harvest Time	120	2.80	100	3.00	80	2.50
No Hedge: Export Maize	120	336	100	300	80	200
Hedge: Sell futures	100	280	100	280	100	280
Hedge: Buy back futures	-120	-280	-100	-300	-80	-250
Profit	-20	0	0	-20	20	30
Export Maize	120		100		80	
Sell dollars	100	280	100	300	100	250
Net profit		280		280		280

If basis were smaller than storage costs then traders would buy futures contracts, sell the commodity on the cash market, save storage costs until expiration and then take delivery.

4.2 Current futures price and the expiration date futures price

To understand how the current futures price is related to the expiration date futures price, we need to analyze how the actions of speculators affect the market. Consider a single speculator deciding whether or not to speculate in futures. He will be unsure what the price will be at expiration, so he will have an opinion on the probabilities of various price outcomes. The speculator's subjective opinion can explicitly be represented by a probability density function (PDF) as illustrated in Figure 1.

The expected value of this subjective probability distribution is given by:

$$E(F_T) = \int_0^\infty F_T G(F_T) dF_T$$

where F_T is the futures price at time T, the expiration date, and $G(F_T)$ is the subjective PDF of F_T. If the current futures price F_0 is less than $E(F_T)$ then there is a greater than 50% probability, in the opinion of the speculator, that he will make a profit by buying futures now and selling them back at expiration. Likewise, if F_0 is greater than $E(F_T)$ then there is a greater than 50% probability that he will make a profit selling futures now and buying them back at expiration. Whether or not the speculator actually does buy or sell futures will depend on his risk aversion and by how much his expected price and the current price diverge.

We assume that the actions of one speculator will not affect the price, but if many speculators all believe that the current price is under- or over-priced then their actions will change the futures price. For example, if many speculators believe that futures are under-priced then they will buy futures, thereby increasing the demand for futures and the futures price. This does not mean that when the futures price reaches equilibrium all speculation ceases. Because speculation depends on subjective opinion, there will always be someone who thinks that the price will increase, trading with someone else, who thinks that the price will decrease.
Those speculators who predict correctly will make profits and will be encouraged to participate in the market again. Those speculators who predict incorrectly will loose money and will move out of the market. In this way, the system encourages the best forecasters to remain in the market. However, at any one time there are bound to be a number of inexperienced "hackers" in the market who could temporarily distort the price (see section 5.2 and 5.3). The point is that speculators use the best information they have to forecast the futures price and cast their votes, in the form of buying and selling contracts, for the price in the future. The collective action of all speculators in the market causes the price to settle at some equilibrium which should be a very good forecast of prices in the future. As has already been shown in Section 4.1 the expiration date futures price and the cash price are closely related. Therefore, the current futures price should also be a very good forecast of the cash price.

5. Speculators and futures markets

Speculators play a very important role in futures markets by supplying much needed liquidity (see Catania, 1989). However, misguided speculation based on bad information can cause market distortions and a misallocation of resources. This section emphasizes the importance of high quality information.

5.1 Risk redistribution fallacy

A fallacy that persists in text books and other writings on futures markets is that the futures market shifts risk from hedgers to speculators. This statement is not true since it is possible for a futures market to provide hedging in the complete absence of speculators. The role of speculators in the futures market is to provide liquidity.

