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THE EFFECT OF OIL PRICE UNCERTAINTY ON STOCK PRICES IN TURKEY

ABSTRACT

Since Turkey is an oil importer country, the uncertainty in oil prices may affect the behaviour of the firms with respect to production costs and hence profitability. In this study, we investigate the impact of oil price uncertainty on stock prices in Turkey using monthly data on selected sectoral indices over the period January 2006–April 2020. The estimation of a bivariate vector autoregression in-mean (BVAR-GARCH-M) model shows that the stock returns are positively affected by oil price volatility during the period under investigation. We also captured that this positive relationship can be characterised by supply-side shocks rather than demand side shocks.

Keywords: Uncertainty, Stock Returns, BVAR-GARCH-M, Turkish economy

JEL codes: C32, Q43

1. INTRODUCTION

The relationship between the change in oil prices or its volatility and the returns of stocks has always been attractive in the literature. It is known that the connection between uncertainty in oil prices and the returns of stocks in financial markets is crucial for the investors, especially for the portfolio managers. It is clear that an investor observes many indicators in order to make the best investment preference. One of the main indicators for the return of the stocks is the oil price uncertainty since it has potential to affect the risk on profitability of the firms. But in the literature, there is no clear consensus on the effect of oil price uncertainty and the stock returns. Sadorsky (2001), El-Sharif, Brown, Burton, Nixon & Russell (2005), among others suggest that there is a positive relationship between variables under investigation while Cunado & Perez de Gracia (2014); among others found negative relationship. The main explanation about this difference comes from the type of shocks. The supporters for positive relationship argue that the change in oil prices create a demand-side effect of stock prices. Therefore, a rise in oil price uncertainty raises the profit of some firms and hence returns. On the other hand, other studies highlight the cost channel and indicate that the supply-side shocks are important for some sectors, especially for the production sector. So a rise in oil price uncertainty raises the cost of production and decreases the profit and hence the return of the stock. In order to be clear, Degiannakis, Filis and Floros (2013) investigated oil-importing and oil-exporting countries and found that there is a positive relationship in oil-exporting countries, while there is a negative relationship in oil-importing countries. Since the Turkish economy is a net oil-importing country, we expect a negative relationship between the oil price uncertainty and the return of stocks.

Many papers focused on Turkish economy regarding these two variables. İşcan (2010) found no relationship between the variables under investigation while Güler and Nalın (2013) suggest there is a long-run relationship between energy sector stock prices and oil prices. Kapusuzoğlu (2011a, 2011b) also captured that there is a long-run relationship between oil prices and BIST100, BIST50 and BIST30 indexes and relationship in the short-run is from stock prices through the oil prices. Ünlü and Topçu (2012) found that the BIST indexes are fast responding to the changes in oil prices. Alkan and Çiçek (2020) searched for the spillover effect between financial markets in the Turkish economy. Although the researches focus on the relationship between oil prices and stock returns, none of them investigated the effect of oil price uncertainty on stock returns, especially on the sector-based. Therefore, in this study, we would like to concentrate on oil price uncertainty and the sectoral returns of the asset in BIST market in Turkey.

The paper is organised as follows. Section 2 gives short descriptive analysis of the data and outlines the methodology in an econometrical manner. Section 3 represents the empirical results, and Section 4 discusses some concluding remarks.

