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THE EFFICIENCY OF THE SOUTH AFRICAN WHITE MAIZE FUTURES MARKET

Kerry McCullough* and Barry Strydom**

ABSTRACT

The efficiency of futures markets for agricultural commodities is an important issue for participants in the agricultural sector who rely on futures contracts to manage price risk and to assist in planning. Tests of market efficiency in futures markets typically address the relationship between spot and futures prices through the application of cointegration techniques. This study employs both the Engle-Granger's and the Johansen's tests for cointegration in order to examine the efficiency of the futures market in South Africa for white maize, which is the most important commodity traded on the South African Futures Exchange by volume. Near spot and futures prices are found to be cointegrated, and there is evidence to indicate that this market is both unbiased and without a risk premium, indicating a weak-form efficient market. This is in contrast to the findings of previous papers, which examined the early years of this market, and points to an improvement in the efficiency of this market.

Keywords: futures markets, agricultural commodities, market efficiency and cointegration

JEL Codes: C58; D53; G14

1. INTRODUCTION

The importance of rising global food prices was starkly demonstrated in 2008 with violent protests erupting around the globe, including in South Africa (Kharsany, 2008:para. 1). Since then, world food prices have continued to climb reaching an all-time high in 2011 with, according to the Food and Agricultural Organisation of the United Nations (FAO), the threat of further increases if the world grain crop does not increase significantly (Ruitenberg, 2011). Central to the discussion regarding rising food prices have been accusations that uncontrolled speculation is to blame for rising commodity prices (Lawrence, 2011; Gilbert, 2010; Henriques, 2008). However, as Gilbert (2010:416) observes, in an efficient market uninformed speculators should not be able to affect asset prices and thus, if commodity markets

* Lecturer, School of Accounting, Economics and Finance, University of KwaZulu-Natal. Email: mcculloughk@ukzn.ac.za

** Senior Lecturer, School of Accounting, Economics and Finance, University of KwaZulu-Natal. Email: strydomb@ukzn.ac.za

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are efficient, rising food prices accurately represent market fundamentals and are not a result of reckless speculation. Given that, due to their liquidity and leverage effects, futures contracts are the prime vehicle for commodity speculators, the question of how efficient agricultural commodity futures markets are is, therefore, of direct importance, not only for market participants and regulators but for the general public as well.

This paper tests the efficiency of the largest and most liquid agricultural commodity futures contract traded on the South African Futures Exchange (SAFEX), namely that of white maize, as efficiency is most likely to occur in a liquid market (Pennings and Meulenberg, 1997:297). In doing so, we contribute to the debate on rising food prices and add to our knowledge of the South African futures market. Our study includes several improvements over earlier work on this topic, including: it makes use of a longer data set than previous studies as well as incorporating the recent period of rising food prices; it corrects for several errors in the methodology of earlier studies; and, to the best knowledge of the authors, it is the first South African study to employ the Johansen's approach in order to directly test the parameter restrictions necessary to show market efficiency.

This study is also the first to employ the near spot market prices, which are now provided by SAFEX. It is important to note that the SAFEX quoted spot price is in fact derived from the SAFEX near-futures contract on white maize (post 1999), while prior to 1999 this spot price represents an aggregation of available silo spot prices around South Africa at the time. Such a measure is not available post 1999 and as such, this SAFEX quoted near spot price is the best possible spot price estimate of South African white maize cash prices available. Although not an ideal cash price, it is not uncommon in the literature for such a measure to be used as a spot price proxy (Auret and Schmidt, 2008:108; He and Holt, 2004:8). In finding evidence of market efficiency we make an important contribution to the debate about the role of speculation in commodity food prices.

The remainder of this paper is organised as follows. In section two we set out the specific theoretical requirements for futures market efficiency, and in section three we review previous studies of the efficiency of the white maize futures contract traded on SAFEX. Section four describes the methodology employed in the study, while section five presents our findings and analysis. Section six concludes.

2. FUTURES MARKET EFFICIENCY

When a market is functioning at a level where it can effectively meet risk management and price stabilization roles then it may be referred to as being efficient (Moholwa, 2005:3). That is, "efficiency" refers to a market's ability to perform its purported functions, which include price stabilisation and risk management. Antoniou and Holmes (1996:116) explain that when the Efficient Market Hypothesis (EMH) is applied to futures markets the implied relationship between spot and future prices, given the information available at that time, is that futures prices are unbiased estimators of *expected* future spot prices. As a result, making abnormal profits from speculative activities should be impossible to achieve. If the futures market is weak-form efficient, it indicates that current market prices, including the futures price, reflect all the information contained in historical prices. This level of efficiency would suggest that abnormal profits may not be earned by predicting future price movements using historical price information.

