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SHORT-TERM INFLUENCE OF THE OIL PRICE ON STOCK PRICES FROM THE BUCHAREST STOCK EXCHANGE

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Abstract: *In the last decades, several studies revealed the significant impact of oil price variation not only on the real economic activity but also on the financial markets evolutions. Such relations are affected by some particularities of the national economies. In this paper we examine the impact of the oil price on the Romanian capital market evolution from January 2000 to February 2013. In our analysis we employ daily values of the Brent oil price and of BET C, one of the main indexes of Bucharest Stock Exchange. A GARCH model allows us to investigate the effects of the oil price fluctuations on returns and volatility of the stock prices. We split our samples of data in three sub-samples in order to capture the influence of three major processes that affected the Romanian economy: the last stage of transition to a capitalist system, the transformations induced by the adhesion to European Union and the global crisis. Our results revealed significant changes on the relation between oil price and stock prices that occurred during these three periods of time.*

Keywords: *Oil Price, Romanian Capital Market, Volatility, GARCH Model*

1. INTRODUCTION

Since 1970s the impact of oil prices on economic systems became an important issue for governments and for researchers. Quite often, sharp increases of energy prices were followed by economic recessions, sometimes accompanied by raises of inflation. In these circumstances, the stock markets became sensitive to the oil prices fluctuations [10, 11, 14, 17, 19, 20, 21].

The relationship between oil prices and stock prices was highly approached in the specialized literature. Several studies highlighted some particularities of a national economy that could affect the relationship between the two variables. For many developed capital markets it was found a negative connection between oil prices and stock prices [12, 15, 16]. Instead, for the emerging markets the results were rather inconclusive [13]. For some oil exporting countries or oil companies it was found a positive correlation between the two variables [8]. Some studies identified a significant impact of the oil prices fluctuations on the stock prices volatility [9, 18].

In this paper we approach the short term impact of oil price on Romanian capital market from January 2000 to February 2013. During this period of time the Bucharest Stock Exchange (BSE) experienced significant changes caused by finalizing the national economy transition to a capitalist system, by Romania's adhesion to European Union and by the global crisis. In order to investigate the effects of these changes on the relationship between the two variables we use three sub-samples of data: first from 5th of January 2000 to 19th of December 2006, second from January 2007 (when Romania became European Union member) to 15th of

September 2008 (when it was announced the bankruptcy of Lehman Brothers) and third, from 16th of September 2008 to 20th of February 2013. We employ daily values of BET C, one of the main indexes of BSE and of Brent oil price. We use GARCH models to investigate the impact of oil price variation on returns and volatility of BET C.

The remainder of this paper is organized as it follows. The second part describes the methods used in the analysis of the relationship between oil prices and stock prices, the third part presents the results and the fourth part concludes.

2. DATA AND METHODOLOGY

This investigation employs daily closing values of BET-C index, provided by BSE, and of the Europe Brent Spot Price FOB (dollars per barrel), provided by Thomson Reuters, from the period of time January 2000 - February 2013 (Figure 1 and Figure 2). We perform the analysis of the oil prices impact on stock prices for three sub-samples:

- first sub-sample, from 5th of January 2000 to 19th of December 2006;
- second sub-sample, from 3rd of January 2007 to 15th of September 2008;
- third sub-sample, from 16th of September 2008 to 20th of February 2013.

For the two variables we calculate returns in logarithmic forms:

$$r_{i,t} = [\ln(P_{i,t}) - \ln(P_{i,t-1})] * 100 \qquad (1)$$

where $P_{i,t}$ and $P_{i,t-1}$ are the closing values of BET C index or of the Brent Price on the days t and t-1, respectively.

Table 1 reports the descriptive statistics of returns. The results reveal the non normality of returns and significant differences, in terms of means and standard deviations, among the three sub-samples.

We employ the Augmented Dickey – Fuller (ADF) unit root tests (Dickey and Fuller, 1979) to analyze the stationarity of the returns [6]. The graphical representations of the returns time series suggests the use of intercept terms in the ADF regressions for the two variables (Figure 3). We chose the numbers of lags based on Akaike (1973) Information Criteria [2].