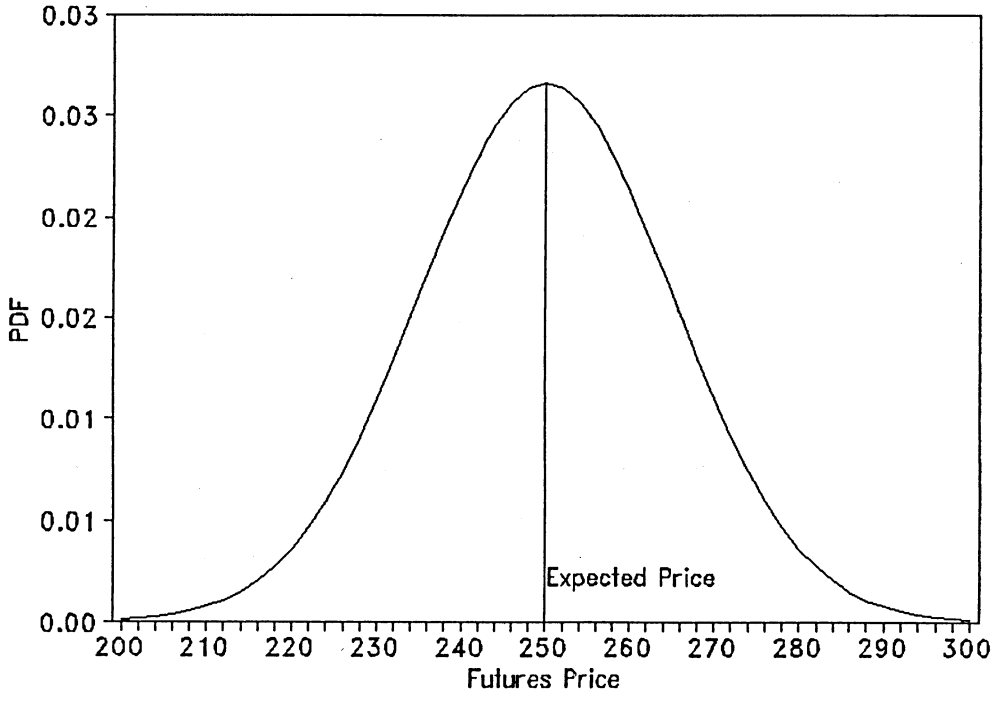

Figure 1: Speculator's subjective probability distribution

At times when the market moves out of equilibrium, because there are too few buyers or too few sellers, speculators take advantage of the arbitrage opportunities and bring the market back into equilibrium.

However, the ability of speculators do their job depends a great deal with how well informed they are and whether they know how to use the information.

5.2 Good speculation

The futures price is the average of every speculators' forecast. If the speculators in the market are experienced and have reliable information on the underlying demand and supply conditions, then their forecast will be a very good forecast of what the cash price will be in the future. The equilibrium futures price will provide valuable public information on which, for example, farmers can base their planting decisions. The point is that a futures market based on high quality information with speculators that react rationally to this information will result in an optimum allocation of resources.

5.3 Bad speculation

At any point in time there are bound to be a number of inexperienced "hackers" in the market who react to bad or incorrect information. If these hackers work independently then it is unlikely that they will distort the price much since their independent actions should cancel out. However, it is possible that a significant number of hackers overreact in the same way to bad information and create a price distortion.

Another possibility is that speculative bubbles can develop in the futures market. Speculative bubbles arise when traders loose sight of the underlying supply and demand conditions. For example, traders may see that futures prices are rising and assume that they will continue to rise. They react by purchasing futures contracts. The extra demand for futures contracts causes prices to rise even further. This self fulfilling prophesy continues to feed on itself causing prices to spiral to artificially high levels. Eventually, enough traders begin to notice that the futures price is way out of line with the supply and demand of the physical commodity and begin to predict a downturn in prices. This is when the "bubble" bursts. Speculators scramble to sell and the price plummets. Artificially high futures prices send the wrong message to farmers and result in a misallocation of resources in the form of over-production.

Since the futures market, unlike the stock market, allows short selling, speculative bubbles are less likely to arise. Short selling allows a speculator, who believes prices will decline, to sell a contract and buy it back later. The stock market is one-sided in that if you believe prices are going to decline then you cannot sell shares unless you already have them. Additionally, speculative bubbles cannot persist in a futures market since the futures price and the cash converge at the expiration.

5.4 Information

Clearly, overreaction by traders and artificial prices from speculative bubbles cause the futures market to be volatile and results in a misallocation of resources. To avoid this, traders need to be well informed. This is where the state can play a role. The state can provide public information about supply and demand and the projected cash price and can alert traders when prices appear to be overinflated. The United States Department of Agriculture (USDA) plays an important role in providing information to futures traders. The USDA issues quarterly statements on factors such as US plantings and weather conditions abroad, which have been shown to affect the futures price (Colling and Irwin, 1990:84). It can be argued, though, that there should be a market for this information and therefore private consultants could profit from providing such information.