2. DATA AND METHODOLOGY

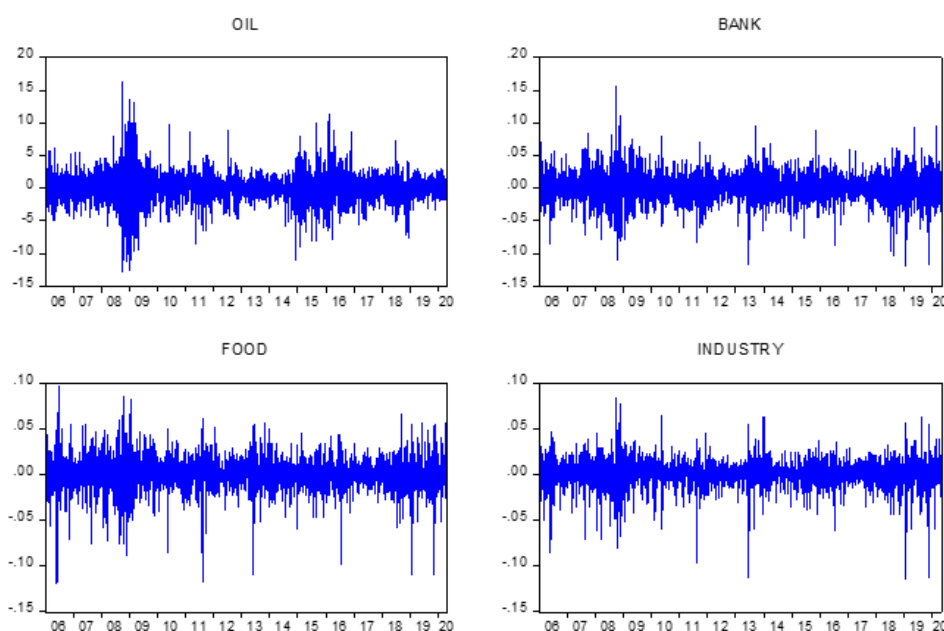
We use daily data to search for the impact of oil price uncertainty on stock returns in Turkey. As known, daily data are affected by noise and some anomalies many economists support that the monthly data might be adequate to capture the response to oil price volatility. In this study, we used five sectoral indices constructed Borsa Istanbul (BIST): bank, food, industry, metal, service. The sample period starts from January 2006 to April 2020. Stock prices are in Turkish lira and the oil price is the West Texas Intermediate (WTI) Cushing crude oil spot price (US dollars per barrel). Our raw data in levels are shown as $P_{i,t}$ where i is the price of oil and indices of bank, food, industry, metal, service. In order to have returned, we used log differences of the variables and multiplied by 100. r_t term indicates returns in the equations.

Table 1: Descriptive Statistics

	Oil	Bank	Food	Industry	Metal	Services
Mean	-0.0444	-0.0007	-0.0001	-0.0006	0.0001	0.0001
Median	0.0000	-0.0010	0.0001	0.0003	0.0009	0.0005
Maximum	16.4137	0.1559	0.0967	0.0839	0.1315	0.0999
Minimum	-12.8267	-0.1114	-0.1189	-0.0862	-0.1107	-0.0789
Std. Dev.	2.6899	0.0265	0.0215	0.0176	0.0267	0.0181
Skewness	0.1570	0.1463	-0.5340	-0.6428	0.0321	0.0032
Kurtosis	8.4191	5.8632	6.8933	6.6668	6.3361	5.9170
Jarque-Bera	960.0748*	269.8979*	531.0489*	491.9355*	362.7783*	277.2512*

* indicates significance level at 1%.

During the period we interested, the mean of changes is negative for the oil price, bank, food and industry sector returns while it is positive but very close to zero for metal and services returns. The highest standard deviation for oil price changes (2.6899) and the lowest one is for the industry sector return (0.0176). The Jarque–Bera (JB) test statistics rejects the null hypothesis that the series is normally distributed. The Ljung–Box Q-statistics for the return series and their squares (calculated up to 12 lags) indicate that there is significant linear and nonlinear dependence. Hence, we may say that an ARCH model might be appropriate to capture the volatility clustering in the data. Same can be captured by Figure 1 where the daily weekly evolution of the oil price and sectoral stock prices with their corresponding changes.