For the returns of BET C index we perform ARMA (p, q) models. The values of p and q will be determined by Box-Jenkins methodology. Then we employ Ljung-Box test Q and the Engle (1982) Lagrange Multiplier (LM) test for ARCH effects to investigate the presence of the autocorrelation and the heteroscedasticity on the residuals of ARMA regressions [7].

We investigate the influence of oil prices returns on BET C index returns and volatility by the two equations of GARCH models: the conditional mean equation and the conditional variance equation [4, 7].

The conditional mean equation of the returns of BET C has the form:

$$retBETC_t = \mu_0 + \mu_1 * retBRENT_t + \sum_{k=1}^{n} (\xi_k * r_{t-k}) + \varepsilon_t \qquad (2)$$

where:

- retBETC is the return of BET C index;
- μ_0 is a constant term;
- μ_1 is a coefficient which reflect the influence of returns of oil price changes on BET C returns;
- retBRENT is the return of the oil price;
- ξ_k (k=1,..n) are coefficients associated to lagged returns of BET;
- n is the number of lagged returns, calculated by the Akaike (1969) Final Prediction Error Criterion [1];
- ε_t is the error term.

The conditional variance of BET C returns has the form:

$$\sigma_t^2 = \omega + \nu * retBRENT_t + \sum_{k=1}^{q} \alpha_k * \varepsilon_{t-k}^2 + \sum_{l=1}^{p} (\beta_l * \sigma_{t-l}^2) \qquad (3)$$

where:

- σ_t^2 is the conditional variance of the returns of BET C index;
- ω is a constant term;
- ν is a coefficient which reflect the effects of oil price returns on the volatility of the BET C index;
- α_k (k = 1, 2, …q) are coefficients associated to the squared values of the lagged values of error term from the conditional mean equation;
- q is the number of lagged values of the error term, calculated by the Akaike (1973) Information Criteria [2];
- β_l (j=1, 2, …p) are coefficients associated to the lagged values of the conditional variance;

- p is the number of lagged values of conditional variance, calculated by the Akaike (1973) Information Criteria [2].

We investigate the robustness of the two regressions by employing Lagrange Multiplier (LM) test for ARCH effects on the residuals.

3. EMPIRICAL RESULTS

The Table 2 presents the results of the ADF tests. The null hypothesis of non stationarity is rejected for all three sub-samples. The results of Ljung-Box Q and ARCH LM tests indicate the autocorrelation and the heteroscedasticity of the residuals of ARMA regressions (Table 3).

The Table 4 reports the parameters of the GARCH model equations. The conditional mean equation displays positive significant values of μ_1 for the first and third sub-samples. The conditional variance equation displays a negative value of ν for the second sub-sample. The ARCH LM tests performed on residuals of these regressions suggest, for all three sub-samples, no reminiscence of ARCH effects.

4. CONCLUSIONS

This paper explored the short term impact of oil prices fluctuations on BSE stock prices for three periods. The results of GARCH regressions revealed some differences among the three sub-samples of data.

Between January 2000 and December 2006 we found a positive influence of oil prices over stock returns. We could link these results by the significant impact of the Romanian oil producers stocks and by the growing influence of developed capital markets, some of them positively correlated to the oil prices. For the second sub-sample, the impact of oil prices on stock returns seemed to be receded by the substantial foreign capital inflows stimulated by Romania's adhesion to European Union. Instead, perhaps as a result of the growing integration of BSE with international financial markets the volatility of stock prices became sensitive to the oil prices fluctuations. For the third sub-sample we found again a positive influence of oil prices on stock returns. We could explain this evolution by the growing importance of the Romanian oil producers companies. During this period of time the impact of oil prices on the volatility of stock prices seemed to disappear. We could link this evolution by the much bigger influence of other factors, in the context of the global crisis.

This investigation could be extended by the study of the oil prices influence on the stock prices of the Romanian companies from the energy sector.