6. Futures markets in South Africa

Having covered some of the more general aspects of futures markets, this paper will now discuss issues relating to the introduction of an agricultural commodities futures market in South Africa. The most important factor which will determine the success or failure of a commodities futures market in South Africa is that there is sufficient liquidity.

6.1 Liquidity

A liquid market is one where traders can move in and out of the market with ease. This means that a buyer can always find a seller and a seller can always find a buyer. Liquidity feeds on itself. If a market is liquid then traders will enter the market more freely because they know that they can close out their positions with ease. More traders makes the market more liquid.

In an illiquid or "thin" market traders run the risk of not being able to close out their positions when they want to. This risk may prevent traders from entering the market thereby aggravating the liquidity problem. For example, a speculator with a short position in futures may wish to liquidate his position because prices are rising. If he has to wait several days or has to offer a higher price just to find a seller then this will worsen his position.

6.2 Price uncertainty

The interest in the market is directly related to uncertainty of prices. If traders do not face uncertain prices then there is no need for a futures market. The marketing policies of many of the major agricultural products in South Africa reduce price uncertainty considerably. For example, the pre-1987 single channel fixed price scheme for maize virtually eliminated all price uncertainty. It did not eliminate all uncertainty for farmers because the price was not announced at planting time, but never-the-less farmers still had a good idea what the price would be. The current single channel pool scheme for maize also eliminates most of the price uncertainty. The Maize Board uses its monopolistic powers to fix the local price, where most of the product is sold. Some uncertainty is introduced by the small proportion of total output which is sold on the world market. Under a free market system, prices are determined by the interaction of supply and demand. Price uncertainty exists because of uncertainty in supply and demand. With crops such as maize, most supply uncertainty is due to weather uncertainty. Demand is also largely affected by the weather, since when subsistence crops fail demand increases.

Because South Africa is a price-taker on the world market, the local price will vary between the import price and the export price. In good years, with good rains, the local price will drop to the export price and maize will be exported. In bad years, the local price will increase to the import price and maize will be imported. Since the world price is uncertain, the import and export prices are also uncertain. The gap between the import price and the export price is closely related to transport costs to and from the world market. Therefore, the higher the transport costs the greater the scope is for the local price to vary independently of the world price.

The strength of the correlation between the local price and the world price has important implications for a local futures market. If the local price is highly correlated with the world price (assumed to be the Chicago price) then South Africa could simply use the Chicago Board of Trade. On the other hand, if transport costs are high enough so that the local price varies, to a greater degree, independently of the Chicago price then there is a need for a local futures market.

The above discussion assumes that people are free to import and export maize as well as to trade on foreign futures markets. With South Africa's current foreign exchange regulations this would not be possible. However, free trade would not require a complete dismantling of the foreign exchange regulations. Instead, the purchase and sale of foreign exchange could be permitted specifically for importing and exporting maize. Likewise, trades on foreign futures markets could be permitted as long as the money was brought back into the country as soon as contracts were closed out.

6.3 Education

Education is another important factor affecting the degree of interest in a futures market. People will distrust the market if they do not understand how it works. Initially, training programmes should be aimed at the people most likely to use the market: farmers, dealers in agricultural products, consultants, investors and speculators. General awareness can be increased by introducing courses on futures markets at universities, agricultural colleges and adult education programmes. Care should be taken not to make the futures market an elitist institution as it is in the United States. The futures market is for everyone, not only for high-powered investors or for those dealing in agricultural products (See section 7.2).

6.4 Index futures

A futures market for an index is used when there are many highly correlated prices which traders wish to hedge. For example, futures contracts on the JSE All Industrial Index and the JSE All Gold Index are traded (SAFIA, 1990:40). This allows anyone, with a portfolio which is highly correlated with one of these indexes, to hedge. The alternative is to have a futures contract for each of the underlying shares. Such a proliferation of futures contracts would result in thin markets lacking interest and liquidity. Index futures do not allow a perfect hedge but never-the-less do remove a substantial amount of risk.