For market participants trying to manage their risk exposure, an efficient market is a positive finding. This positive effect is easily demonstrated by a simple example. Imagine a farmer who produces maize as one of a mix of crops on his farm. Without a futures market (specifically an efficient one) the farmer must decide which crops to plant using only his own future expectations as a guide. If, however, the farmer is able to consider the futures prices as a reliable estimate of the price that will prevail in the future for these crops, decisions relating to crop choice and land allocations can be made with greater accuracy by using the collective market's expectations of future prices. That is, if the futures price indicates that maize will have a higher price in the future, the farmer can choose to allocate more land to maize production given the expectation of an upcoming higher price as that crop goes to harvest.

Efficiency can thus be described as follows: if futures prices are unbiased predictors of expected spot rates, this will indicate an efficient market, where the current futures price is expected to equal the expected spot price of that commodity. That is, by observing current futures contracts prices, upcoming spot prices can be anticipated by market participants (McKenzie, Jiang, Djunaidi, Hoffman and Wailes, 2002:478). In testing for efficiency, one considers a joint hypothesis of the market being not only efficient but also that the market is unbiased (McKenzie and Holt, 1998:1). A futures price is both efficient and unbiased when a given futures price equals the expected upcoming spot price it is associated with (Santos, 2009:2).

3. LITERATURE REVIEW

Only three studies have tested the efficiency of the South African white maize futures market. Wiseman, Darrock and Ortmann (1999:326) applied a co-integration methodology to a data set for the period 1997 to 1998. Price data were collected from various sources as there was no central price reporting system available then. This study used the Augmented Dicky-Fuller to test for the presence of a unit root, and then followed the Engel-Granger (EG) method for detecting cointegration. They tested a model that included lagged futures prices in order to determine if these lagged values could be used to forecast spot prices (Wiseman *et al*., 1999:325). Further, they suggested that a finding that the residuals of the efficiency statement are stationary might be used as support for saying that the market is unbiased (Wiseman *et al*., 1999:325). These approaches, however, have not been commonly used internationally. Wiseman *et al*. (1999:332) found that there was evidence of an inefficient market as past price data could be used to predict upcoming spot prices, although they did also conclude that there was evidence of unbiasedness in the 1998 contract due to the presence of cointegration between the variables.

Nikolova (2003:36) repeated the Wiseman *et al.* study using a longer time frame extending from 1997 to 2002. Wiseman *et al.* used spot and futures prices from the same period and had not converted their data with a natural log transformation. Nikolova (2003:28) addressed these shortcomings by employing a natural log of the data and used futures prices that had been lagged back in time as recommended by other studies. The study applied the Dicky-Fuller tests for detecting unit roots and then tested for co-integration with the EG approach (Nikolova, 2003:33). Nikolova (2003:48) found that the two series were not co-integrated. Each year was individually examined for co-integration, rather than running the spot price *series* against the future price *series* in order to obtain a full residual series to test. It seems unlikely that this finding of no co-integration over this entire time frame was correct, as a test that covered the full period from 1997-2002 may have yielded different results, however, without the data source used this is difficult to verify.

Moholwa (2005:13–14) used a forecasting framework as his mode of testing for predictability, and not cointegration methodology, although Dicky-Fuller, Augmented Dicky-Fuller and Phillips-Perron tests were used to detect unit roots (Moholwa, 2005:10–11). It was concluded that the presence of a unit root (nonstationarity) could not be rejected. Due to the lack of reported spot data on SAFEX this study was performed using only futures prices. Moholwa (2005:9–10) used pooled data sets that contained observations on the price from the introduction of the contract until the last business day of trade in the month prior the contract's expiry. He concluded by stating that, although prices for both white and yellow maize appeared to be partially predictable – implying that price data did contain information that could be used to predict upcoming prices – once brokerage fees and the time value of money had been accounted for, there was little to indicate that decisions made to predict upcoming changes in the futures prices would create any value for the trader in either maize market (Moholwa, 2005:21).