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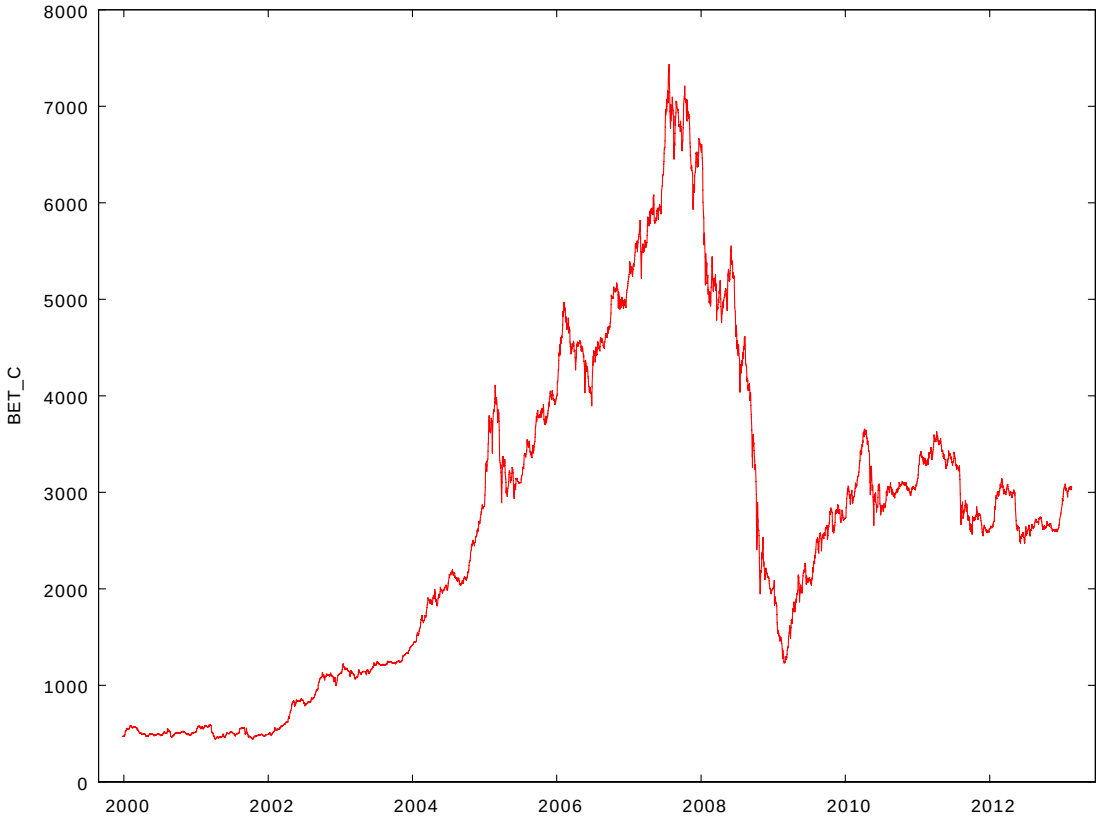

