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RELATIONSHIP BETWEEN OIL PRICES, EXCHANGE RATES AND MAIZE PRICES IN KENYA

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Relationship between oil prices, Exchange rates and maize prices in Kenya

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Abstract

***Purpose*:** The purpose of this study was to determine the Relationship between oil prices, Exchange rates and maize prices in Kenya

***Methodology*:** The study adopted exploratory and descriptive design. Exploratory research was used to understand the relationships among the variables of this research. Descriptive research was used to understand the current situation. The population used for the 3 variables are; Abu Dhabi National Oil Corporation (ADNOC) crude oil prices for oil prices, Central Bank of Kenya for KES/USD exchange rates and Food Agricultural Organization (FAO) Nairobi (due to missing data for Eldoret) wholesale maize prices per metric ton for maize prices.

***Results*:** The study findings revealed that these three markets namely the crude oil market, the foreign exchange market and the commodity market have separate risk management dynamics and should be administered individually. Central Bank of Kenya prudential guidelines (2008) on risk management that came into effect this year, mandate financial institutions to use derivatives to manage risk by using different kinds of instruments like foreign exchange derivatives interest rate derivatives, commodity based derivatives etc. though implementation has not started. However, current risk management strategies in the financial market allow for hedging against adverse movement in foreign exchange market. This would drastically reduce the costs of imports especially petroleum products and its derivatives that go into production.

***Policy recommendation*:** The study recommended creation of a commodity exchange that would add value to commercial participants such as farmers and millers with benefits accruing to consumers. This could prove difficult in the beginning especially in policy guidelines and implementation but would prove worthwhile in the end. Some of the steps taken towards a fully-fledged commodity exchange is the introduction of the Warehouse Receipt System (WRS). This allows farmers to concentrate on farming as they store their produce for future selling and also as security for loans in commercial banks.Procurement policies should be reviewed especially in regards to the oil sector. Although the government through the Kenya Gazette, 2012 has granted a 30% import quota of refined petroleum

products to oil marketer National Oil Corporation of Kenya and 100% import quota of crude oil to Kenya Petroleum Refinery Limited (KPRL) hence giving them volumes needed to hedge in the international market, steps should be taken to widen the scope of players to involve the private sector to participate.

Keywords: *Relationship, oil price, Exchange rates and maize prices in Kenya*

1.1 Introduction

Exchange rates play an important role in international, regional and domestic trade through imports and exports of goods and services in Kenya. Some of the major sources of foreign exchange include tourism, agricultural exports such as coffee, tea, horticultural produce such as flowers, international remittances from the diaspora and regional exports of industrial and consumer goods thus exchange rates have a major effect on the prices of goods and services Oil on the other hand is a major commodity used as an input into the industrial and production sector and has an effect on the prices of finished products. Agricultural commodities such as maize are affected directly by oil prices through its inputs such as fertilizer and diesel to power machinery. A hypothesized relationship between oil prices, exchange rates and commodity prices show the linkages between these markets in Kenya.

This research intends to establish a relationship between oil prices, exchange rates and maize prices and determine the changes in the strength of these linkages between these three markets by using overlapping time periods to measure cointegration relationship through time. Relationships will then be used to inform what risk management strategies can be applied.

1.2 Statement of the Problem

Recent developments in the Kenyan financial system have necessitated the use of risk management tools to dampen the effects of volatility on the economy. Some of the developments include the drafting by the Central Bank of Kenya (CBK) of 'prudential guidelines' that lay out risk management guidelines for trading of derivatives and most importantly commodity based derivatives by banks taking effect on August 1 2012 (Central Bank prudential guidelines, 2008)

The former Minister of Finance and deputy Prime Minister in a speech posited that the government was in advanced stages in the establishment of a futures market focusing on currency, mineral and energy derivatives to hedge against volatility (Kagwe, 2012).

Preliminary analysis of data between January 2008 and July 2012 shows the existence of some form of co-movement hypothesizing the existence of relationships and interrelationships between oil prices, exchange rates and wholesale maize prices.

Understanding the relationships and interrelationships will inform the need to introduce risk management strategies such as derivatives that can help in risk mitigation.

1.3 Research Objectives

i. To model the relationship between oil prices, exchange rates and commodity prices.
ii. To determine the strength of the linkages between these three markets.
iii. To inform the need for risk management strategies by understanding oil price, exchange rates and maize prices dynamics.

