THE IMPACT OF ZAR/US$ EXCHANGE RATE VOLATILITY ON THE PERFORMANCE OF FUTURES MARKETS FOR AGRICULTURAL COMMODITIES

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PRESENTATION OUTLINE

INTRODUCTION

- The futures market is a market in which futures contracts on underlying commodities are traded for hedging and speculative purposes.
- The deregulation of agric mkts in South Africa led to the establishment of agricultural commodities futures in 1995.
- Futures mkts serve several important functions, such as price risk mgt, price discovery, and forward pricing.

MOTIVATION OF THE STUDY

- The study of the performance of futures markets is important to government, producers and processors.
  - For government: implies alternative to mkt intervention such as price stabilization.
  - For producers & food processors: provides reliable forecast of future spot prices.
- Exchange rates across the world have fluctuated widely particularly after the collapse of the Bretton Woods system of fixed exchange rate.
- Exchange rate volatility generates uncertainty: This increases the level of risky-ness of trading activity and depresses trade.
- No published literature in South Africa on the impact of exchange rate volatility on the performance of futures markets.

OBJECTIVE OF THE STUDY

- To investigate the impact of ZAR/US$ exchange rate volatility on the performance of selected futures mkts for agric commodities.
- The results should indicate whether the stability of ZAR/US$ exchange rate would improve or enhance the performance of futures market.

METHODOLOGY

- The analysis is conducted in three logical steps:
- First: The performance of futures markets is assessed using dynamic price asymmetric model.
- Second: Exchange rate volatility is measured using variant GARCH models.
- Third: By means of Bootstrapping Technique the volatility measure is used to determine the impact of exchange rate volatility on the performance of futures mkts.

METHODOLOGY CONT

- Dynamic Price Asymmetric Model
  - Futures prices are transformed to logarithmic values prior to computing price changes and lagged price changes.
- $\ln(FC_t) = \alpha_0 + \sum_{i=1}^{n} \beta_i \ln(PFC_{t-i}) + \sum_{i=1}^{n} \gamma_i \ln(NFC_{t-i}) + \varepsilon_t$
  - The study regresses futures price changes (FC) against both positive (PFC) and negative (NFC) lagged price changes within the same series.

METHODOLOGY CONT

- The hypothesis test whether the aggregate impact of past price increases and decreases on the current price changes are the same:

$$H_0: \sum_{i=1}^{n} \beta_i = \sum_{i=1}^{n} \gamma_i$$

$$H_1: \sum_{i=1}^{n} \beta_i \neq \sum_{i=1}^{n} \gamma_i$$

- The asymmetry test is conducted using the standard likelihood ratio F-test, which uses the sum of squared errors with and without imposing restrictions being tested.

METHODOLOGY CONT

- To test the impact of ZAR/US$ exchange rate volatility on the performance of futures markets the following linear regression model is used:

$$TS_t^j = \varphi_0 + \varphi_1 V_t + \mu_t$$

- Where: $TS_t^j = j^{th}$ performance test statistic (F-statistic), V_t=ZAR/US$ exchange rate volatility measure, φ_0=intercept, φ_1= coefficient of the exchange rate measure, and μ_t = random error.
- OLS estimates of the above equation cannot be used for inferences because the test statistic is a generated dependent variable, which follows an non-standard distribution.

METHODOLOGY CONT

- For this reason Bootstrapping Technique is used.
- Bootstrapping requires only that the residual errors be independently and identically distributed, regardless of the distribution.
- Bootstrapping coefficient estimates and standard errors can thus be used to provide consistent inferences.

METHODOLOGY CONT

Estimating Exchange Rate Volatility

- Exchange rate volatility is a measure that intends to capture the uncertainty faced by traders due to unpredictable fluctuations in exchange rates.
- Various researchers have used different methods to estimate volatility in exchange rate.
- Economic literature is not unanimous as to which measure is most appropriate.
- Recent literature seems to be increasingly adopting the use of GARCH models.
- Variant GARCH models are employed to measure the exchange rate volatility (GARCH, EGARCH and TARCH).
- TARCH and EGARCH are used to take into account the effect of bad news and good news on volatility (Asymmetric Models)

DATA

- Data sets used in this study consist of daily closing futures prices for four agric commodities traded at SAFEX and two traded at CBOT.
- Both data sets are obtained from SAFEX.
- RSA data ranges from 1998 (for white and yellow maize, and wheat) and 2000 for sunflower to 2007.
- The USA data ranges from 1998 to 2003 for corn and 2007 for wheat.
- Sunflower is not traded at CBOT while white maize is not significantly traded.
- Daily ZAR/US$ exchange rate data for the period 1998 – 2007 is obtained directly from SARB.