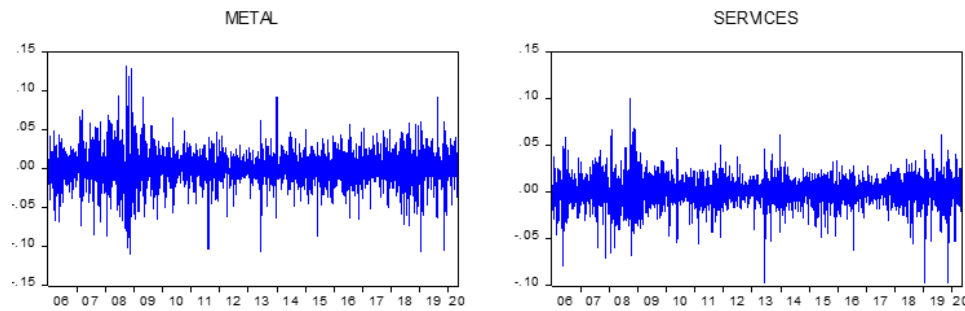


Figure 1: Changes in Oil Prices and Sectoral Stock Returns

3. The VAR-GARCH-in-mean model

We employ a bivariate vector autoregression generalized autoregressive conditional heteroscedasticity in-mean (BVAR-GARCH-M) (1, 1). In particular, we divided periods as supply-side and demand-side periods. In order to define the shocks, we follow Kilian and Park (2009)'s methodology. To do that, the changes in the global supply and demand for oil are accepted as supply-side and demand-side shocks. The conditional mean equation is specified as follows:

$$r_{oil,t} = \alpha_{10} + \sum_{i=1}^n \alpha_{1i} r_{oil,t-i} + \sum_{j=1}^n \beta_{1j} r_{stock,t-j} + \varepsilon_{1t} \quad (1)$$

$$r_{stock,t} = \alpha_{20} + \sum_{i=1}^n \alpha_{2i} r_{oil,t-i} + \sum_{j=1}^n \beta_{2j} r_{stock,t-j} + \varepsilon_{2t} \quad (2)$$

where $r_{oil,t}$ and $r_{stock,t}$ indicates the oil price changes and sectoral stock returns, respectively. ε_{1t} and ε_{2t} are the innovation vector which is normally distributed with conditional covariance matrix. The parameters α_{1i} , and β_{2j} captures the response of oil price changes and sectoral stock returns to their own lags, while α_{2i} and β_{1j} measure causality from oil price changes to stock price, and vice versa. The lag length is selected according to Schwartz Information Criterion (SIC).

After specifying the conditional mean equation, we estimated the conditional equation on the basis of the DCC-GARCH specification in order to capture the volatility dynamics in the variables we have interested. The estimated model can be seen as following:

$$H_t = D_t R_t D_t$$

where D_t is a matrix (2x2) with the conditional volatilities on the main diagonal $D_t = \text{diag}\{\sqrt{h_{i,t}}\}$. While estimating DCC GARCH, we first assume that the conditional variance equations are univariate as followed: $h_{i,t} = c_i + a_i \varepsilon_{i,t-1}^2 + b_i h_{i,t-1}$ where i indicates oil price changes and stock returns. The correlation function in DCC model is expressed as followed: $Q_t = (1 - \alpha^{DCC} - b^{DCC}) \bar{Q} + \alpha^{DCC} \varepsilon_{t-1} \varepsilon_{t-1}' + b^{DCC} Q_{t-1}$; where \bar{Q} is the unconditional covariance matrix of ε_t and α^{DCC} and b^{DCC} are the non-negative scalar coefficients. The stationary condition is $\alpha^{DCC} + b^{DCC} < 1$. If $\alpha^{DCC} = b^{DCC} = 1$, then we may say that the model is constant conditional correlation model. Following Bollerslev and Wooldridge (1992), we estimated the quasi-maximum likelihood (QML) estimator for all specifications. It is known that this estimator computes robust standard errors.

4. EMPIRICAL RESULTS

The quasi-maximum likelihood estimates of the BVAR-DCC-GARCH (1, 1) parameters are presented in Tables 2 for the bank, food, industry, metal, service sectors. The Hosking (1981) multivariate Q-statistics of order (5) and (10) for the standardised residuals indicate the existence of no serial correlation at the 5% level when the conditional mean equations are specified with $p = 2$.