4. METHODOLOGY

4.1 Research problem

It is evident that understanding the level of efficiency in the white maize futures market in South Africa is an important research question for all market participants as well as the broader population. From the above discussion it is apparent that the research on the efficiency of the South African Futures Market for white maize is extremely limited. One also observes the variation in the methodologies employed and the conflicting results evident within the three studies. There is evidence within the studies of an improvement in the efficiency of the market over time. All three studies suffered from major limitations, however, in terms of limited data sets, there is a lack of adequate spot price data, and the exclusion of Johansen's cointegration methodology.

This paper seeks to address these shortcomings by testing the efficiency of the white maize futures market by using an extended data set and we extend the previous studies by employing Johansen's cointegration, which importantly allows us to directly test the parameter restrictions required for market efficiency to be proven. Finally, this is the first South African efficiency study to use the historical spot prices provided by SAFEX, which were not previously available.

4.2 Hypotheses

The null hypothesis of an efficiency study has two parts. The first is that there will be a cointegrating long-run relationship between spot and futures prices as presented by equation 1:

$$S_t = \alpha + \beta F_{t-1} + \varepsilon_t \qquad (1)$$

Where: α is the intercept term;
β is the slope coefficient to the future price term;
F_{t-1} is the future price of the commodity lagged backwards in time *n* weeks;
S_t is the spot price of the commodity at time t.
ε_t is the random error term included in the econometric model in order to capture any variability in the data set not explained by the explanatory variables. This residual term should show white noise properties (Carter, 1999:232).

The second part of the efficiency hypothesis examines the cointegrating regression described in equation 1 and requires that the alpha and beta coefficients be found to take on the following characteristics (Lai and Lai, 1991:569):

H_0: $\alpha = 0$ or $\beta = 1$
H_1: $\alpha \neq 0$ or $\beta \neq 1$

If these parameters collectively hold, it would indicate that market participants have rational expectations and that they charge no premium for bearing risk ($\alpha = 0$) in the futures market (Lai and Lai, 1991:567).

Wang and Ke (2002:7) show that they consider the restriction on the null hypothesis that requires $\beta = 1$ as being the more important of the two restrictions due to the fact that α may be nonzero even when the market is efficient. That is, the finding of a nonzero risk premium could be due to market costs such as transportation, rather than due to inefficiencies or market failure. Due to this, it is recommended that these restrictions be tested separately in order to increase the depth of information that can be extracted from the analysis (Wang and Ke, 2002:13).

If neither of these parameter restrictions are met the market may not be efficient even if it has been shown through the presence of cointegration that spot and future prices move together over time. More specifically, if both parameter restrictions are not met, three possible conclusions can be drawn (McKenzie and Holt, 1998:2), namely:

(i) the market is inefficient;
(ii) there is a constant risk premium present in the market, which results in biased future estimates but which does not necessarily show the market is inefficient; and/or,
(iii) a risk premium that varies with time is present in the market, causing bias to arise.

In a broader interpretation, any indication that the market is not fully efficient implies that the risk reduction/hedging role of the futures market may not be fully utilized by those wishing to incorporate these roles into their trading/farming/investment operations, and further implies that there may be abnormal profit-making opportunities available to market participants such as speculators and other risk-seeking players.

The remainder of the methodology section describes the testing procedures necessary to firstly establish cointegration, and then to determine if the parameter restrictions hold.

4.3 Tests of stationarity

Before it was possible to ascertain if the spot and futures prices were co-integrated each data series was tested for the presence of a unit root indicative of nonstationarity. The Augmented Dicky-Fuller (ADF) and Phillips-Perron

(PP) tests were therefore used in order to determine if the individual series were stationary or not. Following this, the Augmented Dicky-Fuller test was used to ensure that the series used in the regression were both integrated of the same order.

4.4 Tests of cointegration

Cointegration was determined through the use of two methods, namely the EG and the Johansen's approaches. The EG and Johansen's tests have different power and bias properties, as well as other inherent advantages and disadvantages, and so both techniques were used in order to ensure that results were not being skewed by model selection or sample size. Testing for cointegration with the EG approach involves extracting the residual series from the cointegration equation (equation 1) and then testing that series for the presence of a unit root using the EG or Augmented Engle-Granger (AEG) tests. If the residual series is integrated of order one (I (1)), then there is no cointegrating relationship between the variables.

