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ASSESSING THE SPILLOVER OF SHOCKS FROM THE OIL MARKET TO THE STOCK MARKET OF DIFFERENT INDUSTRY SECTORS IN AMERICA - A QUANTILE REGRESSION APPROACH

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Abstract

The research problem of this paper examines the impact of Brent oil price shocks on stock returns of nine companies from the US market, operating in three different industrial sectors. The observation period covers 2015 to 2023. The research process involves determining the impact of shock transmission using a quantile regression approach. The results show that most of the evaluated quantile parameters are highly statistically significant, i.e. with more than 99% probability. The estimated quantile parameters have the property of being able to observe the spillover effects of shocks in different states of the economy, such as recession, normal state and expansion. The research results suggest that the spillover of shocks from the Brent oil market is most pronounced in the automotive industry sector, that is, in the companies that are most dependent on oil for energy. The significance of the research is reflected in the lack of existing research that deals with the impact of the most important commodity in the world on the prices of company shares with the application of this methodology, which is also a contribution to science. Finally, the results of this research are very relevant for making investment decisions for economic policy makers, investors and company management.

Keywords: oil, shocks, returns, stocks, quantiles

1. INTRODUCTION

Market participants have only recently raised interest in the spillover effect of shocks from the oil market to the stock market. The main cause of this is the turbulence in the energy market in the last twenty years (see Grecu et al., 2020). Oil is an irreplaceable commodity in the world, and its price is influenced by many factors.

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The most significant factors are regional wars, economic crisis, speculative activities, supply uncertainty and demand in oil markets (Yu et al., 2018). Kirkulak-Uludag and Safarzadeh (2017) suggest that oil is the basis for the functioning of the country's economy, given that shocks on the oil market affect the company's income to a greater or lesser extent. Oil production at a high level and demand growth at a low level contribute to the fact that the price of oil fell significantly in 2016. During 2017, there was an increase in demand at the global level as well as various political events. In other words, the embargo that took place in Iran and was introduced by the United States of America, as well as the decision of the Russian government, resulted in oil prices reaching their maximum in four years in 2018. Then, the 2020 COVID-19 pandemic followed, which significantly slowed down the global economy and contributed to enormous fluctuations in the price of oil. The fluctuations that occurred contributed to the fact that most market participants who are in any way connected with oil pay attention to changes in the price of oil and organize their businesses in accordance with the market situation (Li et al., 2022).

In this research, Brent oil was combined with companies from the automotive industry, the pharmaceutical industry, and the soft drink industry in a quantile regression model. In other words, we are looking at various ups and downs in the price of Brent oil.

Uncertainty in crude oil prices is a prominent source of uncertainty that has come to the fore among academic researchers. Based on the above, this paper attempts to contribute to the literature by looking at oil in the last nine years. In the observed period, oil experienced various turbulences, which implied the existence of a large risk, as we can see in Figure 1. The dynamics of Brent oil prices are shown on the left side of Figure 1. Fluctuations that led to price changes show uncertainty, which resulted in fluctuations in terms of Brent oil yields, shown on the right side of Figure 1. A distinct risk is evident in 2020, which is clearly related to the COVID-19 pandemic. At the time of the pandemic, oil had drastically negative returns, which were the cause of extremely high losses on a daily basis for participants in the Brent oil market. Existing research looked at the effects of oil prices on macroeconomic trends, stock market trends, inflation, and other economic indicators (Elder & Serletis, 2010). The results obtained from these studies show that the existence of oil uncertainty has a negative impact on the movement of companies' returns. Most often, these results indicate that the uncertainty in the price of oil contributes to the highest degree of risk in investments that are not recoverable, while it is much better in the financial sense to invest that is delayed. In growth stages, oil price uncertainty contributes to risk not only for firms but also affects development opportunities. Investing under risk does not only contribute to the riskiness of companies, but there is also the possibility of achieving a competitive advantage in relation to other companies. In their research, the authors indicate that shocks in the oil market will spill over into other financial markets. The effects of these markets are increasingly pronounced (Cong et al., 2008). This is especially important because oil is an extremely important industrial raw material that has a direct impact on the work of industries that use the production process in their operations (Bampinas et al., 2023). Shocks caused by

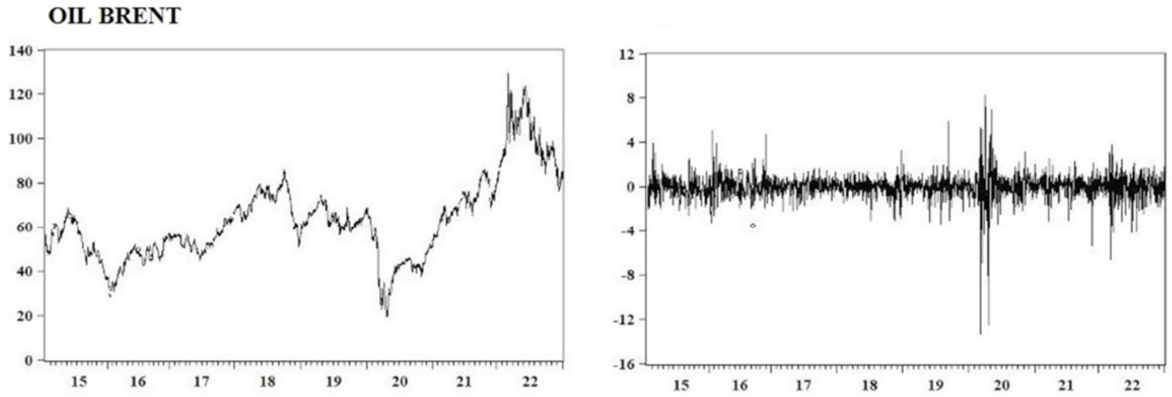

Figure 1. Price movements (left) and yield movements (right) of Brent oil in the period from 2015 to 2023