EMPIRICAL RESULTS

Price asymmetry tests in South African futures markets

Commodity	F-statistic	R^2
White maize		
1998	0.760	0.003
1999	0.374	0.006
2000	3.217	0.016
2001	6.838*	0.117
2002	0.538	0.017
2003	0.025	0.025
2004	7.329*	0.184
2005	13.632*	0.224
2006	0.561	0.027
2007	4.116*	0.081
Yellow maize		
1998	18.528*	0.093
1999	2.182	0.053
2000	2.486	0.108
2001	2.955	0.038
2002	16.686*	0.158
2003	0.4140	0.002
2004	0.120	0.049
2005	11.353*	0.057
2006	4.488*	0.034
2007	7.897*	0.073
Wheat		
1998	1.248	0.005
1999	3.899	0.013
2000	54.707*	0.487
2001	9.599*	0.048
2002	0.858	0.072
2003	8.451*	0.081
2004	3.343	0.025
2005	3.349	0.046
2006	4.646*	0.067
2007	8.455	0.006
Sunflower		
2000	0.466	0.014
2001	0.397	0.017
2002	3.186	0.042
2003	3.530	0.056
2004	3.188	0.128
2005	18.753*	0.226
2006	6.614*	0.027
2007	10.859*	0.057

Price asymmetry tests in USA (CBOT) futures markets

Commodity	F-statistic	R^2
Corn		
1998	0.477	0.002
1999	33.813*	0.143
2000	0.749	0.001
2001	7.647*	0.144
2002	2.418	0.237
2003	0.540	0.003
Wheat		
1998	-16.326	0.001
1999	4.382*	0.129
2000	3.673*	0.286
2001	10.00*	0.312
2002	2.194	0.078
2003	10.976*	0.087
2004	18.102*	0.286
2005	14.677*	0.208
2006	0.014	0.019
2007	15.861*	0.089

ARCH (1) effect test for the ZAR/US$ exchange rate ARIMA

F-Statistic	TxR-squared
314.706 (0.000)	280.306 (0.000)

Parameter Estimates of Various Conditional Volatility Measures

Model	ω	α	β	γ
GARCH(1,1)	0.0000004	0.195799 (0.010950)	0.843336 (0.006757)	-
TARCH (1,1)	0.0000004	0.171413 (0.012262)	0.843387 (0.006727)	0.046318 (0.016453)
EGARCH (1,1)	-0.429684	0.327426 (0.012171)	0.978993 (0.003318)	-0.019374 (0.007384)

Bootstrapped coefficient estimates for F test statistics

Model	Constant (φ_0)	Slope (φ_1)
RSA Agricultural Futures		
TARCH (30-day period)	6.860 (0.798)	-3735.550* (2222.332)
USA Agricultural Futures		
TARCH (30-day period)	6.725 (1.261)	188.923 (4792.486)

CONCLUSIONS

- The results revealed that the ZAR/US$ exchange rate volatility turn to rise in response to bad news, and fall in response to good news.
- The results also revealed that the stability of ZAR/US$ exchange rate would improve or enhance the performance of futures market for agricultural commodities in South Africa.
- Policy implication: Market regulators wishing to improve the functioning and stability of futures markets for agricultural commodities should advocate for the exchange rate stability as one of the possible policy instruments.

LIMITATIONS & SUGGESTIONS FOR FUTURE RESEARCH

- It will be useful for the future studies to adopt more advanced analytical techniques to take into account structural changes in terms of exchange rate volatility.
- It will also be useful to determine the relationship amongst trading patterns, exchange rate volatility and the performance of futures markets.
- There is a need for research endeavours to investigate the impact of ZAR/US$ exchange rate volatility over varying data frequencies such weekly and monthly with a full set of data from both sides.
- The results obtained serve as a foundation for future empirical research and contribution to a body of knowledge in this area.

THANKS