The first stage of this test thus involved extracting the estimated residuals from the regression of equation 1, and then applying the EG and AEG tests.

$$\Delta\hat{\varepsilon}_t = \beta_1\hat{\varepsilon}_{t-1} \qquad (2)$$

Equation 2 was then tested with the following hypotheses adapted from Enders (2004:336):

$H_0 : \beta_1 = 0$ and therefore $\hat{\varepsilon}_t$ = I(1), residuals are not cointegrated as they are nonstationary.
$H_1 : \beta_1 \neq 0$ and therefore $\hat{\varepsilon}_t$ = I(0), residuals are cointegrated as they found to be stationary.

If the null hypothesis is *not* rejected then there is no cointegration (Brooks, 2008:340). The reason for this is that if the residual term is found to show stationarity then it can be concluded that spot and futures prices have a long-run equilibrium relationship, that is they are cointegrated.

Cointegration was then tested with the Johansen's methodology whereby a matrix was formed of the two variables, spot and futures prices, such that vector X was formed shown as follows:

X = [S F]

In this vector, S denotes the spot price and F the futures price (Yang *et al.,* 2001:285). If S and F are shown to be cointegrated then a vector autoregressive (VAR) model with k lags may be described (Yang *et al.,* 2001:285). From this VAR it is possible to construct the long-run coefficient matrix to which the test of cointegration is applied and from which the VECM is formed (Brooks, 2008:350). This matrix consists of both cointegrating vectors and speed of adjustment parameters (Enders, 2004:36).

In order to test for cointegration it was necessary to establish the rank of the matrix in question. The rank of the matrix was determined by establishing how many of the characteristic roots (known as eigenvalues) were different from zero (Brooks, 2008:350-351) using the Trace and Maximum Eigenvalue Tests. A rank greater than 0 shown to be statistically significant indicates cointegration is present between the variables; further a rank of 1 suggests that there is 1 cointegrating relationship between the variables; a rank of 2 would suggest 2 relationships and so on. As it is possible for these tests to produce conflicting results, the use of both ensures that the correct rank is identified (Enders, 2004:354).

4.5 Tests of efficiency

Although cointegration is the first step in establishing if a market is efficient or not, it is still necessary to apply the parameter restrictions. The Johansen's method of detecting cointegration results in a set of matrices that contain the information that allows a Vector Error Correction Model (VECM) to be examined and further allows for parameter restrictions to be placed on the matrices in order to test the efficiency statement fully. No such parameter testing mechanism exists within the EG approach.

The constant term in the cointegrating equation must still be shown to be equal to zero, that is, $\alpha = 0$. Although EViews does not allow for a direct restriction on the constant term to be applied, this was overcome by forming a VECM with the assumption that there is a constant term in the cointegrating equation, but not in the vector autoregression (VAR), shown as the VECM, as this was the term of interest.

4.6 Data

The data used in this study consists of historical spot and futures price data on white maize futures contracts traded on the SAFEX obtained directly from the SAFEX website (SAFEX, 2008). White maize futures have been traded in South Africa since 1996 and have expiry dates in March, May, July, September and December, which translates to either a two- or three-month interval between contracts. Starting with the May 1996 contract and ending with the May 2009 contract, each white maize futures contract had two data points collected. The first was each contract's price at the maturity date, and the second was the futures price quoted on each contract eight weeks prior to the contract's expiry. This was done in line with Beck's (1994:251) recommendation of choosing a futures price that is less than or equal to the time interval being examined in order to reduce the possibility of introducing correlations into the sample as a result of overlapping data readings. In this manner a data set of 66 observations was compiled, with each observation consisting of a spot price and a futures price on a single contract. Once the full spot price and futures price series were compiled, a natural log transformation was applied to the data in line with previous studies of this nature, including Fedderke and Joao (2001); Leng (2002); and Zapata, Fortenbery and Armstrong (2005).

5. FINDINGS AND ANALYSIS

5.1 Testing for nonstationarity

Table 1 shows the results of the PP and ADF tests on the level data, and then the ADF test on the series in First Difference Form (FDF).

Table 1: Unit root tests and data order

Series	Testing for a Unit Root		Testing for Data Order
	PP	ADF	ADF (FDF)
Spot Price	-2.752166	-1.739859	-7.719992
Futures Price	-2.754108	-1.840648	-7.458547

The estimated Phillips-Perron test statistics for both the spot and futures price series are smaller in absolute terms than the corresponding critical value of -4.105534 at the 1% level. The ADF test shows estimated *tau* statistics that are also smaller in absolute terms than the associated critical value of -3.536587 at the 1% level. These tests thus indicate that the null hypothesis that these series are nonstationary and *do* contain a unit root *cannot* be rejected at all conventional levels.

