

# **ZIMBABWE STOCK EXCHANGE (“ZSE”)’S EXPOSURE TO GLOBAL CRUDE OIL PRICE VOLATILITY;**

## **ABSTRACT**

The major aim of this paper is to investigate Zimbabwe’s Stock Exchange indices’ exposure to global oil price volatility for the period 2009-2012. To determine the relationship between volatility of crude oil returns and volatility of stock returns of the ZSE indices using econometric GARCH models. Also to investigate the correlation of the global oil price in the form of Brent Crude oil prices index and Western Texas Intermediate (WTI) oil prices index and ZSE Industrial Index and the ZSE Mining index between 2009 and 2012. A GARCH approach is employed to analyse data from ZSE and Chicago Mercantile Exchange, OPEC and Datastream® Data. Daily data for crude oil prices and Zimbabwe stock exchange indices was collected for the period 2009-2012 and subjected to analysis using the GARCH method to evaluate the correlation between ZSE market indices and global oil price volatility. The variables of the Zimbabwe stock exchange are ZSE Industrial Index; and ZSE Mining index. Variables on Crude oil prices comprised of Western Texas Intermediate (“WTI”) spot prices index; and Brent Crude oil spot prices index. Returns of stock on all the four indices were calculated. The returns of stock would mirror stock price movements. Volatility of returns on ZSE industrial index was very low with standard deviations ranging between -.01 to +.01. Volatility of returns on the ZSE Mining index was significant relative to the industrial index with standard between -0.1 to -0.1. Volatility of stock returns on Brent Crude spot price index was very high with standard deviations ranging between -0.6 to +0.6, while stock returns on Western Texas Intermediate (“WTI”) spot prices index displayed high volatility, standard deviations ranged from -0.1 to +0.1. GARCH coefficients indicated that the mean of stock returns as represented by  $\mu$  were generally negative for the two domestic stock indices while the global oil price indices stock returns were positive. Parameters  $\alpha_i$  and  $\beta_j$  of the four indices were statistically significant. The  $\beta_j \alpha$  of all the four indices were highly significant ranging between 0.6300 to 0.9300 indicating that volatility was persistent in the period under investigation and that volatility was to a large extent driven by the prices and values of the previous time period (past performance). There was a positive correlation between industrial index and Brent crude with a correlation coefficient of 0.505 as well as a positive correlation between the ZSE Industrial index and the WTI oil price index with a coefficient of 0.520. There was a negative correlation coefficient of -0.332 between the Mining index and the global Brent crude oil prices as well as a negative correlation coefficient of -0.201 between Mining index and WTI Crude. The results of the study confirmed the hypothesis that the ZSE stock markets are indeed exposed to significant exogenous risks emanating from rising global crude oil price movements. There are however, moderating factors as the volatilities on ZSE stock returns are much lower compared to volatilities of stock returns on the global oil indices. Also the correlation coefficients are on the low side. Increases in crude oil prices have the potential to subdue any favourable factors to share price increases.

**KEY WORDS:** Volatility, global oil index, GARCH model, Correlation, Stock returns,

## 1. INTRODUCTION

This investigation seeks to ascertain the impact of global crude oil price volatility on the stock markets in Zimbabwe during the period 2009-2012. This is a period in which internal macroeconomic variables and political variables had a moderate influence on the Zimbabwe Stock Exchange. Limited research has been conducted in this area particularly in Zimbabwe. Brent Crude Oil Price Index; and Western Texas Intermediate (WTI) Crude Oil Price Index would represent global oil price indices. The Zimbabwe stock market indices namely, the industrial index and mining index were taken to reflect movements on the stock exchange.

The research is expected to provide insights into the relationship between crude oil spot prices volatility and the performance of the ZSE stock markets indices. The relationship shall be utilized to forecast the impact that future global oil spot prices changes will have on the stock market indices, trade volume and the overall ZSE stock market performance.

Oil price movements are a factor affecting stock valuations in that, in theory, the value of stock equals the discounted sum of expected future cash flows (Fisher 1930; Williams 1938). These cash flows are affected by macroeconomic events that can be directly influenced by oil prices. Since stock prices and indices reflect the stock market's best estimate of the future profitability of firms, oil price movements should have an impact on the stock market as they affect profitability of the firm through cost of production and distribution. The decline in profitability reduces dividend pay-outs to equity holders thus making equity investments less attractive to investors. However, this impact is not uniform for all stocks on the stock exchange. Some companies are more exposed to oil price movements than others. Therefore to clearly see the impact of oil price movements on companies it is important to consider the effect of oil price volatility on separate stock market indices hence the idea to use both the ZSE Industrial Index and Mining Index.