2.0 LITERATURE REVIEW

2.1 Theoretical review

2.2.1. Hotelling's Oil Price Theory

Harold Hotelling (1931) postulated that deposits of oil should be viewed as an asset just like any income generating investment. He noted that since oil competes with other assets, there is a systematic way of forecasting the price of oil. Generally, the theory posits that owners of oil, a finite source of energy, motivated by profit will only produce oil at a rate above the prevailing interest rate. Taking into account the short-term fluctuations of the oil price due to volatility, Hotelling argued that long-term prices of oil increase year after year at the prevailing in rate of interest. He argues that the if the oil price taking into account the costs of production and storage did not rise above the prevailing interest rate, there would be no restrictions to supply. If the oil price did not keep up with or was underperforming than the prevailing interest rates then producers would supply as much of the product and invest the cash in higher producing assets that earn higher rates of return above the prevailing interest rates such as bonds. However, if prices increased more than the prevailing interest rates, this would motivate than not to produce oil taking into account that there are no massive inventories of oil in the world hence supporting the assumption that producing only when oil prices were above prevailing interest rates.

Criticisms of Hotelling's oil price theory are based on 2 fronts i.e. historical oil prices since the mid-1800s have remained stable, apart from the oil crisis of the 70s, 80s and mid 2000s and the use of financial instruments such as oil futures where future prices of oil have sometimes been sometimes lower than spot prices, a situation called backwardation hence contradicting Hotelling's theory (Ridley, 2011).

2.2.2 Hubbert's Peak Oil Theory

M. King Hubbert in Nuclear Energy and the Fossil Fuels (1956) postulated that petroleum production follow a bell shaped curve with the peak representing maximum production output followed by a steady decline until depletion. He posits that fossil fuels which include crude oil, coal reserves and natural gas once discovered, production increases exponentially as the finite resource is being recovered and maintained as new technology is applied thereafter reaching a peak followed by declines in production during the subsequent years.

Hubbert's peak oil was proved in the United States in the 1970s when production peaked at 10.2 billion barrels per day (bbpd) and has since been on the decline.

2.2.3 Purchasing Power Parity

Purchasing Power Parity has its roots in the Law of One Price. The Law of One Price states that identical goods in two different countries sell for the same price under certain conditions at the same price. These conditions include; no barriers to trade, no tariffs or quotas, no arbitrage etc. Prices of these goods must be converted into one currency. An example is when

we convert British Pounds to US dollars, the price of a shirt in the UK should be similar to one bought in the United States. According to Hakkio (1992), the Law of One Price does not hold in certain conditions. An example is when a shirt is cheaper in the United States than in the United Kingdom, a USA exporter could make a profit by buying the USA sweater and selling it in United Kingdom hence exploiting the opportunity. However, this would eventually lead to equilibrium of prices, as sweater prices in both countries converge at a point. Hakkio (1992) postulated that instead of looking at a particular good, a basket of goods should be considered hence the concept of Absolute Purchasing Power Parity, Absolute PPP goes a step higher than the Law of One price to the general price level. Absolute PPP is where a basket of goods and services should cost the same in all countries after converting the prices into a common currency (Hakkio, 1992).

The shortcoming of Absolute PPP is that price levels in different countries compute price levels using imperfect price indices or subjectively hence a simple ratio of price level may not be adequate to measure equilibrium exchange rates (Hakkio, 1992). A better measure would be the use of the Relative PPP which asserts that exchange rates depend on the differences of inflation rates. An example is if the UK inflation exceeds the US inflation by 5 percentage points, the purchasing power of the dollar rises 5% relative to the pound.

3.0 METHODOLOGY

The study adopted descriptive research design. A survey was done to establish the factors among owners of SMES in Kenya. There are about 850 such establishments in Kenya of which a sample of 85 firms was taken using stratified random sampling. Data was collected by use of questionnaire method which had both structured and unstructured questions. It was analyzed mainly by use of descriptive statistics such as the mean and inferential statistics such as regression.

4.0 RESULTS FINDINGS

4. 1 Descriptive Result

Results in table 1 indicate that the mean Maize price over the period of study was usd 336 per metric ton, the mean Oil Prices was usd 90.97 and the mean Exchange Rates usd/KSH was 79.34. The Jacque Bera test of normality indicates that the distribution of the three variables, maize prices, oil prices and exchange rate followed a normal distribution. The probabilities for Jacque Bera results were higher than the cut off (critical) probability of 0.05. This implies that there is a very high probability that the distribution of data is normal. Testing for normality is important since data that is not normally distributed violates the assumptions of linear regression and hence any regression performed on such data is inappropriate and would yield misleading results. However, this is not the case with this study, the data is normal and obeys assumptions of linear regression.