Such an index could be considered for agricultural commodities. The yields of all summer grain crops in South Africa are highly correlated and therefore, in a

free market, their prices are bound to be highly correlated. A summer grains index could be created by taking a weighted average of the prices of the major summer grains. Weights would be fixed at some measure of the relative importance of each crop. This summer grains index futures contract could then be used by farmers who face prices closely correlated to the index. Other indexes could be introduced for other groups of crops whose prices are also highly correlated.

7. Computer-based trading system

The last section of this paper provides arguments for a computer-based trading system rather than the more traditional floor trading system.

7.1 Price discovery

The bedlam on the trading floor at exchanges such as the Chicago Board of Trade, especially at closing time, indicates that other factors rather than the underlying supply and demand conditions affect the price. Price discovery should take place in a cool, calm atmosphere. The futures price should increase or decrease each day depending on what new supply and demand information has become available. Futures prices for agricultural products in the United States often swing wildly due to traders overreacting to information. A computer-based trading system, where traders key in offers to sell and bids to buy contracts from remote terminals around the country should eliminate much of this over-excitement. A futures market requires interest not excitement.

7.2 Vested interest, location and limited access

Historically, floor trading made sense but with modern computer technology centralized trading is no longer necessary. The reason why floor trading persists at places such as the Chicago Board of Trade is because of the vested interest of the few privileged traders who have access to the floor.

The primary reason for choosing a central location for the exchange is for convenience of access. With modern electronic communication physical proximity is no longer important. Computer terminals with access to the central "clearing" computer could be located anywhere in the country or even out of the country. In fact, anyone with a personal computer and a modem could have access to the market.

Floor trading restricts access to registered traders because there is a limited physical space. The number of traders "on the trading floor" in a computer-based system is not limited. Even a relatively cheap personal computer could cope with hundreds of traders bidding and offering contracts simultaneously.

7.3 Minimum price changes and contract size

The minimum price change for Corn Futures trading at the Chicago Board of Trade is one quarter of a cent (= $12.50 per contract)(Catania, 1990:283). This may reduce liquidity since traders may desire to trade at prices between the minimum changes. Part of the reason for having this minimum price change rule is that the sign language used on the trading floor would not be able to cope with arbitrary price changes. A computer-based trading system would not suffer from this limitation. Prices could be quoted to any number of decimal places without affecting the efficiency of operation.

The contract size for corn is 5000 bushels (= 127 metric tons). This large contract size was probably implemented to avoid clogging up the trading floor with small insignificant trades. However, large contract sizes may scare away small traders. Instead, South Africa could use a much smaller contract size, say one ton. Once again, a computer-based system will be able to cope with masses of small trades. The small trades will provide additional liquidity for the market.

7.4 Limited hours

As noted earlier, the excitement generated on the trading floor may result in overreaction by traders and wide price swings. This excitement reaches a frenzy at closing time at the Chicago Board of Trade. Trading hours for agricultural products are very limited: 9:30 a.m. to 1:15 p.m. Monday to Friday. These limited hours are, once again, a product of the floor trading tradition where physical presence is necessary. A computer-based system need not have limited hours. It could be "open" 24 hours a day, seven days a week. This would not require people to operate the trading terminals 24 hours a day either. One would simply send an instruction to the central "clearing" computer to, say, sell five futures contracts if the price increases to or beyond a particular level. Trades would take place in a much cooler and calmer environment and are therefore more likely to be based on supply and demand information.

7.5 Transaction costs

A barrier to entry to the futures market is the transactions costs. Potential traders may be less inclined to enter the market because of the brokerage fees. The fee has to be paid on entry and exit and every time a trader wishes to change his position. The brokerage fee is a fixed cost best spread over many contracts. The computer-based system would eliminate the need for many of the "services" provided by brokers and the few privileged traders who have access to the floor. With a computer-based system the line of communication is considerably shorter. Traders have direct access to the trading "floor" thereby eliminating many of the "middle men". Reduced transactions costs will encourage people to trade thereby increasing the liquidity of the market.