The impact of oil price volatility on the stock market should be felt more on oil importing countries such as Zimbabwe. During the period under review the Zimbabwean economy experienced a high rate of economic growth with a consequential increase in oil and fuel consumption. (Dr G. Gono- Reserve Bank of Zimbabwe, January 2012). Since 2009 the country's average daily fuel consumption increased steadily. The demand in fuel is expected to continue increasing because of the following factors;

- ❖ Liberalisation of trade which has seen a huge increase in the importation of relatively cheaper and affordable second hand vehicles particularly from Japan.
- ❖ The shift in company policies whereby most employees within managerial grades are accorded company vehicles as part of their employment packages.

- 85 ❖ Growth in urban population due to rural urban migration which has put pressure on urban
- 86 transport.
- 87 ❖ The land reform programme has increased small scale farmers attempting to mechanize and
- 88 indigenisation of the mining sector has seen small scale miners come on board who largely
- 89 depend on diesel powered equipment.
- 90 ❖ The growth of the urban elite class whereby some families have multiple vehicles which are
- 91 utilized at the same time; and
- 92 ❖ The persistent electricity shortages have led to the increase in demand for diesel and petrol
- 93 power generators.

94

95 Zimbabwe imports 100% of its oil requirements hence fluctuations in oil prices would be significant

96 factor as an indicator of the country's exogenous risk.

97 During the period understudy the global economy was going through a period of weak growth,

98 financial turbulences caused by excessive external debt levels particularly in Europe. At the

99 aggregate level the knock-on effects of economic problems in developed markets have been minimal

100 on the growth of emerging countries such as Zimbabwe. Economic growth in Zimbabwe was largely

101 underpinned by increased domestic demand and government expenditure.

102 However, there are other external variable which could have had a significant impact on the stock

103 exchange. These variables could be, external interest rates, volumes of trade by external investors,

104 exchange rate, and commodity prices etc . While not down playing impact of these other variables,

105 the research will focus more on oil price volatility as a measure of exogenous risk exposures.

106

## 107 2. LITERATURE REVIEW

### 108 2.1 Theoretical framework

109

110 Huang *et al* (1996) showed that crude oil price volatility affects positively the expected costs and

111 negatively the stock prices indices. However, according to the theories put forward by previous

112 researchers, there seems to be no consensus among researchers when it comes to the relationship

113 between stock spot prices and changes in global oil spot price .

114

115 Some evidence from previous research suggests positive correlation between oil prices and stock

116 market indices. This phenomenon is particularly evident in net-oil exporting economies. Expected oil

117 prices increases reflect positive growth in demand which attracts investors to oil exporting countries in

118 an effort to earn positive returns based on the increase in oil prices and demand. This drives up stock

119 prices and thus stock indices in oil exporting countries stock markets. In other words, increases in oil

120 prices have a positive impact on the stock markets of oil exporting countries ( Setser 2004, Layade A.

121 A. and Okoruwa V. O.(2012) For net oil importing countries the reverse should be the case. Based on

122 the idea that stock prices are the discounted values of future cash flows, (Huang *et al* 1996, p.5)

123 suggested that net oil importing economy's response to crude oil price volatility can be explained via

three channels that emanate from the hypothesis that the expected discount rate is composed of the expected inflation and the expected real interest rate. These two variables are jointly influenced by the expected oil prices. The expected oil prices affect stock market indices through the discount rate. Indeed, because oil is the major resource in a net oil importing economy, increases in oil prices affect negatively the balance of payments, which in turn affects the foreign exchange rate and increases the expected domestic inflation rate. Increase in oil prices would as a consequence be negatively related to stock market indices.

## 2.2 Empirical Literature Review

There are a significant number of empirical literatures available on the relationship between the global oil price volatility and stock markets. Jones and Kaul (1996) discovered a negative reaction of US, Canadian, UK and Japanese stock prices to oil price increases by investigating the impact of oil price changes on real cash flows of listed companies. This was supported by Chang et al. (2009), Maghyereh (2004) and George Filis et al in their respective studies. Their results suggested that an increase in global oil prices increased operating costs of listed companies (particularly those involved in production) which subsequently reduced the companies' real cash flows restricting the companies' ability to pay dividends hence making listed companies less attractive to investors. The result was a fall in stock prices and hence a subsequent decline in stock market indices.

Onouri (2007) argued that, in the short run Gulf Co-operation Council (GCC) stock market returns are dominated by the influence of non-observable psychological factors. In the long run, the effects of oil price changes are transmitted to fundamental macroeconomic indicators which in turn, affect the long run equilibrium linkages across markets. Aroui and Fouquau (2009) found a significant positive relation between oil prices volatility and the stock index of Qatar, Oman and UAE. The finding was supported by Layade A. A. and Okoruwa V. O(2012) in a study in Nigeria. Stock indices from oil exporting countries namely S&P/TSX 60 (Canada), MXICP35 (Mexico) and Bovespa Index (Brazil) surprisingly exhibited negative correlation with price increases particularly at the height of oil price increases in 1991 (George Filis, et al).