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Table 1: Descriptive Results

	MAIZEPRICES	OILPRICES	EXCHANGERATE
Mean	336.6	90.97	79.34
Median	352.0	92.25	79.63
Maximum	513.0	137.3	101.3
Minimum	174.0	42.10	61.90
Std. Dev.	79.57	24.74	7.965
Skewness	-0.221	-0.178	0.037
Kurtosis	2.311	2.099	3.621
Jarque-Bera	1.533	2.150	0.896
Probability	0.465	0.341	0.639
Observations	55	55	55

A group graph of the three variables is presented in figure 1. Results from eyeballing the trends indicate that there seems to be a relationship among the three trends. This perhaps is an indicator of co- integration, that is, convergence to long run equilibrium.

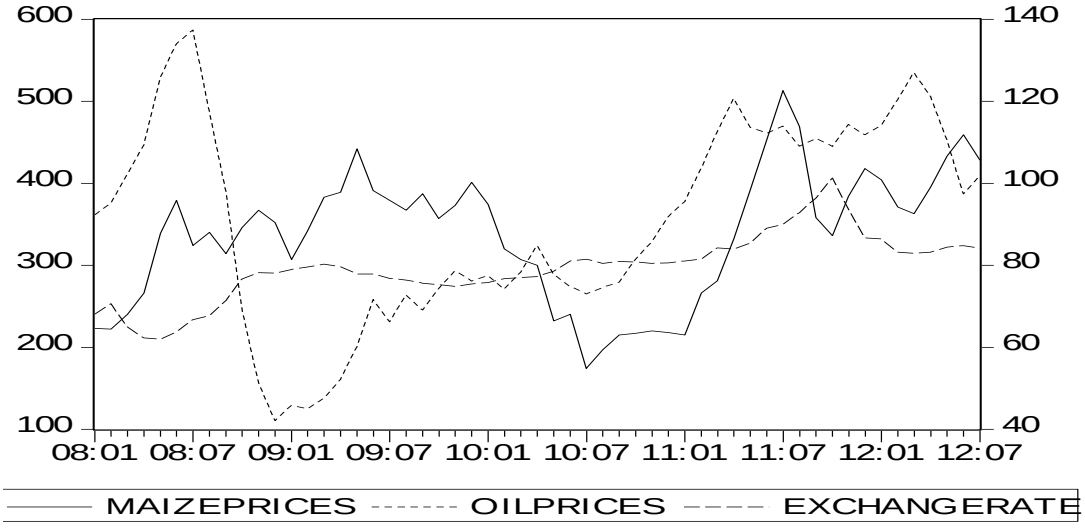

Figure 1: Grouped Trends

Figure 2 presents the graphical trend of oil prices. The graph reveals that oil prices have gradually increased over the time period. However, the trend has not been consistent as indicated by the low R squared of 14.4%.

Figure 2: Graphical trend of oil prices

Figure 3 presents the graphical trend of exchange rate (USD/KSH). The graph reveals that exchange rate have gradually increased over the time period. The trend has been consistent as indicated by the high R squared of 67%.

Figure 3: Graphical trend of exchange rate (USD/KSH)

Figure 4 presents the graphical trend of Maize prices. The graph reveals that exchange maize prices have gradually increased over the time period. However, the trend has not been consistent as indicated by the low R squared of 0.084

4.2 Unit root tests

Prior to testing for a causal relationship and cointegration between the time series, the first step is to check the stationarity of the variables used in the model. The aim is to verify whether the series have a stationary trend, and, if non-stationary, to establish orders of integration. The study used both Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests to test for stationarity.

The null hypothesis of a unit root (ho; The data is non stationary) is rejected against the one-sided alternative if the t-statistic is less than (lies to the left of) the critical value. In this example, the test fails to reject the null hypothesis of a unit root in the IP series at any of the reported significance levels. This is because 0.2697, -0.1698 lies to the right (is larger) than critical values. Therefore, results in table 2 indicated that all variables are non stationary (i.e. presence of unit roots) at 1%, 5% and 10% levels of significance. This calls for first differencing of the non stationary variables.

Table 2: Unit root tests-Level

Variable name	ADF test	PP test	1% Level	5% Level	10% Level	Comment
MAIZE PRICES	0.2697	0.2697	-2.6055	-1.9467	-1.6190	Non Stationary
OILPRICES	-0.1698	-0.1698	-2.6055	-1.9467	-1.6190	Non Stationary
EXCHANGE RATE	0.7579	0.7579	-2.6055	-1.9467	-1.6190	Non Stationary

Source: Eviews computation

Table.3 displays the unit root tests after first differencing. It is clear from the results in table 3 that all the variables become stationary (unit root disappears) on first differencing.