Table 2: Estimation Results

	Bank	Food	Industry	Metal	Service
α_{10}	0.155 (0.036)	0.167 (0.031)	0.178 (0.029)	0.128 (0.006)	0.166 (0.063)
α_{11}	-0.035 (0.030)	-0.041 (0.034)	-0.013 (0.039)	-0.044 (0.041)	-0.065 (0.003)
β_{11}	-0.033 (0.032)	-0.043 (0.036)	-0.036 (0.036)	-0.042 (0.040)	-0.062 (0.025)
α_{20}	0.113 (0.034)	0.233 (0.039)	0.108 (0.037)	0.169 (0.122)	0.131 (0.043)
α_{21}	-0.052 (0.030)	-0.064 (0.029)	-0.035 (0.022)	-0.069 (0.034)	-0.025 (0.029)
β_{21}	-0.041 (0.036)	-0.039 (0.032)	-0.059 (0.041)	-0.059 (0.031)	-0.014 (0.018)
c_1	0.652** (0.655)	0.776* (0.233)	0.507*** (0.785)	0.699** (0.254)	0.562** (0.556)
a_1	0.112*** (0.029)	0.201** (0.034)	0.154** (0.039)	0.189*** (0.037)	0.102*** (0.104)
b_1	0.874*** (0.016)	0.799** (0.043)	0.903** (0.025)	0.782*** (0.022)	0.478*** (0.061)
a^{DCC}	0.0003	0.0002	0.0000	0.0000	0.0001
b^{DCC}	0.8658	0.9192	0.9522	0.9393	0.8889
<i>Log - lik</i>	-6255.21	-8322.16	-7145.11	-5841.49	-7242.52
Q(5)	16.554 (0.322)	19.223 (0.312)	12.322 (0.455)	19.325 (0.411)	19.924 (0.341)
Q(10)	39.104 (0.199)	53.233 (0.201)	47.511 (0.209)	46.825 (0.354)	36.566 (0.209)

*, ** and *** indicate 1%, 5% and 10% significance level.

Table 2 indicates that there exists causality from oil prices to all stock returns which is captured by α_{21} . The causality is negative for all α_{21} coefficients. For β_{11} coefficients, we see that causality is also negative for all variables. These findings imply that there is negative relationship between stock returns and oil price changes in the Turkish economy. The reason might be that Turkey is a net oil-importer country and hence a rise in uncertainty in oil prices cause Turkish firms costs to rise and hence profitability. As a result, it may increase stock indices to fluctuate than usual.

On the conditional covariance equations, we may see that both oil price changes and sectoral stock returns follow conditional heteroscedasticity process. The ARCH and GARCH parameters are significant at the 10% level in all cases. The persistence of the conditional variance varies between 0.86 and 0.95. All equations hold stability conditions where sums of a_1 and b_1 are lower than one.

Figure 2 shows the changes in the dynamic conditional correlation between the variable couples. It is clear that the correlation between oil price and stock returns varies during the time. The highest correlation is between the oil price and industry stock returns as expected. This finding implies that a rise in the uncertainty in oil price affects the industry sector on the basis of production costs and hence the return of industry sector fluctuates. If we focus on the average correlations, we may see that it is estimated as 0.013 for oil price & bank sector, 0.011 for oil price & food sector, 0.019 for oil price & industry sector, 0.014 for oil price & metal sector, 0.009 for oil price & service sector. As far as the impact of the recent financial crisis is concerned, we see that the highest correlation exists during the financial crisis period. This finding implies that the financial crisis had impact on correlation regardless of the sector in stock market in Turkey.