Finally, using a two-regime Markov-switching GARCH model, Aloui and Jammazi (2009) examined the relationship between crude oil shocks and stock markets indices from December 1987 to January 2007. This study focused on two major crude oil markets, namely WTI and Brent, and three developed stock markets, namely France, UK and Japan. The results show that the net oil price increase variables play a significant role in determining the volatility of stock indices. It can be concluded that global oil prices exert a causative influence on GDP, inflation, industrial production and interest rates the domestic variables that affect stock market indices performances, Mukherjee *et al.*, 1997, Lee *et al.*, (2000), Balke and Wohar (2001),

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## 164 **2.3 Zimbabwe stock market indices 2009-2012**

165

166 The Industrial index tracks daily price changes in stocks of 74 listed companies drawn from various  
167 sectors of the economy ranging from Agro-Industry, Conglomerates, Financial services, Insurance,  
168 Property and Retail, while the Mining index tracks stock price movements of 4 listed companies  
169 involved in the mining industry. The indices performed well upon inception in 2009 with the Mining  
170 index reaching an annual high of 300.00 points while the Industrial Index rose to 150.00 points during  
171 the same year.

172

## 173 **3 METHODOLOGY**

### 174 **3.1 Research design.**

175 This investigation seeks to evaluate the contemporaneous and lagged time varying correlation  
176 between stock market indices and oil prices for a net oil importing country Zimbabwe. A GARCH  
177 approach is employed to analyse data from ZSE and Chicago Mercantile Exchange, OPEC and  
178 Datastream® Data.

179 Daily data for oil prices and Zimbabwe stock exchange indices was collected for the period 2009-  
180 2012. And was subjected to analysis using the GARCH method to evaluate the correlation between  
181 ZSE market indices and global oil price volatility. The variables of the Zimbabwe stock exchange are  
182 ZSE Industrial Index; and ZSE Mining index. Variables on Crude oil prices comprised of Western  
183 Texas Intermediate ("WTI") spot prices index; and Brent Crude oil spot prices index. Returns of stock  
184 on all the four indices were calculated. The returns of stock would mirror stock price movements.

185 The Brent crude oil price index is used in this investigation as it accounts for up to 60%\* of the trade  
186 in world oil daily production and Western Texas Intermediate accounts for up to 20% of global oil  
187 trades. Oil prices from both oil price indices are expressed in dollar terms and have been extracted  
188 from Datastream® Database. Further information and statistics included in this document was  
189 sourced from Journals, and research papers about oil prices and stock markets.

190 Microsoft Excel 2007, Mathlab 7.60 (R2000a), RStudio and SPSS 13.0 were used in the analysis of  
191 the research data. The Dickey-Fuller test was conducted to test for stationarity. The GARCH (p, q)  
192 model is used in the volatility analysis.

193

194 \*Source; Chicago Mercantile Exchange

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### 196 **3.2 The GARCH (p, q) model.**

197 The GARCH (p, q) model expresses the variance at time  $t$ ,  $\sigma_t^2$

198 Where,  $q$  stands for lags of the squared error and  $p$  stands for lags of the conditional variance.

199 :

200

$$\sigma_t^2 = \omega + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^p \beta_j \delta_{t-j}^2$$

201

202  $\omega, \alpha_i$  and  $\beta_j$  are the parameters to be estimated.

203 The GARCH estimation model consists of two equations,  $\sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2$  for the mean which is a simple

204 autoregressive AR (1) model and the other  $\sum_{j=1}^p \beta_j \delta_{t-j}^2$  for the Variance which is identified by a

205 particular ARCH specification, i.e. GARCH (1, 1). Where  $\omega > 0$ ,  $\alpha_i > 0$ ,  $\beta_j > 0$ , and  $\beta_1 + \alpha_1 < 1$ , so that

206 the next period forecast of variance  $\sigma_t^2$  is a blend of last period forecast and last period's squared

207 return.

208 Where  $\omega$  is the constant representing the intercept.

209  $\mu$  is the mean estimate of the time series data.

210  $\alpha$  is the coefficient of previous day forecast.

211  $\beta$  is the coefficient of previous day squared error.