The final column of Table 1 labeled 'Testing for Data Order' shows the results of running the ADF test on the spot and futures price series after first difference form had been applied. In both the spot and the futures series it can be observed that the estimated *tau* value is now greater in absolute terms than the associated critical values. Consequently, the null hypothesis that the first difference of the spot and futures price series contains a unit root is rejected and it is concluded that both the spot and futures series are integrated of the first order. It was thus established that both spot and futures prices were not stationary in level form but were stationary in first difference form, showing that these series are both integrated of the same order and so it was possible to proceed to testing for cointegration.

5.2 Testing for cointegration

5.2.1 Engle–Granger cointegration

In testing the residual series of the cointegrating equation for the presence of a unit root it was found that the estimated t-statistic of -7.504742 is higher than the associated critical values at the 1% level of between -4.592 and -4.4441. This result shows that the residual series from the cointegrating equation described in equation 1 is indeed stationary, indicating that a long-run cointegrating relationship exists between spot and futures prices.

5.2.2 Johansen's co-integration

The results of the Johansen test of cointegration are shown in Table 2 and it can be observed that both the Trace and Maximum Eigenvalue Tests reach the same conclusion: that it is unlikely that the rank of this equation will be zero, and both show that the rank of this matrix will at most be equal to 1. That is, 1 cointegrating equation must exist between the spot and futures price series, indicating the presence of a long-run cointegrating relationship. The first of these tests (second row in the table below) examined the null hypothesis that there are no cointegrating vectors, and when this was rejected the null hypothesis became that there was one cointegrating vector, this being the significant result.

Table 2: Johansen's cointegration

	Johansen's Cointegration	
	Trace Test	Maximum Eigenvalue Test
No Cointegrating Relationships	34.88917	30.99011
At most 1 Cointegrating Relationship	3.899062*	3.899062*

* indicates a statistically significant result at the 5% level

The fact that both the Trace Test and the Maximum Eigenvalue tests indicate the presence of one cointegrating vector increases the confidence with which it can be concluded that cointegration is present between spot and future prices. Further, considering that both these tests, as well as the EG test, separately reach the same conclusion it is possible to conclude that the first requirement of market efficiency has been met and thus it has been shown that there is a long-run cointegrating relationship between spot and futures prices.

Before examining the VECM a lag test was performed to establish the appropriate lag structure for the VECM. As seen in table 3 below a single lag was determined to be optimal.

Table 3: Information criteria for lag length selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-11.63515	NA	0.005401	0.454505	0.524316	0.481812
1	103.3404	218.4536*	0.000134*	-3.244681*	-3.035247*	-3.162760*
2	105.1321	3.284638	0.000144	-3.171068	-2.822011	-3.034533
3	108.0728	5.195363	0.000149	-3.135761	-2.647080	-2.944611
4	109.6961	2.759506	0.000162	-3.056535	-2.428232	-2.810772
5	111.0224	2.166349	0.000178	-2.967413	-2.199487	-2.667035
6	113.3506	3.647467	0.000189	-2.911686	-2.004136	-2.556693

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

5.3 Johansen's VECM and parameter restrictions

The matrix formed under this method can be depicted very simply as X = [S F]. If one examines the original cointegrating relationship (and it has been established that there is only one of these cointegrating relationships) one can see why a cointegrating vector of [1; -1] between these prices is displayed below. In the original equation $St = \alpha + \beta F_{t-1,\,t} + \varepsilon_t$ the spot price is on the left hand side of the equation and is positive. When a matrix is formed both these variables are moved to the same 'side' of the equation, resulting in a positive spot coefficient but a negative futures coefficient.

Due to this, in order to test that $\beta=1$ the following restrictions are placed on the VECM, namely: B(1, 1) = 1, B(1, 2) = -1. This is testing that, given that the spot price coefficient is positive one (that is, the spot price is unaffected) then the coefficient to the futures term must equal -1 for futures prices to be unbiased predictors of upcoming spot prices. In other words, there must exist a one-for-one relationship between spot and futures prices so that the concept of unbiasedness will hold. Table 4 shows the results of this restriction.