Table 3: Unit root tests-First Differencing

Variable name	ADF test	PP test	1% Level	5% Level	10% Level	Comment
MAIZE PRICES	-5.7027	-5.7027	-2.6064	-1.9468	-1.6190	Stationary (1)
OILPRICES	-3.7629	-3.7629	-2.6064	-1.9468	-1.6190	Stationary (1)
EXCHANGE RATE	-5.0888	-5.0888	-2.6064	-1.9468	-1.6190	Stationary (1)

Source: Eviews computation

4.3 Cointergration tests

After ascertaining the stationarity properties of the series, The Johansen Cointegration test analysis was done using an appropriate lag length of 4. Johansen Results in table 4 indicate that that the null hypothesis of no Co integration equations for the model linking maize prices to oil prices and exchange rates was rejected at 5% (1%) significance level. This finding was because the likelihood ratio statistic for the null hypothesis of the existence of at most no Cointegrating equations was larger than the z critical vales at 5% and a 1% level. This implies that at least one co integrating equation exists. This further implies that all the variables in the model converge to an equilibrium in the long run (i.e are cointergrated).

Table 4 :Johansen Cointegration test analysis

Date: 10/06/12 Time: 16:45

Sample: 2008:01 2012:07

Included observations: 50

Test assumption: Linear deterministic trend in the data

Series: MAIZEPRICES OILPRICES EXCHANGERATE

Lags interval: 1 to 4

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.372808	35.87637	29.68	35.65	None **
0.189459	12.55121	15.41	20.04	At most 1
0.040143	2.048546	3.76	6.65	At most 2

*(**) denotes rejection of the hypothesis at 5%(1%) significance level

L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Table 5. indicates the Cointergating equation. Oil prices have a negative unexpected sign (-6.6920). This implies that there is a negative relationship between oil prices and maize prices in the 4th lag. The standard errors of Oil Prices are large (3.844)). This indicates high uncertainty in estimating the coefficient of Oil prices.

Exchange rates have the expected sign (24.519). This implies that there is a positive relationship between oil prices and maize prices in the 4th lag. The standard errors of exchange rates are large (12.44). This indicates high uncertainty in estimating the coefficient of exchange rates.

Table 5: Cointergating equation

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

MAIZEPRICES	OILPRICES	EXCHANGERATE	C
1.000000	6.692072	-24.51948	1023.021
	(3.84499)	(12.4000)	
Log likelihood	-495.1448		

Maize prices = -1023.021 - 6.692 Oil prices + 24.519 Exchange Rate

4.4 Analytical model

Table 6: OLS LONGRUN RESULTS

Dependent Variable: MAIZEPRICES
Method: Least Squares
Date: 10/06/12 Time: 16:41
Sample: 2008:01 2012:07
Included observations: 55

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	58.34676	108.0850	0.539823	0.5916
OILPRICES	0.400616	0.420997	0.951589	0.3457
EXCHANGERATE	3.047854	1.307850	2.330431	0.0237

R-squared	0.114894	Mean dependent var	336.6182
Adjusted R-squared	0.080852	S.D. dependent var	79.57002
S.E. of regression	76.28554	Akaike info criterion	11.55985
Sum squared resid	302613.1	Schwarz criterion	11.66934
Log likelihood	-314.8957	F-statistic	3.375029
Durbin-Watson stat	0.293858	Prob(F-statistic)	0.041867

The R Squared shows that oil prices and exchange rates influenced 11.4% of the variance of maize prices. Adjusted R Squared reveals that the relationship is positive (Adjusted R Squared = 0.0808). It reveals that a change in oil prices and exchange rates lead to an increase in maize prices. This means that when oil prices by a dollar and exchange rates depreciate by a shilling, maize prices will rise up by 8.08%.

4.5 Granger Causality

Granger causality results were conducted at different lag lengths. Specifically, the lag lengths were 2 lags (eviews default), 3 lags, 4 lags, 5 lags and 6 lags. The null hypothesis of " no granger causality" between exchange rates and maize prices, maize prices and exchange rates were not rejected. Therefore exchange rate does not granger cause maize prices and maize prices do not grange cause exchange rates.

The null hypothesis of " no granger causality" between oil prices and maize prices, maize prices and oil prices were not rejected. Therefore, oil prices do not granger cause maize prices and maize prices do not grange cause oil prices.

The null hypothesis of " no granger causality" between oil prices and exchange rates., exchange rates and oil prices were not rejected. Therefore, oil prices do not granger cause exchange rates and exchange rates do not grange cause oil prices.