### 212 3.3 Correlations.

213 **For measuring the correlation between stock markets and oil price volatility the following**

214 **formula was used.** The correlation coefficient  $r_{X,Y}$  between the ZSE Industrial Index( $X$ ) and Brent

215 crude oil prices ( $Y$ ) with expected values  $\mu_X$  and  $\mu_Y$  and standard deviations  $\sigma_X$  and  $\sigma_Y$  is their

216 covariance normalized by their standard deviations, as follows;

217 Since  $\mu_X = E(X)$ ,  $\sigma_X^2 = E(X^2) - E^2(X)$ , and likewise for  $Y$ ,

218 Then correlation coefficient ( $r_{X,Y}$ ) is given by;

219

220

$$\frac{E(XY) - E(X)E(Y)}{\sqrt{E(X^2) - E^2(X)}\sqrt{E(Y^2) - E^2(Y)}} = r_{X,Y}$$

221

222 Therefore the inputs for the coefficient correlation are;

223  $E(X)$  is the expected value of the global crude oil prices namely;

224

225 ○ Brent Crude Oil Prices 2009-2012

226 ○ Western Texas Intermediate oil prices 2009-2012

227 **E(Y)** is the expected value of the ZSE stock market indices namely;

228       ○ ZSE Industrial Index daily closing values 2009-2012

229       ○ ZSE Mining Index daily closing values 2009-2012

230 **E(XY)** is the expected value of product of the of ZSE stock index closing value and the corresponding  
231 Brent/WTI oil price;

232 **E(X<sup>2</sup>)** is the expected value of the square of the Brent/WTI crude oil price

233 **E (Y<sup>2</sup>)** is the expected value of the square of ZSE stock market indices either Industrial/ Mining index

234 Correlation coefficients will be used to measure the strength of the correlation between the following  
235 results:

236       ❖ Correlation between the ZSE Industrial Index and Brent crude oil prices;

237       ❖ Correlation between the ZSE Industrial Index and WTI crude oil prices;

238       ❖ Correlation between the ZSE Mining Index and Brent crude oil prices; and

239       ❖ Correlation between the ZSE Mining Index and WTI crude oil prices.

## 240 **3.4 Calculating Net Returns.**

241

242 The following formula is used to calculate returns.

243 Let ***P<sub>t</sub>*** be the price of an asset at time *t*. Assuming no dividends, the **net return *R<sub>t</sub>*** over the holding  
244 period from time ***t-1*** to time *t* is given by;

245

$$\text{Net return} = R_t = \frac{P_t}{P_{t-1}} - 1 = \frac{P_t - P_{t-1}}{P_{t-1}}$$

246 The numerator ***P<sub>t</sub> - P<sub>t-1</sub>*** is the revenue or profit during the holding period, with a negative profit  
247 meaning a loss. The denominator ***P<sub>t-1</sub>*** was the initial investment at the start of the holding period.

248 Therefore, the net return can be viewed as the relative revenue or profit rate.

249

## 250 **4.0 RESULTS AND DISCUSSION**

### 251 **4.1 Data specification**

252

Data on the ZSE Industrial and Mining Indices as well as the Brent crude oil price index and WTI crude oil price index was prepared for analysis by creating the respective time series data in the form of a csv files that were imported for analysis in RStudio.

Returns of the Industrial index, Mining Index, Crude oil price index and WTI price index were calculated and the respective time series were generated.

## 4.2 Augmented Dickey Fuller Stationarity Test (ADF test, 1981)

According to the Dickey fuller test, the null hypothesis is that X is non-stationary when the parameter  $\lambda = 0$ . The results in Table(1) below, the Dickey Fuller parameter  $\lambda$  for the respective times series data of the indices proved to be sufficiently negative, a result which means that the null hypothesis is rejected. The respective time series data of the indices was stationary.

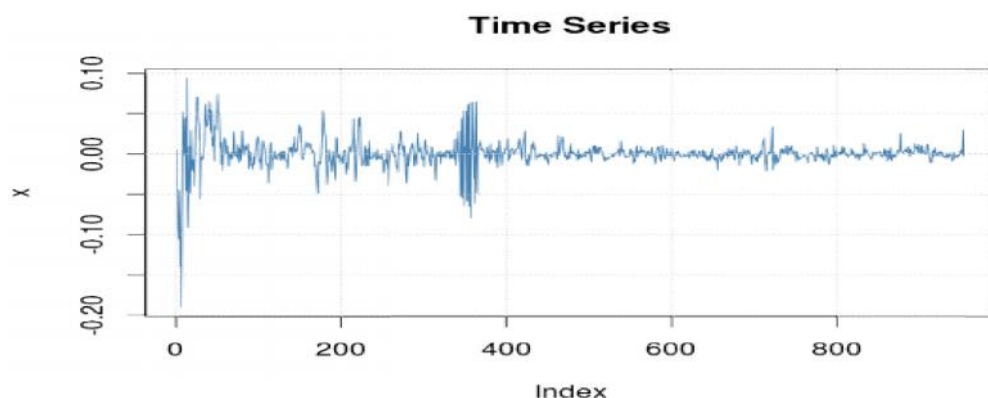
Table 1 Results of Stationarity tests

| Index            | Dickey Fuller | Lag Order | p-Value | Alternative Hypothesis |
|------------------|---------------|-----------|---------|------------------------|
| Industrial Index | -8.773        | 9         | 0.01    | Stationary             |
| Mining Index     | -8.274        | 9         | 0.01    | Stationary             |
| Brent Crude      | -10.250       | 9         | 0.01    | Stationary             |
| WTI              | -10.280       | 9         | 0.01    | Stationary             |