changes in the price of oil have an extraordinary impact on the functioning of the energy sector itself (Jiang et al., 2021). Uncertainty in oil price movements may lead investors to consider whether to divest their stocks (Wang et al., 2020). Also, uncertainty changes the perception of investors, which consequently affects the price of shares (Zhang & Wang, 2015). If the stock markets are developed, it means that they have a larger volume of stock trading on a daily basis. Therefore, higher daily trading volume causes less negative downside risk (Ammar & Hellara, 2022).

To the best of my knowledge, no paper has examined the impact of oil on company quantiles, which is a contribution to science. In addition to the fact that extremely few works deal with the role of oil prices on prices in the industrial sector (see Punzi, 2019), there is a motivation to do this research through the use of an unconventional methodological approach, quantile regression, which has not been carried out before in this sense. Quantile regression is a productive methodology for modeling the quantiles of a response variable based on one or more independent variables (see Hao & Naiman, 2007). Quantile regression estimates the effect of the dependent variable on the quantiles of the response variable or the dependent variable. It is applied in moments when the conditions of linear regression are not met. The practicality of quantile regression is reflected in the fact that quantiles emphasize the solution to the problem compared to the effect of the mean, which is the case with classical linear regression (see Meinshausen, 2006). The application of this special procedure provides an insight into the spillover of oil price uncertainty to the stock market of various industrial sectors in different market conditions, i.e., recession conditions (quantiles on the left tail), normal conditions (middle quantiles), and expansion conditions (quantiles on the right tail). The application of this methodology contributes to success in dealing with extreme values and empirical data, and biased conclusions are prevented (Lubrano & Ndoye, 2014).

In addition to the introduction, the work is made up of several segments. The second segment of the paper provides the research methodology—the quantile regression approach. The third segment of the work presents the set of data that was used in the research. In the last stage of this work, we

measure the magnitude of the impact of the transmission of shocks from the Brent oil market on the return of shares of companies from three different industrial sectors by applying the relevant methodology of influence on quantiles, i.e., applying quantile regression. Finally, the last segment of the paper constitutes the conclusion.

2. LITERATURE REVIEW

The economic crisis brought about by the pandemic allows insight into the facts and answers to the question of why uncertainty has increased tremendously (Altig et al., 2020). These conclusions are not surprising since a large number of researchers have reached similar conclusions. For example, Mensi et al. (2022) noted that yield spillover is extremely pronounced in the episode of the COVID-19 crisis, as well as that said crisis has the greatest impact on spillover effects both in a positive and negative sense for the companies under observation. Varahrami and Dadgar (2021) considered the relationship between oil market and stock market spillover effects in the COVID-19 pandemic. They conclude that forecasting the market was extremely difficult and that in these moments, a negative causal effect is recorded when the price of oil changes on the index of the Iranian stock market. In their research, Chang et al. (2023) deal with quantile correlation, in which they examine in detail the interdependence of oil prices and BRICS stock markets. The authors came to the conclusion that there is an exceptional degree of connection in moments of market decline, when it comes to the global financial crisis, and in moments related to the pandemic. Periodic changes are recorded at the moments in which the allocative change occurred. Caporin et al. (2023) found in their research that the effects of the COVID-19 pandemic and the state of war that occurred in Ukraine (between Russia and Ukraine) had a positive effect on oil companies, and prices increased from the end of 2020 by 40% and from the end of 2022 by 34%. They also state that the process of developing a strategy for independence from fossil fuel until 2035 and independence from carbon until 2050 is underway in the European Union, which puts these companies in an independent position because there is a high probability that the economic policy makers of other countries will also take over the stated strategy, which will consequently lead to a drop in demand. In their research, Ma et al. (2021) dealt with the turbulence that occurred in the oil market under the conditions of the COVID-19 pandemic and the war between Russia and Ukraine. The findings they arrive at indicate that market participants could see the changes happening in the market and adjust their expectations. Brent crude oil is an extremely important commodity that is traded on a global level. The ability to observe fluctuations in the price of crude oil is extremely important, and it is defined to project a large number of industrial portfolios. The price of oil shows significant volatility when it comes to stock indexes or when it comes to exchange rates, and in this way they represent a good method of methodological test on time series that behave badly (Ewald et al., 2023). The ongoing conflict between Russia and Ukraine has had a profound impact on the global oil industry, resulting in significant oil price volatility. In 2010, a comparable scenario occurred as the implementation of quantitative easing in the United States resulted in a significant increase in crude oil prices of over 100% (Wang et al., 2023).

Crude oil prices serve as an important benchmark for global energy prices. Currently, they play a key role in shaping various societal decisions, especially those related to the transition to (green) energy. The global oil market should serve as a platform for constant interaction between producers, regulators and users of different origins, despite occasional doubts about its global nature and integration (Dragomirescu-Gaina et al., 2023). The impact of a strong energy market extends beyond the economy as a whole, influencing key domestic markets such as foreign exchange and stock markets, as well as shaping trading methods (Tiwari et al., 2024).