At default lags (2 lags)

Table 7: Granger causality

Pairwise Granger Causality Tests

Date: 10/06/12 Time: 17:34

Sample: 2008:01 2012:07

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
EXCHANGERATE does not Granger Cause MAIZEPRICES	53	0.23669	0.79015
MAIZEPRICES does not Granger Cause EXCHANGERATE		1.09195	0.34375
OILPRICES does not Granger Cause MAIZEPRICES	53	0.63724	0.53316
MAIZEPRICES does not Granger Cause OILPRICES		1.06579	0.35247
OILPRICES does not Granger Cause EXCHANGERATE	53	1.36536	0.26502
EXCHANGERATE does not Granger Cause OILPRICES		1.41221	0.25354

Granger causality results were conducted at a lag length of 3 periods. The null hypothesis of " no granger causality" between oil prices and maize prices, maize prices and oil prices were not rejected. Therefore, oil prices do not granger cause maize prices and maize prices do not grange cause oil prices.

The null hypothesis of "no granger causality" between exchange rates and maize prices, maize prices and exchange rates were not rejected. Therefore exchange rate does not granger cause maize prices and maize prices do not grange cause exchange rates.

The null hypothesis of "no granger causality" between exchange rates and oil prices were rejected at 10% level of significance. Therefore, exchange rates granger oil prices.

However, the null hypothesis of "no granger causality" between oil prices and exchange rates were not rejected. Hence, oil prices do not granger cause exchange rates

At Lags 3

Pairwise Granger Causality Tests

Date: 10/06/12 Time: 17:41

Sample: 2008:01 2012:07

Lags: 3

Null Hypothesis:	Obs	F-Statistic	Probability
OILPRICES does not Granger Cause MAIZEPRICES	52	0.53771	0.65887
MAIZEPRICES does not Granger Cause OILPRICES		0.58591	0.62738
EXCHANGERATE does not Granger Cause MAIZEPRICES	52	0.16707	0.91803
MAIZEPRICES does not Granger Cause EXCHANGERATE		0.89906	0.44911
EXCHANGERATE does not Granger Cause OILPRICES	52	2.32959	0.08705
OILPRICES does not Granger Cause EXCHANGERATE		1.05832	0.37623

At 4 lags

Pairwise Granger Causality Tests

Date: 10/06/12 Time: 17:43

Sample: 2008:01 2012:07

Lags: 4

Null Hypothesis:	Obs	F-Statistic	Probability
OILPRICES does not Granger Cause MAIZEPRICES	51	0.48911	0.74365
MAIZEPRICES does not Granger Cause OILPRICES		0.60835	0.65885
EXCHANGERATE does not Granger Cause MAIZEPRICES	51	0.19060	0.94199
MAIZEPRICES does not Granger Cause EXCHANGERATE		2.09680	0.09824
EXCHANGERATE does not Granger Cause OILPRICES	51	1.95074	0.11977
OILPRICES does not Granger Cause EXCHANGERATE		0.86478	0.49298

At 5 Lags

Pairwise Granger Causality Tests

Date: 10/06/12 Time: 17:44

Sample: 2008:01 2012:07

Lags: 5

Null Hypothesis:	Obs	F-Statistic	Probability
OILPRICES does not Granger Cause MAIZEPRICES	50	0.30875	0.90471
MAIZEPRICES does not Granger Cause OILPRICES		0.44340	0.81538
EXCHANGERATE does not Granger Cause MAIZEPRICES	50	0.41604	0.83470
MAIZEPRICES does not Granger Cause EXCHANGERATE		1.97686	0.10370

EXCHANGERATE does not Granger Cause OILPRICES	50	2.47501	0.04856
OILPRICES does not Granger Cause EXCHANGERATE		0.83091	0.53565

At 6 lags

Pairwise Granger Causality Tests

Date: 10/06/12 Time: 17:36

Sample: 2008:01 2012:07

Lags: 6

Null Hypothesis:	Obs	F-Statistic	Probability
EXCHANGERATE does not Granger Cause MAIZEPRICES	49	0.48931	0.81194
MAIZEPRICES does not Granger Cause EXCHANGERATE		1.92484	0.10330
OILPRICES does not Granger Cause MAIZEPRICES	49	0.34197	0.90990
MAIZEPRICES does not Granger Cause OILPRICES		0.99379	0.44426
OILPRICES does not Granger Cause EXCHANGERATE	49	0.65453	0.68628
EXCHANGERATE does not Granger Cause OILPRICES		3.21773	0.01237

Granger causality tests show no presence of causality and therefore exogeneity.