Table 4: Parameter Restriction $\beta = 1$

Vector Error Correction Estimates Standard errors in ( ) & t-statistics in [ ]	
Cointegration Restrictions:	
B(1,1)=1, B(1,2)=-1	
Convergence achieved after 1 iterations.	
Restrictions identify all cointegrating vectors	
LR test for binding restrictions (rank = 1):	
Chi-square(1)	0.146168
Probability	0.702225

In this scenario the hypotheses are a joint restriction and thus the critical values were taken from the Chi-squared table with two degrees of freedom. It is found that it is not possible to reject the null hypothesis that the slope coefficient is equal to one, and thus it is determined that the restriction $\beta = 1$ holds.

Although it was not possible within EViews to apply a joint restriction, which includes a restriction on the constant term, as was done in Table 4 above, it was still possible to estimate the VECM in such a way as to be able to comment on the value of the constant term. The term of interest in Table 5 is the constant term labelled "C" with its associated t-statistic. This VECM output is generated during the application of the $\beta = 1$ restriction above and allows one to comment on both "restrictions" simultaneously. Although this constant term relates to the cointegrating regression, and so one would be concerned with wrongly rejecting a null hypothesis due to incorrectly inflated t-statistics (Brooks, 2008:319-320), the result can still be interpreted with some confidence as the t-statistic is very low. That is, there is some evidence to suggest that the white maize market in South Africa does not contain a risk premium.

Table 5: Parameter Restriction α = 0

Vector Error Correction Estimates Standard errors in ( ) & t-statistics in [ ]	
Cointegrating Eq:	CointEq1
LOGS(-1)	1.000000
LOGF(-1)	-1.000000
C	0.002418
	(0.00830)
	[0.29134]

The critical values for the t-test here are taken from Brooks (2008:617). The reported t-statistic is much smaller than any of these possible critical values indicating that it is not possible to reject the null hypothesis that this term is equal to zero. There is thus evidence to suggest that the South African futures market for white maize does not contain a risk premium.

Having examined these restrictions there is evidence that futures prices are unbiased predictors of upcoming spot prices and that the market displays a zero risk premium. Wang and Ke (2002:7) suggested that the more important of the two restrictions is that it be shown that $\beta = 1$, as a market may be considered efficient even in circumstances where a risk premium is present. Weak-form market efficiency requires that historical market information and prices cannot be used to earn abnormal profits, and this appears to be the case in the domestic white maize futures market in South Africa.

6 CONCLUSION

For a futures market to be found to be efficient requires firstly the existence of a long-term equilibrium relationship between spot and futures prices, and secondly that the parameters of the relationship display an intercept equal to zero and a beta coefficient equal to one. We applied both the EG and Johansen tests of cointegration to the spot and futures price series and both tests found that the two price series were integrated over the period studied. A VECM was then formed in order to test the parameter restrictions and we were able to conclude that the intercept was not statistically different from zero and that the hypothesis that the beta coefficient was equal to one could not be rejected. The results of our statistical analysis, therefore, show that the white maize futures contract meets both of the requirements to be judged efficient, at least in the weak-form.

Our results differ from previous studies. Wiseman *et al*. (1999) found that the 1997 white maize contracts were not cointegrated while in 1998 they were cointegrated, indicating that market efficiency had improved from 1997 to 1998. Nikolova's (2003) study did not find nonstationarity in the underlying data and so never went on to check for cointegration. The study by Moholwa (2005) did not test for cointegration, but did conclude that once transaction costs are accounted for there is evidence of market efficiency.

This study contributes to our understanding of a major agricultural commodity futures market. While the studies by Wiseman *et al*. (1999) and Nikolova (2003) found mixed evidence of cointegration they used small samples, and examined the early years of the white maize futures market where thin trade may account for their findings. By applying the Johansen's Cointegration technique we were able to directly test the parameter restrictions, which Wiseman *et al.* (1999) were not able to, and we were able to use the near spot price data provided by SAFEX, which were not available to previous studies. The fact that this spot price data is based on the near-futures contract rather than the actual cash prices determined at the silos is an important limitation, nevertheless our results provide a strong indication of market efficiency.

A finding of market efficiency within the futures market for white maize has important implications for market participants, regulators and policy makers. More specifically our results shed light on the public debate surrounding the role of speculation in rising food prices. The results of our analysis do not provide evidence that speculative activity has resulted in futures prices diverging unrealistically from spot prices. In addition, our findings that futures prices for white maize are unbiased predictors of expected futures spot prices and of a zero-risk premium, provide compelling evidence that the futures market for white maize in South Africa is efficiently performing its functions such that market participants can employ futures price data as a meaningful predictor of likely future spot prices.

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