3. RESEARCH METHODOLOGY

In order to measure the spillover of shocks from the oil market to the stock market, we use the Koenker and Bassett (1978) quantile regression approach. Koenker (2005) confirmed that in cases where there is a possibility that the assumption of normality is significantly violated and when there are marked exceptions in the data, quantile regression is appropriate, given that quantile functions provide more complete and reliable data regarding the influence of the variable that is conditional on the dependent variable.

Quantile regression approaches are based on the median; that is, the model is set as a function of covariates (dependent variables) on parts of the distribution (quantiles) of the independent variable. In other words, this setup requires response distributions that are represented as parameters of the mean, and they are represented as 0 in the error distribution. If we extend this ordinary regression, a quantile regression model involving response observations and associated covariance vectors i = 1,...n, can be formulated as a standard model as in the following equation:

$$y_i = \mu(x_i) + \varepsilon_i$$

where are y_i i x_i variables, where the time series of production of a particular company is the dependent variable, while the price of oil is the independent variable. According to Zivkov et al. (2014) if Med (ε|x) = 0, then it is $\mu(x_i)$ is the conditional median function, while the linear conditional model is the median Med $(y_i|x_i) = x_i\beta$. Solving for the regression coefficient can be done using the following equation:

$$argmin \sum_{i=1}^{n} |y_i - \acute{x}_\imath \beta| \; ; \beta \epsilon R$$

The middle case in quantile regression is extended to the other quantiles, and these quantiles can be estimated using the following equation: $\hat{\beta}(\tau) = argmin \sum_{i=1}^{n} \rho_\tau \; (y_i - \acute{x}_\imath \beta); \; \beta \; \epsilon \; R$ where is τ ϵ (0,1) is the quantile of interest, while $\rho_\tau(z) = z\,(\tau - 1\,(z < 0))$ i $I\,(.)$ represent functional indicators. Quantiles $\hat{\beta}(\tau)$ represents τ^{th}, that is, the regression quantile where is in the case $\tau = 0.5$ corresponds to medial regression.

Quantile regression provides accurate inference that applies to the data, not only to the coefficients of the quantile regression but also to any other distributional response function that is of key interest. It also represents alternatives to fitting techniques in the classical sense. In addition to the application of quantile regression, the paper will also use the application of descriptive statistics, where the obtained results will be explained in detail. Also, in addition to this methodology, the paper will present a

graphic representation of the realized returns of sector companies. In the data set chapter, the method of logarithmic transformation of the data, which we included later to obtain the results, will be presented. Globalized business environment, rapid market development requires focusing on a specific market in order to gain complete insights into its business dynamics. For the stated reason, in this research the sample is based on different industrial sectors from America.

4. DATA SET

The data set used in this research consists of daily data from three different sectors of the economy. We transformed these daily data into logarithms according to the following equation:

$$r_{it} = 100\, x \ln(p_{it} / p_{it-1})$$

And in this way, we corrected the differences that appear between the time series, so to speak, all observed variables are treated as growth rates in order to correct the differences in dimensions between the time series. The data was collected from Stooq.com statistics, while the research period is related to the period from 2015 to 2023.

Table 1 shows the descriptive statistics of nine time series of US companies and Brent oil. We can see that all the time series have a very low return value that moves around 0, which means that the observed time series are stationary. Ford Motors Co has the lowest mean value, which means that the prices of this company grew the least in the observed period. Also, we notice that Stellantis NV Motors is the most risky, that is, it has the most deviation from the mean value. We observe that there is a high value of kurtosis, which suggests the existence of extreme movements, which consequently indicates an increased degree of shocks. Most companies have negative skewenes meaning that most observations are to the left of the mean. Also, it is noticeable that there is a skewness of all time series, that is, the Jarque-Bera test suggests non-normality for most in the selected time series. The last column shows the results obtained using the Dickey-Fuller GLS test, which confirms the stationarity of the time series.

Table 1. Descriptive statistics of the empirical time-series

	Mean	Std Dev	Skewness	Kurtosis	JB	Dickey-Fuller GLS
Panel 1.			**Undependent varibale**			
Oil Brent	0.009	1.169	-1.232	23.309	34897.30	-44.375
Panel 2.			**Dependent variable**			
General Motors	0.004	0.99	-0.199	11.295	5785.14	-4.614
Ford Motors Co	0.001	0.980	0.184	10.791	5103.77	-1.651
Stellantis NV Motors	0,022	1.137	-0.650	9.595	3790.84	-2.130
Johnson & Johnson	0.015	0.509	-0.465	13.255	8893.85	-3.243
Novo Nordisk	0.033	0.751	-0.533	10.671	11499.10	-4.071
Procter & Gamble	0.016	0.526	-0.003	15.014	12.107	-4.150
Coca Cola	0.014	0.515	-0.955	13.791	10073.95	-20.437
Pepsi	0.018	0.528	-0.617	26.597	45653.17	-5.278
Monster Energy Drink	0.022	0.778	0.153	12.999	8393.78	-4.918

JB stands for the Jarque-Bera coefficients of normality, DF-GLS is Dickey-Fuller generalized lest squares test with 10 lags assuming only constant, and 1% and 5% critical values are 2.566 and 1.941, respectively.