4.6 Correlations Analysis

Bi variate correlations between maize prices, oil prices and exchange rates are given in table 4. X. The results indicate that only exchange rates and maize prices were significantly correlated. The correlation between exchange rates and maize prices was positive (0.354) and significant at 0.05 (5%) level.

Table 8: Granger causality

	maizep~s	OILPRI~S	EXCHAG~E
Maizeprices	1		
OILPRICES	0.1498	1	
EXCHAGERATE	0.3154*	0.0828	1

Correlation is significant at 0.05 (2 tailed).

4.7 Discussions

Results indicate through the Jacque Bera test that the time series data representing the three variables are normally distributed. The presence of unit root was found in oil prices, exchange rates and maize prices at levels and first differences. Cointegration relations exist between oil prices, exchange rates and maize prices indicating that there exists a long run relationship among the variables and hence converge at a particular part by eliminating the white noise (error term). The presence of a long run relationship also indicates that there is also a short run relation that corrects any disequilibrium back to the long run relationship. However, results highlighting the short run model indicate the presence of an unexpected sign in the oil price coefficient and also the constant showing the fact that no theory exists to explain these phenomena. No Granger Causality exists among pairs indicating that no on variable or variables can forecast the other leading also the conclusion that no one variable is exogenous. Correlation coefficient analyses indicate that the exchange rate and maize prices correlation coefficient is statistically significant at 5% level indicating that the correlation coefficient did not happen by chance.

Results imply that oil prices, exchange rates and maize prices are normally distributed hence do not violate the linear regression assumptions. The variables also follow a stochastic trend hence violate the Ordinary Least Squares (OLS) assumption of constant mean, constant variance and homoscedasticity hence require another empirical model to explain this phenomena. Cointegration relations indicate the presence of a long run and short run relationship among variables where the strength of the linkages and relationships can be estimated. The nature of our short run model implies that there is a departure from the norm that should be explained by either observing the environment under which we operate to explain this phenomenon. The presence of no granger causality indicates that no one variable is exogenous or can forecast the values of the other variables. Correlation analysis indicates that the correlation coefficient between exchange rates and maize prices did not occur by chance.

Presence of unit root in all three variables correlates with findings from Yu et al (2006), Campiche et al (2007) and Harri, Nalley and Hudson (2009). Cointegration relations were also found by Harri, Nalley and Hudson (2009) for hypothesized period of between 2004 and 2008 and Campiche (2007) between the second hypothesized periods of 2006-2007. However, the short run model values differ with the empirical results. Zhang and Reed (2008) were unable to compute relationships because of lack of the availability of data. Granger Causality results diverge greatly from empirical results of the researchers. Harri, Nalley and Hudson (2009), Campiche et al (2007) and Yu et al (2006) results indicate that crude oil prices are exogenous and can be used to forecast the prices of other commodities while crude oil prices cannot be determined by price movements of the other variables whereas the research found none. Zhang and Reed (2008) however disagree that oil prices did affect the prices of grains and pork and the prices increases were as a result of demand and supply issues apart from 2006 where high prices were as a result of high crude prices. Other researchers such as Urbanchuk (2007), Reed et al (1997) and Hanson et al (1993) agree that an increase in oil prices does lead to an increase in Consumer Price Index (CPI), consumer food prices and the agricultural sector respectively in the United States. Campiche (2007) found the following pairs as being statistically significant between 2003 and 2006; corn and crude oil, soybean oil prices and crude oil prices.

*5.0*SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of Findings

Normality of data, presence of a unit root in the variables, presence of cointegration relations, no Granger Causality among variables and statistically significant correlation coefficient at 5% for exchange rates and maize prices were found in the research.

5.3 Conclusions

Risk management strategies being developed in the financial sector are feasible in our research. These three markets namely the crude oil market, the foreign exchange market and the commodity market have separate risk management dynamics and should be administered individually. Central Bank of Kenya prudential guidelines (2008) on risk management that came into effect this year, mandate financial institutions to use derivatives to manage risk by using different kinds of instruments like foreign exchange derivatives interest rate derivatives, commodity based derivatives etc. though implementation has not started. However, current risk management strategies in the financial market allow for hedging against adverse movement in foreign exchange market. This would drastically reduce the costs of imports especially petroleum products and its derivatives that go into production. This is supported by the short run model that shows the cost of maize prices when the shilling depreciated

Structural changes in policy should enhance the use of risk management strategies. The procurement of crude oil in Kenya is the single biggest impediment to risk management strategies. The almost spot buying of crude oil impedes the oil tender winner from hedging against risk in the future. A spike in international crude guarantees a spike in gasoline prices and eventual transmission to consumer prices. Procurement rules should allow the tender winner to take a position depending on the different economic conditions prevailing in the world over a set period of time so as to allow a hedge position to mature. This was seen especially during the 'Arab Spring' where crude prices tanked to over $140 per barrel causing the economy to bear the full force of the adverse volatility. The oil price formula is not a stop gap measure in ensuring affordable gasoline prices, although it alleviates the volatility marginally.