## 4.3 Industrial index volatility of returns under GARCH (1, 1) plot:

Figure 1 is a graphical representation of the results showing the volatility of Industrial Index returns. During the first trading months after dollarization on the ZSE, the returns on the Industrial index exhibited a greater degree of variability. This phenomenon however persisted for over a year as the market battled to correct the stock price distortions emanating from the transition from Zimbabwe dollar to United States dollar. The results of the conditional standard deviation also confirm the existence of wide variations in industrial stock index returns during the initial dollarization phase. The degree of deviation subsided in the subsequent years and eventually became relatively constant. During the initial stages deviations reached a peak of + 0.12 to -0.12 but at the close of 2012 deviations were in the region of below +0.01to -0.01. This result is consistent with the decline in volatility during the same period of time;

Figure 1 Industrial Index time series

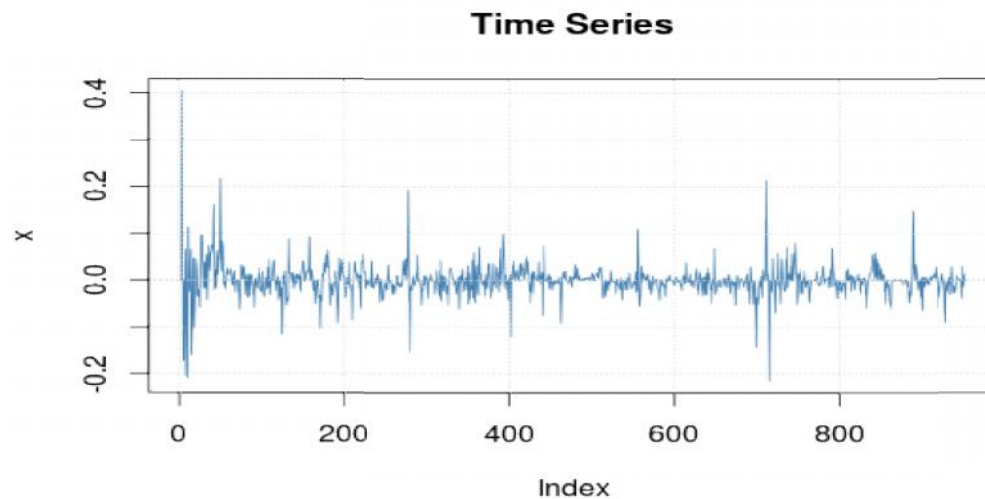


Where  $x$  = the return on the ZSE Industrial index  
 Index = the number of days since 1 January 2009

#### 4.4 Mining index volatility of returns under GARCH (1, 1) plot:

The results of the Mining index returns time series showed a more persistent level of variability (Figure 2) below. The plot above shows alternating periods of high volatility and periods of relatively low volatility. The index showed clusters of deviations ranging from -0.2 to +0.2 indicating a high degree of persistent volatility throughout the period under study. The Mining index time series data both proved to be significant and the volatility of the mining index was largely dependent on the GARCH component.

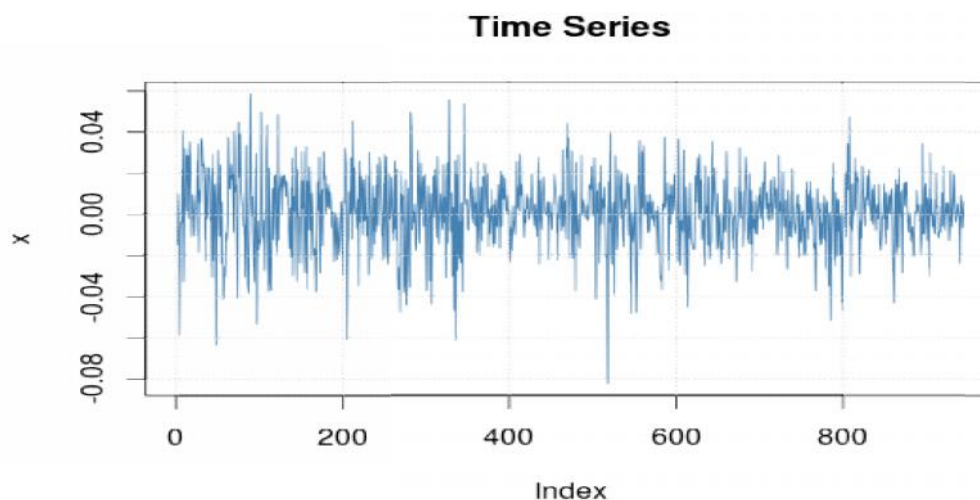
Figure 2 Mining index returns time series plot