APPENDIX

Figure 1 - Evolution of BET C index from January 2000 to February 2013

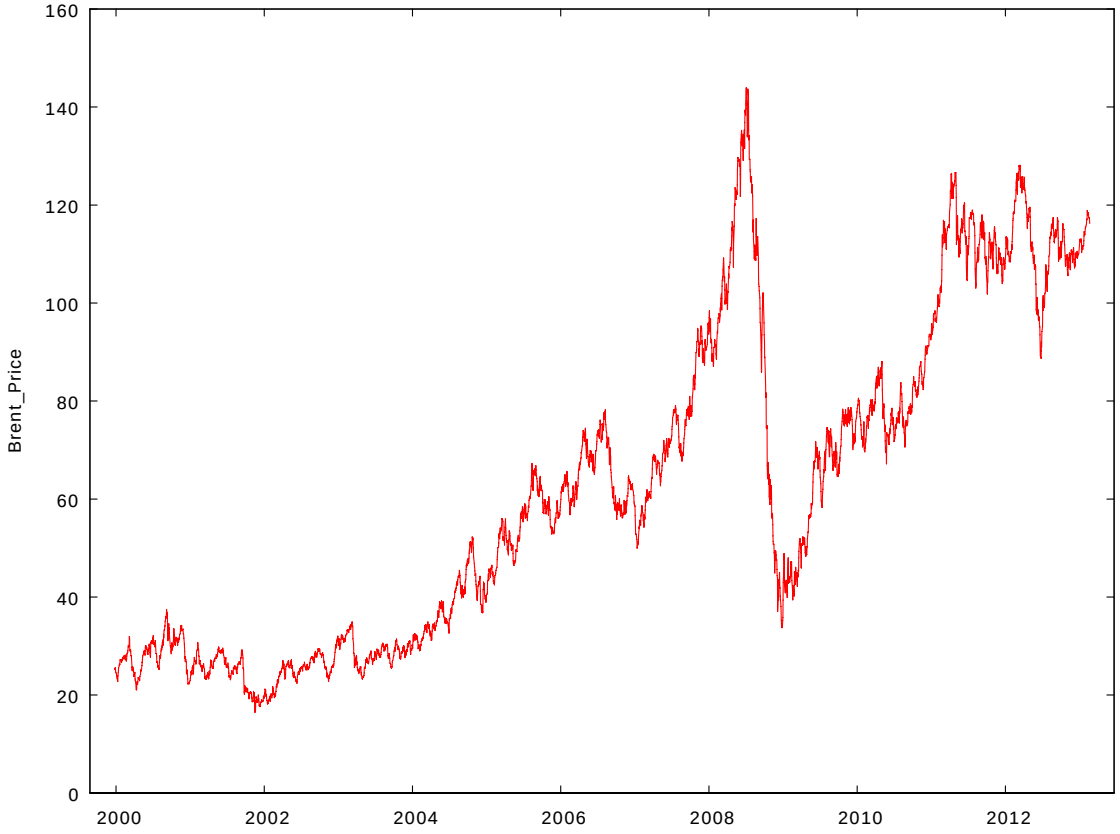

Figure 2 - Evolution of Europe Brent Spot Price from January 2000 to February 2013

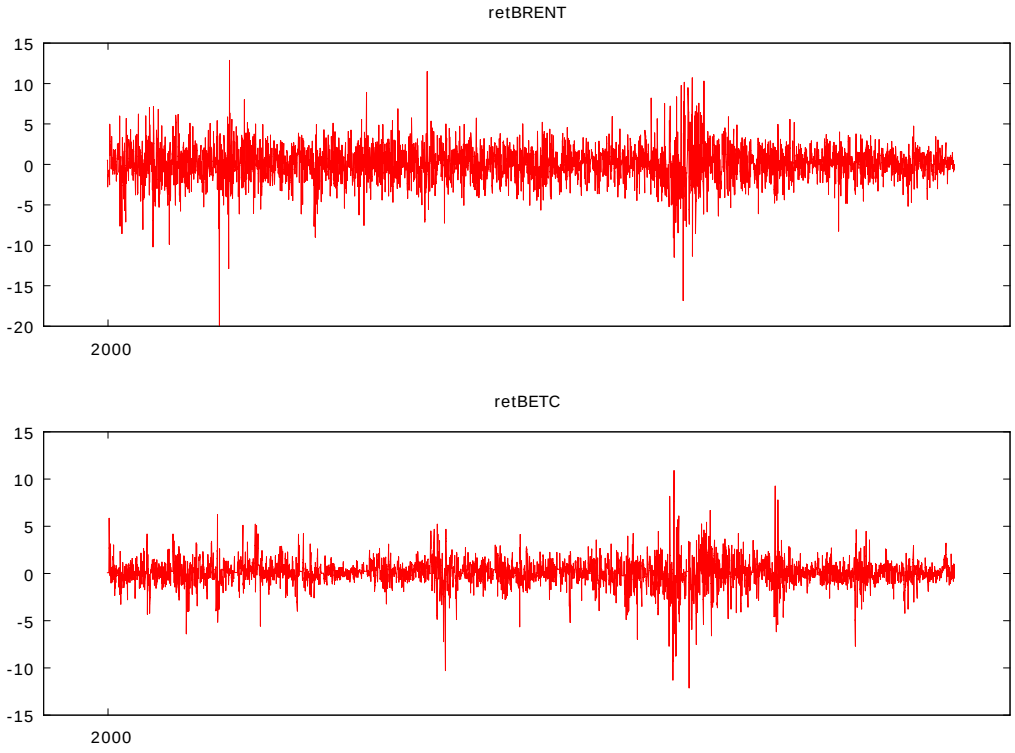

Figure 3 - Returns of Europe Brent Spot Price and of BET C index from January 2000 to February 2013