In the commodity market (maize), the government remains the biggest impediment to fair pricing hence the failure of the model to capture the interrelationships among these three markets. The Ministry of Agriculture during the harvest season sets the price of maize at which it would buy. Even when production costs are high especially crude prices, the government sets a low price for the product hence hurting farmers. This phenomena is seen in our model where there is a negative relationship between maize prices and oil prices contrary to theory. This eventually leads to hoarding of the commodity which results in high consumer prices.

5.4 Recommendations

The following recommendations should be made to enable and ensure that adverse price movements are mitigated. The creation of a commodity exchange that would add value to commercial participants such as farmers and millers with benefits accruing to consumers. This could prove difficult in the beginning especially in policy guidelines and implementation but would prove worthwhile in the end. Some of the steps taken towards a fully-fledged commodity exchange is the introduction of the Warehouse Receipt System (WRS). This

allows farmers to concentrate on farming as they store their produce for future selling and also as security for loans in commercial banks.

Procurement policies should be reviewed especially in regards to the oil sector. Although the government through the Kenya Gazette, 2012 has granted a 30% import quota of refined petroleum products to oil marketer National Oil Corporation of Kenya and 100% import quota of crude oil to Kenya Petroleum Refinery Limited (KPRL) hence giving them volumes needed to hedge in the international market, steps should be taken to widen the scope of players to involve the private sector to participate.

5.5 Areas of Further Study

Some of the areas of study would be the effects of government involvement in markets and its disadvantages in determining prices.

REFERENCES

Arrow, K.J. & Debreu, G. (1954). Existence of equilibrium for a competitive economy. *Econometrica,22*.Retrievedfrom http://www.stanford.edu/class/msande311/arrow-debreu.pdf

Brooks, C. (2008). *Introductory econometrics for finance* (2nd ed.). Cambridge, UK: Cambridge University Press.

Campiche, J L., Bryant, H.L., Richardson, J.W. & Outlaw, J.L. (Eds.). (2007). Proceedings from AAEA '07*: Examining the evolving correspondence between petroleum prices and agricultural commodity prices*. Portland, OR: TAMUS.

Cassel,G.(1914).Money and foreign exchange. Available from http://203.200.22.249:8080/jspui/bitstream/123456789/826/1/Money_and_foreign_exchange_after_1914.pdf

Central Bank of Kenya. (2008). Prudential guidelines for institutions licensed under the banking act. Nairobi, Kenya: Government Printing Office.

Creswell, J.W. (2009). Research design: *Qualitative, quantitative and mixed methods approaches*. London, UK: SAGE.

Cuthberton, K., Hall, S.G. & Taylor, M.P. (1990). *Applied econometric technique.* Michigan, USA: University of Michigan Press.

Dickey,F.A. & Fuller, W.A. (1981). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association, 79(366)*. Retrieved from http://www.deu.edu.tr/userweb/onder.hanedar/dosyalar/1979.pdf

Engle ,R. F. & Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation and testing. *Econometrica, 45(2)*. Retrieved from http://www.jstor.org/discover/10.2307/1913236?uid=3738640&uid=2&uid=4&sid=21100983161763

Fun, J. (2011). Top three exchange theory. *Go Articles*. Retrieved from http://goarticles.com/article/Top-Three-Exchange-Theory/3969997/

Giddy, I.H. (1976). An integrated theory of exchange rate equilibrium. Journal of Financial and Quantitative Analysis, 11(5). Retrieved from www.jstor.org/stable/2330587

Goschen, G.J. (1879*). The theory of the foreign exchanges*. London, UK: Effingham Wilson & Co.

Granger, C.W.J. (1988). Developments in the study of cointegrated economic variables. *Oxford bulletin of Economics and Statistics, 48(3)*. Retrieved from http://homepage.ntu.edu.tw/~kslin/macro2009/Granger%201986.pdf

Gujarati, D. (2003). *Basic econometrics* (4th ed.). New York, NY: McGraw Hill Company.