#### 4.5 Brent crude oil price index volatility of returns under GARCH (1,1) plot

The Brent crude index showed the highest degree of persistent volatility indicating global oil price uncertainty (Figure 3). The frequency of very high and very low peaks was persistent throughout the period. The range of deviations was between -0.6 and +0.6. There were frequent periods of high volatility intensity. The results confirm that global oil prices reflect the forces of demand and supply of the precious commodity and also capture future expectations of supply and availability.

Figure 3 Brent Crude price index time series plot

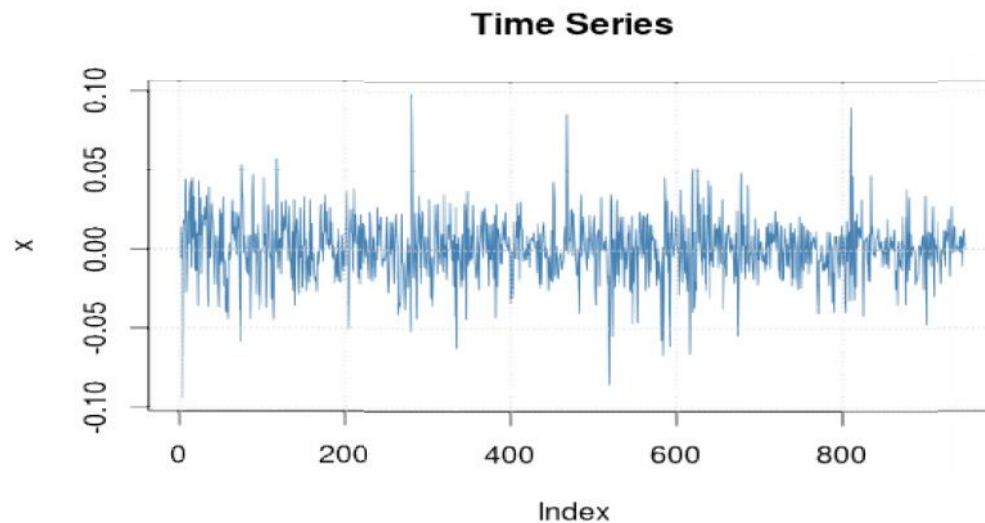


#### 4.6 WTI crude oil price index volatility of returns plot under GARCH (1, 1)

As shown in Figure 4 below the WTI crude oil price index exhibited relatively less volatility compared to the Brent index. The WTI oil price index returns also exhibited significant levels of persistent volatility throughout the period under investigation. The index showed sustained periods of high levels

of standard deviation. The results confirm that global oil prices are highly volatile, as the WTI oil price index returns also exhibited significant levels of persistent volatility.

Figure 4 WTI Crude price index returns time series



#### 4.6 Table 2 Summary of GARCH (1, 1) Coefficients

According to Table 2 below the means of the returns as represented by  $\mu_j$  were generally negative for the two domestic stock indices while the means of global oil price indices returns were positive over the period 2009-2012. This could reflect an underlying negative correlation. It therefore means that the ZSE stock indices were on average bearish (declining) during the same period. Both coefficients  $\alpha_1$  and  $\alpha_2$  were statistically significant. The  $\beta_1$  and  $\beta_2$  of all the four indices were highly significant. This showed persistent volatility clustering. The Brent crude oil price index exhibited the highest degree of volatility of all the indices investigated.

Table 2 Summary of GARCH coefficients

| Index       | $\alpha_1$  | $\alpha_2$  | $\beta_1$ | $\beta_2$ |
|-------------|-------------|-------------|-----------|-----------|
| Industrial  | -0.00036567 | 0.000005887 | 0.305670  | 0.68201   |
| Mining      | -0.00150250 | 0.000042307 | 0.079480  | 0.87865   |
| Brent Crude | 0.00083763  | 0.000006520 | 0.053106  | 0.92677   |
| WTI         | 0.00075793  | 0.000094626 | 0.143120  | 0.62473   |

#### 4.7 Results of correlations

## 4.7.1 Industrial index and Brent crude oil, WTI crude correlation.

As shown in Table (3) below, the industrial index and Brent crude results show a positive correlation of 0.505 between the two indices. Industrials index counters maintained profitability during the period 2009-2012 despite sustained increases in oil prices. The correlation of the ZSE Industrial index and the WTI oil price index was also positive with a correlation coefficient of 0.520 which is rather strong. This implies that the ZSE Industrial Index generally increased during the period under review in tandem (same direction) with increases in Brent global oil prices and WTI oil prices. The positive correlation can be attributed to the general increase in the country's productivity and oil consumption which was largely seen by investors as a positive sign of future growth prospects in Zimbabwe. That coupled with the general macroeconomic stability made ZSE Industrials stock counters attractive investments. That drove stock prices upwards hence resulting in a bullish (increasing) Industrial Index.