Table 1 - Descriptive Statistics of the returns

Indicator	First sub-sample	Second sub-sample	Third sub-sample
Returns BET C			
Mean	0.131130	-0.0800471	-0.0151332
Median	0.109813	0.0224794	0.0609585
Minimum	-10.2876	-6.95772	-12.1184
Maximum	6.24570	4.45800	10.8906
Std. Dev.	1.26519	1.50295	1.82303
C.V.	9.64835	18.7758	120.466
Skewness	-0.424856	-0.570615	-0.626211
Ex. kurtosis	5.84709	1.44315	7.84218
Jarque-Bera test	2661.92	62.906	3022.02
p-value of Jarque-Bera test	0.00001	0.00001	0.00001
Returns Brent Price			
Mean	0.0463623	0.0959502	0.0218064
Median	0.119972	0.101468	0.0531513
Minimum	-19.8906	-4.60487	-16.8320
Maximum	12.8534	8.19520	10.6982
Std. Dev.	2.35322	1.86421	2.31054
C.V.	50.7572	19.4289	105.957
Skewness	-0.507452	0.163488	-0.285374
Ex. kurtosis	4.65200	1.11223	5.68477
Jarque-Bera test	1728.68	24.9753	1564.12
p-value of Jarque-Bera test	0.00001	0.00001	0.00001

Table 2 - Results of ADF tests for returns

Period of time	Returns of BET C		Returns of Brent Price	
	Number of lags	Test statistics	Number of lags	Test statistics
First sub-sample	12	-10.5864 (0.0001***)	6	-15.6667 (0.0001***)
Second sub-sample	10	-5.06635 (0.0001***)	8	-18.9389 (0.0001***)
Third sub-sample	16	-6.04909 (0.0001***)	13	-8.49135 (0.0001***)

Notes: p-values are within brackets ***, **, *; mean significant at 0.01, 0.05, and 0.1 levels, respectively

Table 3 - Results of Ljung-Box Q Tests and ARCH LM Tests for BET C returns

Sub-sample	Ljung-Box Q Test	ARCH LM Test
First sub-sample	9.22244 (0.02648**)	180.923 (0.0001***)
Second sub-sample	4.69056 (0.09582*)	41.2296 (0.0001***)
Third sub-sample	10.9702 (0.01189**)	216.685 (0.0001***)

Notes: p-values are within brackets ***, **, *; mean significant at 0.01, 0.05, and 0.1 levels, respectively.

Table 4 - Results of GARCH regressions

Indicator	First sub-sample	Second sub-sample	Third sub-sample
Panel A: GARCH conditional mean equation			
μ_0	0.137540 (0.0245159) [0.0001***]	0.0285288 (0.0686727) [0.6778]	0.0171506 (0.0273580) [0.5307]
μ_1	0.0161311 (0.00820332) [0.0493**]	0.0280570 (0.0311160) [0.3672]	0.149025 (0.0229257) [0.0001***]
Panel B: GARCH conditional variance equation			
ω	0.146012 (0.0528692) [0.0057***]	0.396972 (0.113645) [0.0005***]	0.0313427 (0.0160396) [0.0507*]
ν	0.00252446 (0.0178436) [0.8875]	-0.192886 (0.0658653) [0.0034***]	0.00679185 (0.0151830) [0.6546]
α	0.386667 (0.0837415) [0.0001***]	0.202205 (0.0692290) [0.0035***]	0.147464 (0.0413136) [0.0004***]
β	0.610367 (0.0748684) [0.0001***]	0.641773 (0.0828204) [0.0001***]	0.852283 (0.0372222) [0.0001***]
ARCH LM tests for residuals of GARCH model	4.77856 (0.4435)	6.28679 (0.2793)	4.3975 (0.4937)

Notes: Standard Errors are within round brackets; p-values are within squared brackets; ***, **, * mean significant at 0.01, 0.05, and 0.1 levels, respectively