Hakkio, C.S. (1992). Is purchasing power parity a useful guide to the dollar. Economic Review, 3. Retireved from http://www.frbkc.org/PUBLICAT/EconRev/EconRevArchive/1992/3Q92hakk.pdf

Hanson, K., Robinson, S. &Schluter, G. (1993). Sectoral effect of a world oil price shock: Economy wide linkages to the agricultural sector. *Journal of Agricultural and Resource Economics, 18(1)*. Retrieved from http://ageconsearch.umn.edu/bitstream/30818/1/18010096.pdf

Harri, A., Nalley,L. & Hudson, D. (2009). The relationship between oil, exchange rates and commodity prices. *Journal of Agricultural and Applied Economics, 41(2)*. Retrieved from http://ageconsearch.umn.edu/bitstream/53095/2/jaaeip13.pdf

Hashemi-j, A. (2009). The international fisher effect: Theory and application. Investment Management and Financial Innovations, 6(1). Retrieved from http://businessperspectives.org/journals_free/imfi/2009/imfi_en_2009_01_Hatemi-J.pdf

Irungu, G. (2011. November 11). Why central bank had uphill task in stabilizing the shilling. *The Business Daily*, pp 12, 13.

Harold, H. (1931). The economics of exhaustible resources. *Journal of Political Economy,39*. Retrieved from http://msl1.mit.edu/classes/esd123/2003/bottles/Hotelling.pdf

Hubbert, M. K. (1956).Nuclear energy and fossil fuels. Available from http://energycrisis.biz/hubbert/1956/1956.pdf.

Johansen, S. (1992). Testing structural hypotheses in a multivariate cointegration analysis of the PPP and the UIP for UK. Journal of Finance, 40, 1375-1384.

Kagwe, W. (2012, February 2). Futures exchange to open this year, *The Star*. Retrieved from http://www.the-star.co.ke/business/local/60777-futures-exchange-to-open-this-year

Kamau, M., Olwande, J. &Githuku, J. (Eds.). (2010) Proceedings from TI '10: *Consumption and expenditure on key food commodities in urban households: he case of Nairobi.* Nairobi, Kenya: Tegemeo Institute.

Kenya Gazette Supplement. (2011). The price control (essential goods) act (Kenya Gazette supplement No. 121 Acts No 26). Nairobi: Kenya. Government Printing Office.

Kenya Gazette Supplement (2012). Energy importation of petroleum products quota allocation amendment (Kenya Gazette Supplement Legal Notice No 25). Nairobi: Kenya. Government Printing Office.

Kenya National Bureau of Statistics. (2006). Kenya integrated household budget survey. Retrieved from http://www.knbs.or.ke/pdf/Basic%20Report%20%28Revised%20Edition%29.pdf

Kenya National Bureau of Statistics. (2012). Leading economic indicators. Retrieved from: http://www.knbs.or.ke/news/lei062012.pdf.

Keynes, J.M. (1924). A tract of monetary reform. Available from http://203.200.22.249:8080/jspui/bitstream/123456789/2209/1/A_tract_on_monetary_reform.pdf

Kirimi, L., Sitko, N., Jayne, T.S., Karin, F., Muyanga, M., Shehan. M…..Bor, G. (2011). A farm gate to consumer value chain analysis of Kenya's maize marketing system. *Tegemeo Institute, 44*. Retrieved from http://www.tegemeo.org/documents/work/WP44-A-Farm-Gate-to-Consumer-Value-Chain-Analysis-of-Kenya-Maize-Marketing-System.pdf

Mishkin, F.S. (2006). *Economies of monry, banking and financial markets* (8th ed.). Boston, MA: Addison-Wesley.

Okulo, L. (2011, September 28). Central bank to introduce forex controls. *The Star*. Retrieved from

http://www.the-star.co.ke/national/national/42068-central-bank-to-introduce-forex-controls

Onumah, G. (2010). Promoting agricultural commodity exchanges in ghana and Nigeria: A review report. Retrieved from

http://www.unctad.info/upload/SUC/EcowasGhanaCerealMarkets/Presentations/COMEX_Report_Onumah_en.PDF

Ridley, D. .(2011). Hotelling's law. Available from

http://faculty.fuqua.duke.edu/~dbr1/research/Hotellings-Law.pdf

World Bank (2012). Kenya economic update. Retrieved from:

http://siteresources.worldbank.org/INTAFRICA/Resources/257994-1335471959878/kenya-economic-update-june-2012.pdf

Yu, T.H.E., Bessler, D.A. & Fuller, S. (2006). Proceedings from AAEA '06: *Cointegration and causality analysis of world vegetable oil and crude oil prices*. Long Beach, CA: AAEA.

Zhang, Q. & Reed, M. (Eds.). (2008). Proceedings from SAEA '08: *Examining the impact of the world crude oil price on China's agricultural commodity prices: The case of corn, soybean and pork.* Dallas. TX: EDIRC