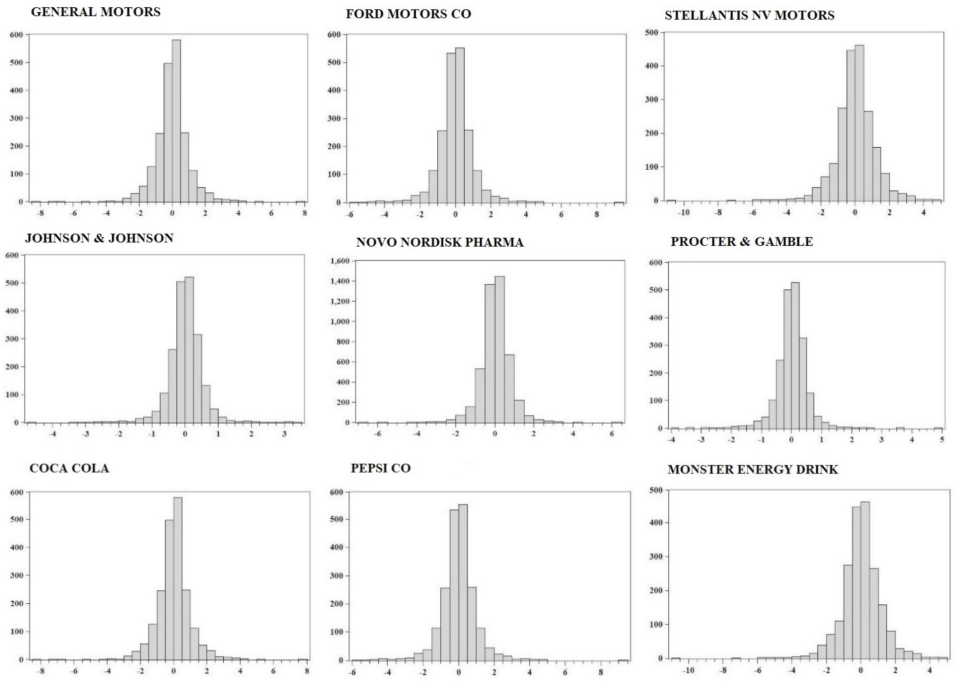

Figure 2. Display of time series of independent and dependent variables

On the basis of the graphical display through histograms, we can see that all time series are leptokurtic, that is, they have a pronounced mean value and thick tails.

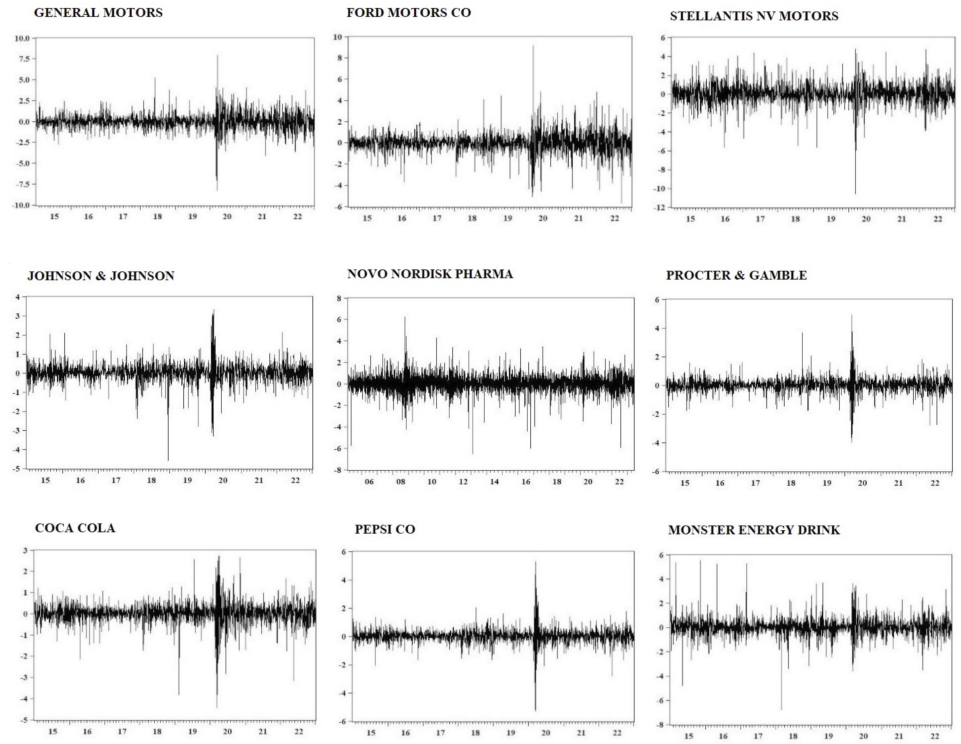

Figure 3. Presentation of the trend in the returns of the observed companies' shares in the period from 2015-2023. years

Figure 3 shows the trend in the returns of the observed companies' shares in the period from 2015 to 2023. As we can see, the independent variable, Brent oil, had continuous positive and negative oscillations in the observed period, while the most significant negative movement was recorded during the COVID-19 pandemic. Furthermore, looking at the graphic representation of the dependent variables of the companies, we observe distinct positive and negative tendencies in movement, which are not so pronounced until 2019/2020. At the moment of the pandemic, all companies recorded a marked decline, which reached its peak in that year in relation to the entire observed period. The COVID-19 pandemic is accompanied by the very large impact and consequence of an economic shock, which is mostly reflected in job losses and increased mortality. There is no significant connection with similar historical events with which a comparison can be made, and therefore it is very important to prepare instruments and measures with which economies will deal with similar risks in the future.