## 4.7.2 Mining index and Brent crude, WTI crude correlation.

There was negative correlation of -0.332 between the Mining index and the global Brent crude oil prices. An overall increase in global Brent crude oil prices negatively affected the ZSE Mining index. The results also show a negative correlation of -0.201 between Mining index and WTI Crude. The correlation is rather weak. The results support the hypothesis that stock market indices (in this case ZSE Mining index) are negatively correlated to global crude oil price volatilities. This can be attributed to the fact that mining is largely an oil intensive sector thus oil price increases tend to increase production costs which subsequently negatively affects the bottom line (profitability) of ZSE mining counters thus making them less attractive to investors resulting in falling stock price and thus resulting in a bearish (declining) ZSE Mining Index.

Table 3 Summary of Stock Market Indices and Global crude Oil Prices Correlation

|            |                 | Industrial | Mining   | Brent    | WTI      |
|------------|-----------------|------------|----------|----------|----------|
| Industrial | Pearson         | 1.000      | 0.4230** | 0.505**  | 0.520**  |
|            | Correlation     |            |          |          |          |
|            | Sig. (2-tailed) | 0.000      | 0.000    | 0.000    | 0.000    |
|            | N               | 927.0      | 927.0    | 927.0    | 927.0    |
| Mining     | Pearson         | 0.423**    | 1.000    | -0.332** | -0.201** |
|            | Correlation     |            |          |          |          |
|            | Sig. (2-tailed) | 0.000      | 0.000    | 0.000    | 0.000    |
|            | N               | 927.0      | 927.0    | 927.0    | 927.0    |

|              |                 |         |          |         |         |
|--------------|-----------------|---------|----------|---------|---------|
| <b>Brent</b> | Pearson         | 0.505** | -0.332** | 1.000   | 0.928** |
|              | Correlation     |         |          |         |         |
|              | Sig. (2-tailed) | 0.000   | 0.000    | 0.000   | 0.000   |
|              | N               | 927.0   | 927.0    | 927.0   | 927.0   |
| <b>WTI</b>   | Pearson         | 0.520** | -0.201** | 0.928** | 1.000   |
|              | Correlation     |         |          |         |         |
|              | Sig. (2-tailed) | 0.000   | 0.000    | 0.000   | 0.000   |
|              | N               | 927.0   | 927.0    | 927.0   | 927.0   |

\*\* . Correlation is significant at the 0.01 level (2-tailed).

N= the number of data points

. Figure 5 below gives a graphical representation of the correlation based on the trend of the respective indices. During 2009-2012 the mining index can be seen to be largely declining while during the same period both the Brent Crude and WTI crude oil price indices were largely on a positive growth trend. The ZSE mining index graph can be seen to intersect both the WTI and Brent crude graphs. This is classical illustration of a negative correlation.

The negative correlation of the Mining index and the two oil price indices was more pronounced in the later stages of 2012 thus explaining the low value of the correlation coefficient. In the same regard the industrial index can be seen to move in tandem with both the Brent Crude and WTI crude oil price indices. This shows positive correlation and for the entire duration of the investigation period the 3 graphs moved to a large extend in the same direction thus explaining the high correlation coefficient between the variables.

## 5 CONCLUSIONS

The low volatility of the stock returns on Zimbabwe Stock Exchange indices compared to the relatively high volatility of stock returns on the global oil indices indicates the presents during this period of cushioning factors that tend to reduce the impact of adverse crude oil price movements on the ZSE indices. It is also important to note that volatility was less dependent on the current price of the oil or stock markets. Volatility was to a large extend driven by the prices and values of the previous time period (past performance) as represented by  $\beta$ . ZSE stock market indices are influenced by historical oil price movements.