7.6 Audit trail

Another advantage of using computers to trade futures contracts is that there is a full audit trail. At any moment there is a complete record of exactly who sold what and who bought what and for how much. The traditional method of trading requires telephone calls back and forth and messages in the form of sign language the trader on the floor. Trading is then conducted by shouting bid and offer prices on the trading floor. Clearly this traditional method of trading is susceptible to errors. Finding exactly where an error occurred and whose fault it was can be very difficult.

7.7 Teaching futures markets through simulation games

Simulation games are an excellent way of learning how to use a futures market. Computers are particularly well suited to running simulation games. Potential traders can play futures market simulation games to familiarize themselves with the workings of the futures market. Players are given information on the underlying supply and demand conditions as time passes. From this

information they formulate their own subjective expectations of the futures price and buy or sell futures contracts accordingly. Players compete on the simulated market just as traders compete on the real market. Small amounts of margin money could be charged in order to make the game more realistic, then players would win and loose small quantities of real money. In a real-time simulation game, simulated time can be considerably speeded up relative to actual time so that several years of experience can be compressed into a short space of time.

Apart from the education benefits of a simulation game, in the early stages it can also be used to help develop software suitable for the real computer-based futures market. Problems that crop up in the simulation game can be sorted out before the real futures market is launched.

8. Conclusion

The most obvious benefit of an agricultural commodities futures market is that it allows traders to hedge against price risk. However, futures markets also provide useful public information on expected future cash prices. So, even if a farmer does not make use of the futures market for hedging, he can still benefit from the price forecasts the futures market provides. These price forecasts are only as good as the information on which they are based, but speculators are motivated by the profit incentive to obtain the best information available.

This paper has raised some issues which require more thorough research. The problem of "cornering the market" requires attention. Reading on why and how American futures markets have failed at times and what measures have been taken to prevent this from happening again. The problem of the optimal hedging strategy when output is uncertain, with special reference to residual export markets, needs to be researched further. Some of the examples presented assumed the existence of a foreign exchange futures market. Can such a market be introduced in South Africa? Options on futures are gaining popularity in the United States. Can options play a role in South Africa?

Before South Africa can contemplate introducing a futures market for agricultural products, the agricultural product markets need to be freed from regulation. Prices must be free to fluctuate so that they reflect the underlying supply and demand conditions. It may be natural to assume that South Africa should structure its agricultural futures market in the same way that the very successful Chicago Board of Trade is structured. However, there are several reasons why a computer-based trading system would work better. A computer-based system is more flexible: there need be no limited access, minimum price changes and limited hours. Contract sizes can be smaller and transactions costs can be reduced. All of these factors should help to improve liquidity. However, the most important reason for favoring a computer-based system is that price discovery takes place in an orderly manner and should therefore closer reflect the true underlying supply and demand conditions.

References

CATANIA, PJ. (1989). Executive Editor. Commodity Trading Manual. Chicago Board of Trade.

COLLING, PL and SH IRWIN. (1990). The Reaction of Live Hog Futures Prices to USDA Hogs and Pigs Reports. American Journal of Agricultural Economics. Vol 72:84-94.

KARP, LS. (1987). Methods for Selecting the Optimal Dynamic Hedge When Production is Stochastic. American Journal of Agricultural Economics. Vol 69:647-657.

ROLFO, J. (1988). Optimal Hedging Under Price and Quantity Uncertainty: The Case of the Cocoa Producer. Journal of Political Economy, Vol 88:100-16.

SAFIA. (1990). Financial Futures - An Introduction. Second Edition. South African Futures Association.

VAN DER MERWE, GP. (1990). Research Note: Organized Futures Trading. Agrekon, Vol 29:72-73.

VAN DER VYVER, A and J VAN ZYL. (1989). A Futures Market for Maize in South Africa. Agrekon, Vol 28: 77-84.