5. EMPIRICAL RESULTS

This section of the paper includes the results of estimated quantile parameters in the interval from $\tau 0.05$ to $\tau 0.95$. The table shows the obtained data, while Figure 2 is a graphical representation. In this research, we evaluate the spillover of shocks from the Brent oil market to the financial market of shares of companies from different sectors of the economy. The results indicate that most of the estimated quantile parameters are highly statistically significant, ie more than 99% probability. The estimated quantile parameters have the feature of being able to observe the spillover effects of shocks in different states of the economy, such as recession, normal state and expansion. Specifically, in this paper, 7 quantiles are observed, where quantiles closer to the left tail ($\tau 0.05$ and $\tau 0.15$) suggest a state of recession, quantiles around the median ($\tau 0.35$, $\tau 0.5$, $\tau 0.65$) indicate a normal state, while quantiles closer to the right tail ($\tau 0.8$ and $\tau 0.95$) show a state of expansion. The table shows 7 estimated quantiles, which give an estimate of the spillover effect of shocks from the Brent oil market on 9 companies, which come from different sectors. It is indicative that all the estimated quantile parameters are positive, which means that there is an exact proportional relationship between the movement of Brent oil returns and stock returns. In other words, in the phase of global recession, the price of oil falls due to reduced economic activity in the world, which is accompanied by less demand for oil. Also, in the recession phase, most companies do poorly, and activity in the financial markets is reduced due to increased uncertainty, which is reflected in the fall in stock prices. In this case, the negative returns of the independent variable, Brent oil, affecting the negative returns of the dependent variable, company stocks, result in a score of positive quantiles on the left tail of the distribution. On the other hand, in the expansion phase, the price of oil rises due to increased global demand for it, and stock prices also rise due to the positive performance of companies and investors' expectations that the stock price will be even higher in the future. In this case, the estimated quantile parameters also have a positive sign. Under normal conditions, the exact proportional relationship between oil and stocks also exists, only the value of the estimated quantile parameters is lower

compared to the quantiles of the tails. This is because the growth (fall) of oil and stock yields is much lower in normal conditions than in the phases of recession and expansion, so the quantile parameters around the median are also lower than at the tails of the distribution.

The observation period refers to 2015-2023. years. The obtained results indicate that volatility is more pronounced in moments of more serious market turmoil, i.e., recession and expansion, which is in line with expectations and other existing work. Many authors point to the existence of a feedback loop between the economy and financial markets in periods of exceptional market turbulence (see, e.g., Atukeren et al., 2021; Iglesias & Rivera–Alonso, 2022).

As for the results in the table, we start with the case of a company from the automotive industry - General Motors. It is interesting to note that the estimated quantiles from the edge of the empirical distribution (τ0.05 and τ0.95) are the highest compared to all other companies, which signals that Brent oil has the greatest impact on a company that is very energy intensive, i.e., whose production process requires a es significant amount of energy. Such results are in line with economic logic and expectations. In other words, in the period of recession, i.e. at the quantiles τ0.05 and τ0.20, we observe that a drop in the yield of Brent oil by 1% is followed by a drop in the yield of shares of General Motors by 0.19% and 0.15%, respectively. Under normal conditions, on the quantiles shown, the effect of the price of oil on the observed company is the smallest. In the expansion period, at the quantiles τ0.80 and τ0.95, a 1% increase in Brent oil yields causes a 0.11% and 0.17% increase in stock prices. According to Wang et al. (2022), the political aspect is extremely important for mitigating the implications of external shocks from high oil prices. Policymakers must be guided in the coming

Table 2. Estimated quantile parameters for the effect of shocks from the Brent oil market on the stock market of different companies

	Estimated Quantiles						
	0,05	0,20	0,35	0,50	0,65	0,80	0,95
	Dependet variable – General Motors						
Oil Brent	0.191***	0.153***	0.144***	0.104***	0.100***	0.115***	0.170***
	Dependent variable – Ford Motors Co						
Oil Brent	0,165***	0,146***	0.129***	0.129***	0.140***	0.132***	0.145***
	Dependent variable – Stellantis NV Motors						
Oil Brent	0.231***	0.183***	0.184***	0.185**	0.164**	0.152***	0.047
	Dependent variable – Johnson Johnson						
Oil brent	0.084***	0.035***	0.032***	0.021	0.029***	0.047***	0.051*
	Dependent variable – Novo Nordisk Pharma						
Oil Brent	0.088***	0.047**	0.031**	0.040**	0.034*	0.034**	0.052
	Dependent variable – Procter & Gamble Co						
Oil Brent	0.095***	0.040***	0.027**	0.025***	0.019	0.016	0.015
	Dependent variable – Coca Cola						
Oil Brent	0.138***	0.064***	0.042***	0.033***	0.026*	0.018*	0.073***
	Dependent variable – Pepsi Co						
Oil Brent	0.115***	0.040**	0.027**	0.024**	0.028**	0.026*	0.042**
	Dependent variable – Monster Energy Drink						
Oil Brent	0.100***	0.072***	0.073***	0.076***	0.046**	0.051*	0.053***

***, **, * represent statistical significance at the 1%, 5% and 10% level, respectively

years by clean energy plans as a basis for the establishment of the automotive industry and by reducing the degree of dependence.