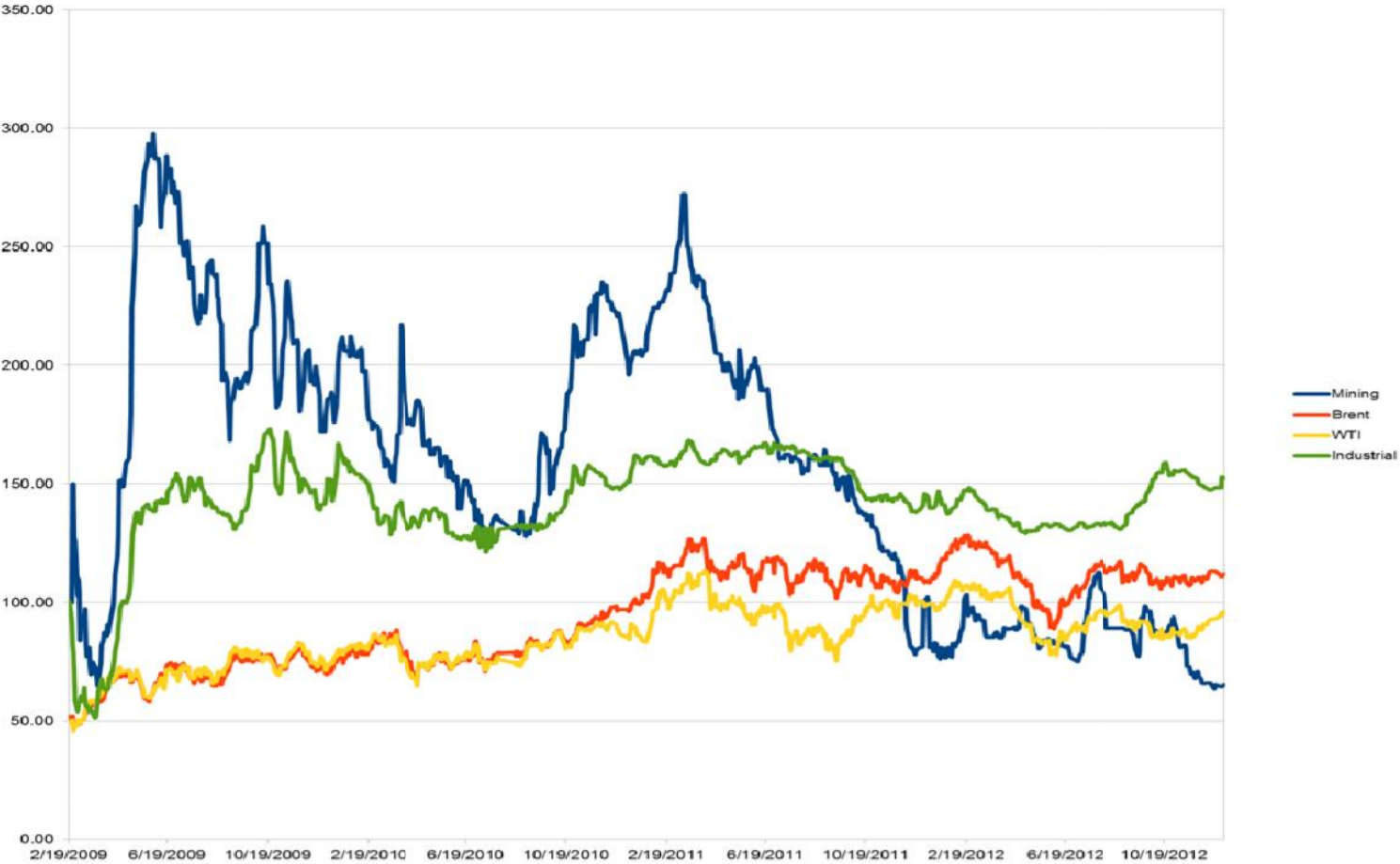
390 There is an underlying negative relationship between the two domestic stock indices and the global oil  
391 price indices as reflected by the negative  $\mu$  (means) of stock returns on ZSE indices and the  
392 positive  $\mu$  (means) of global oil indices.

393 With respect to correlation investigations the ZSE Mining Index was found to be negatively correlated  
394 to global oil prices indices. Increases in global oil prices would induce a fall in the ZSE Mining Index.  
395 This would be through increased production costs of mining companies. On the other hand the results  
396 of this study revealed evidence of beneficial effects of global oil price movements on the ZSE  
397 Industrial index. The Industrial index is positively correlated to the global crude oil price movements.  
398 The expected negative relationship between share price movement and oil price movements was  
399 outweighed by factors favourable to share price rises. Furthermore, the ZSE Industrials index is  
400 comprised of counters from a wide spectrum of sectors some of which may have limited direct  
401 exposure to crude oil prices.

402

403 The results of the study confirmed the hypothesis that the ZSE stock markets are indeed exposed to  
404 significant exogenous risks emanating from rising global crude oil price movements. There are  
405 however moderating factors. These increases in crude oil prices have the potential to subdue any  
406 favourable factors to share price increases.

Figure 5 ZSE Stock Market Indices and Global Oil Prices Correlation Summary



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