The next case involves other companies from the automotive industry - Ford Motors Co. It is interesting to note that here also on the left edge of the empirical distribution (τ0.05 and τ0.95) the rated quantiles are the largest, that is, it also indicates that Brent oil has the greatest impact on energy-dependent companies. In other words, in the period of recession, i.e. at the quantiles τ0.05 and τ0.20, we observe that a drop in the yield of Brent oil by 1% is followed by a drop in the yield of shares of Ford Motors Co by 0.16% and 0.14%, respectively. Under normal conditions, on the quantiles shown, the effect of the price of oil on the observed company is smaller compared to the period of recession. In the expansion period, at the τ0.80 and τ0.95 quantiles, a 1% increase in Brent oil yields causes a 0.13% and 0.14% increase in prices, reprectively.

The third case also includes a company from the automotive industry - Stellantis NV Motors. It is interesting that for this company, the evaluated quantiles, which are on the edge of the empirical distribution, are the highest compared to companies from other sectors, but also compared to the observed companies from the automotive industry. Which means that this company is the most energy intensive. Practically, in the period of recession, at the quantiles τ0.05 and τ0.20, we observe that a 1% drop in Brent oil yield is followed by a 0.23% and 0.18% drop in Stellantis NV Motors stock returns, respectively. Under normal conditions, on the quantiles shown, the effect of the price of oil on the observed company follows the period of recession. In the expansion period, at quantiles τ0.80, a 1% increase in Brent oil yield causes a 0.15% increase in the share price, while at the τ0.95 quantile, it can be seen that oil does not affect the company's shares in expansion at all.

The second segment of the table includes three companies from the pharmaceutical industry. First, the analysis covers the case of Johnson & Johnson. By looking at the estimated quantiles on the edge of the empirical distribution, we can see that this company is low energy intensive, that is, its production process does not require a large amount of energy. In the recession period, i.e., at the quantiles τ0.05 and τ0.20, we observe that a 1% drop in the yield of Brent oil is followed by a drop in the yield of Johnson & Johnson shares by 0.08% and 0.03%, respectively. Under normal conditions, on the quantiles shown, the effect of the oil price on the observed company is the smallest in the entire observed period. In the expansion period, at the quantiles τ0.80 and τ0.95, a 1% increase in oil prices causes a 0.04% and 0.05% increase in prices, respectively.

Next, we look at the case of the pharmaceutical company Novo Nordisk Pharma. In the recession period, that is, at the quantiles τ0.05 and τ0.20, we observe that due to a drop in the price of oil by 1%, there is a drop in the company's yield by 0.08% and 0.04%, respectively. Under normal conditions, on the quantiles shown, the effect of the price of oil on the observed company is smaller compared to the recession period. In the expansion period, at the quantiles τ0.80, a 1% increase in oil prices causes the share price to increase by 0.03%, while at the quantile and τ0.95 Brent oil does not affect the shares at all.

Looking at the pharmaceutical company - Procter & Gamble Co and all the quantiles for all observed periods, we can see that in

the period of recession, a drop in the price of oil by 1% causes a drop in the price of shares by 0.09% and 0.04%, while in the period of expansion the impact of the price of Brent oil on the company's cannot be observed.

The third segment includes in companies from the beverage industry. One of the largest companies in the world in the field of beverages is the American company Coca Cola. It is interesting that the estimated quantiles from the edge of the empirical distribution (τ0.05 and τ0.95) are smaller compared to companies from the automotive industry, which indicates that Brent oil has less impact on companies that are not energy-intensive, i.e. the Coca Cola Co does not require significant amount of energy. The obtained results are aligned with economic logic and expectations. Practically, in the period of recession, i.e., at the quantiles τ0.05 and τ0.20, we observe that a drop in the yield of Brent oil by 1% is followed by a drop in the yield of Coca Cola shares by 0.13% and 0.06%, respectively. Under normal conditions, on the quantiles shown, the effect of the oil price on the observed company is smaller compared to the recession period. In the expansion period, at the τ0.80 and τ0.95 quantiles, a 1% increase in Brent oil yields causes a 0.0% and 0.07% increase in stock prices.

The next observed case is Pepsi Co. With this company too, we can see that there is a lower degree of energy intensity, i.e. the company Pepsi Co does not require significant amounts of energy. In other words, in the period of recession, that is, at the quantiles τ0.05 and τ0.20, we observe that due to a drop in the price of oil by 1%, there is a drop in the company's yield by 0.11% and 0.04%, respectively. Under normal conditions, on the quantiles shown, the effect of the price of oil on the observed company is smaller compared to the recession period. In the expansion period, at the quantiles τ0.80 and τ0.95, a 1% increase in oil prices causes a 0.02% and 0.04% increase in stock prices.

Finally, we comment on the case of the company - Monster Energy Drink. With this company, there is a lower degree of energy dependence, that is, the company Monster Energy Drink does not require significant amounts of energy, which is confirmed by the estimated quantiles on the edge of the empirical distribution. Practically, in the period of recession, that is, at the quantiles τ0.05 and τ0.20, we observe that due to a drop in the price of oil by 1%, there is a drop in the company's yield by 0.10% and 0.07%, respectively. Under normal conditions, on the quantiles shown, the effect of the price of oil on the observed company is smaller compared to the recession period. In the expansion period, at quantiles τ0.80 and τ0.95, a 1% increase in oil prices causes a 0.05% and 0.05% increase in stock prices.

We conclude that the estimated quantiles from the edge of the empirical distribution are the largest for companies from the automotive industry, which suggests that Brent oil has the greatest impact on companies whose production process requires a greater amount of energy. Such results are in line with economic logic and expectations. In his research, the author Leong (2021) also analyzes the impact of the price of oil on the industry, and in his research we see the confirmation of the obtained results, namely that, there is a lower degree of dependence between the effects of oil and the textile industry com,pared to, for example, the car market. Huang et al. (2015) in their research investigated the impact of oil prices on sectors reacting differently in different observed periods, and that the

financial sectors reacts positively in all observed periods, while the energy and materials sector reacts positively in the medium and long term. The authors Mensi et al. (2021) analyze the existing information on the relationship between the price of oil and shares from the US market and look at it in three ways. They conclude that there is a spillover of effects from the oil market to the stock market, which equates to a period that includes a period of economic slowdown. The authors Reboredo and Rivera Castro (2014) conclude in their research that oil price changes did not have an impact on returns either at the aggregate or at the sectoral level during the crisis period, but with the exception of oil and gas companies, which can also be seen based on the results obtained in this research. The effect of oil is stronger in the short term than in the medium or long term in more cases. Based on the application of daily data, Wang and Wang (2019) conclude that the effect of the oil price impact varies by economic sector and by time period.

Figure 4 shows a graphical representation of the estimated quantile parameters and the confidence intervals located above and below the estimated quantiles. The narrower the confidence intervals, the more reliable the quantiles, and vice versa. In most of the pictures, that is, most of the observed

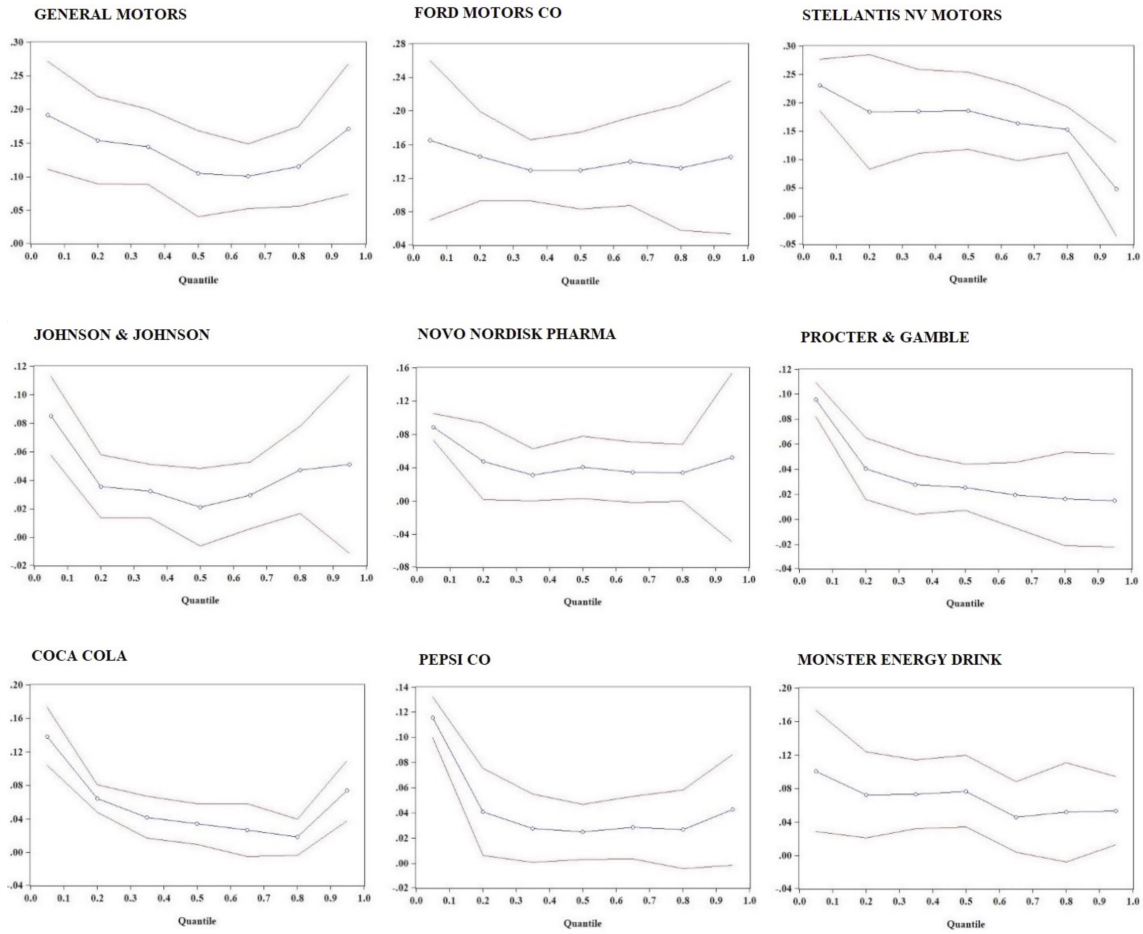

Figure 4. Estimated quantiles from oil to sector company stocks. Note: Intervals are adjusted, with 95% probability

companies on the tails have much wider confidence intervals than on the middle quantiles, the quantile of the median, which indicates that these quantiles are less reliable than the quantile of the median. All companies on the lower left quantile show high significance, which means that oil strongly affects companies in the recession phase, compared to the right quantile, the expansion phase. In the expansion phase, on the last quantile on the right, the company Stellantis NV Motors shows quantiles that are not significant, that is, there is no influence of oil on the shares of this company. The same is the case with the company Novo Nordisk Pharma, while the company Procter & Gamble shows the same on all observed quantiles in expansion. These results are consistent with Xie et al. (2021) who confirm in their research that in times of high turbulence, uncertainty increases regarding the impact of oil on stocks, while also indicating that only the low quantiles have a significant impact, showing a regime in the form of the letter „ In“. Similar results can be found in research conducted in the previous period (see Xiao et al., 2019; Badshah et al., 2018). Zhao (2020) confirms that the correlation between oil shocks and stock prices differs across capital markets. Furthermore, Anand and Paul (2021) confirm that fluctuations in oil demand have a significant impact on the stock market. Lu et al. (2023) note that demand-side oil shocks have a greater impact on generating changes in stock prices, while supply shocks have a negligible impact on the understanding of stock price volatility. Empirical studies repeatedly show that oil supply shocks have a negligible effect on the stock market, while demand shocks have a significant effect. Furthermore, other studies provide inconclusive findings, arguing that oil supply shocks also have a significant impact on the stock market. Escribano et al. (2023) believe that before the global financial crisis in 2008, the correlation between the stock market and BRENT was less pronounced. Later, after the crisis, this ratio saw a significant improvement, potentially attributed to the economic expansion that reduced the importance of oil prices. The increased correlation between oil prices and major equity indices from late 2008 to 2023 can be attributed to global uncertainty stemming from various crises and conflicts. Importing countries had a higher incidence of negative pairwise association with BRENT compared to exporting countries, which can be attributed to their economic structure and dependence on oil. Consequently, BRENT can serve as a hedge against a possible fall in equity investment for commodity-importing countries, and also as a risk diversification tool for commodity-exporting countries, due to its inverse weak ratio.

6. CONCLUSION

This paper provides a detailed analysis of the impact of Brent oil on the returns of companies from three different sectors, namely the automotive industry, the pharmaceutical industry and the soft drinks industry. In this process, we use the quantile regression methodology. By analyzing the impact of Brent oil on the quantiles of companies, we can claim that the results obtained are objective and credible.

We identified several noteworthy findings through the results obtained. First, the obtained results indicate that shocks from the Brent oil market are more pronounced in the recession period, and in these moments, the

price of oil records its decline due to economic activity that is not as pronounced, that is, reduced, which further results in a decrease in the demand for oil. Second, during a recession, many companies record bad business, and activity in the financial markets declines because the degree of uncertainty is on the rise, which leads to a fall in stock prices. This finding is valid for all the surveyed companies. Thirdly, we find that the automotive industry, namely General Motors, Ford Motors Co, Stellantis NV Motors, suffers the largest transfer of shocks from the oil market in the entire observed period, given that the automotive industry is the most intensively energy dependent compared to the other observed companies. The pharmaceutical and soft drink industries suffer much less spillover from Brent oil market shocks because they are not as energy dependent on oil.

In short, this research provides a better understanding of the volatility connection between the Brent oil market and the stock market of companies that are more energy-intensive, that is, those that are less energy-intensive, while the application of econometric methodology ensures the accuracy of the obtained results that are usable not only for academic researchers but also for economic practitioners.

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ПРОЦЕНА ПРЕЛИВАЊА ШОКОВА СА ТРЖИШТА НАФТЕ НА ТРЖИШТЕ БЕРЗА РАЗЛИЧИТИХ ИНДУСТРИЈСКИХ СЕКТОРА У АМЕРИЦИ – ПРИСТУП КВАНТИЛНОЈ РЕГРЕСИЈИ

Сања Бакић

Извод

Истраживачки проблем овог рада испитује утицај шокова цена нафте типа Брент на приносе акција девет компанија са америчког тржишта, које послују у три различита индустријска сектора. Период посматрања обухвата 2015. до 2023. Процес истраживања обухвата одређивање утицаја преноса шока коришћењем приступа квантилне регресије. Резултати показују да је већина евалуираних квантилних параметара високо статистички значајна, односно са више од 99% вероватноће. Процењени квантилни параметри имају особину да могу да посматрају ефекте преливања шокова у различитим стањима привреде, као што су рецесија, нормално стање и експанзија. Резултати истраживања сугеришу да је преливање шокова са тржишта Брент нафте најизраженије у сектору аутомобилске индустрије, односно у компанијама које су енергетски најзависније од нафте. Значај истраживања огледа се у недостатку постојећих истраживања која се баве утицајем најважнијег комодитија на свету на цене акција компанија уз примену овакве методологије, што је уједно и допринос науци. Коначно, резултати овог истраживања су веома релевантни за доношење инвестиционих одлука за креаторе економске политике, инвеститоре и менаџмент компаније.

Кључне речи: нафта, шокови, приноси, залихе, квантили

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