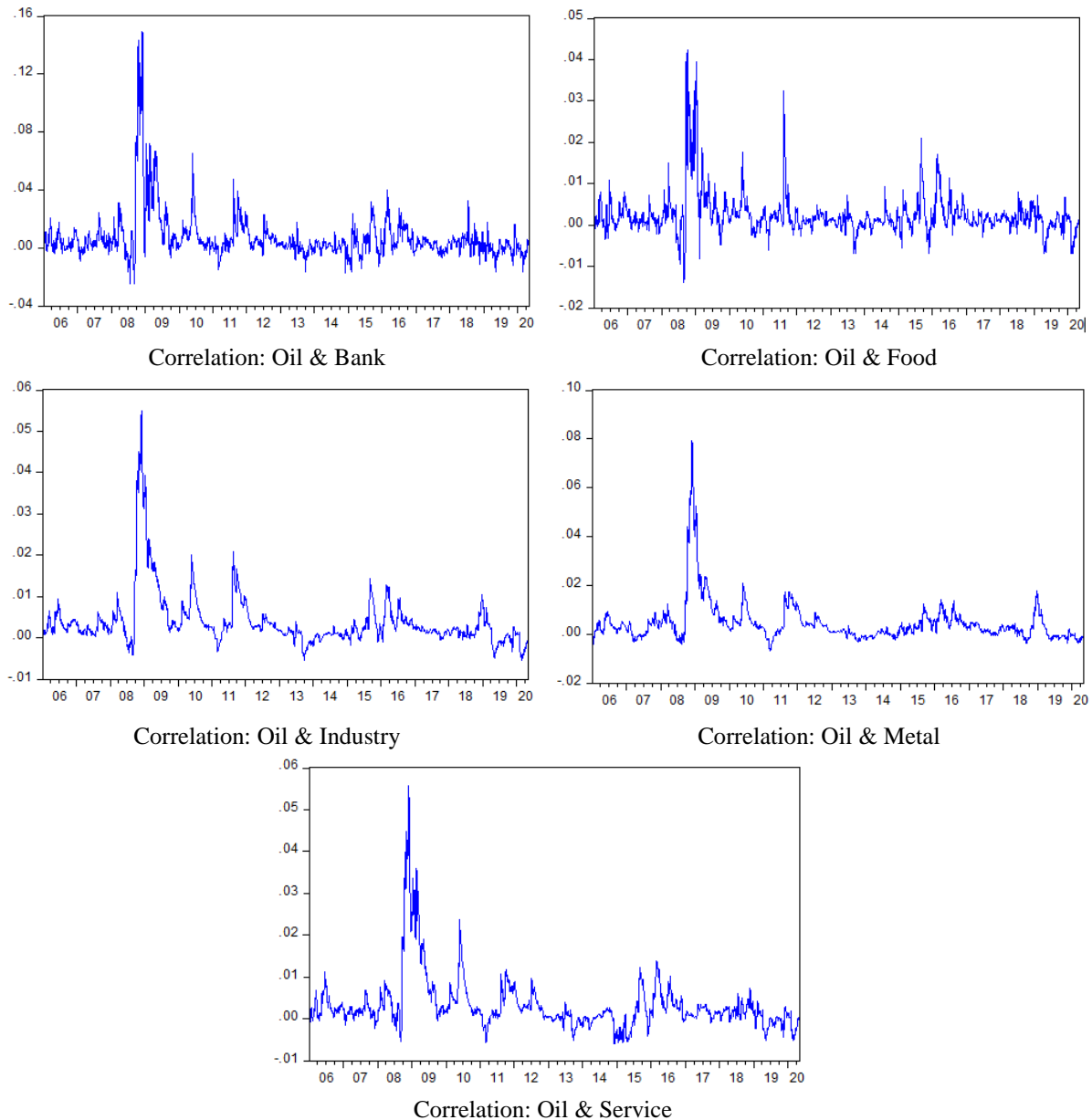


Figure 2: Dynamic Correlations

5. CONCLUSIONS

In this paper, we searched for the impact of oil price uncertainty on stock prices in Turkey using daily data on five sectoral indices: banking, food, industry, metal and services. Employing the BVAR-GARCH-M models, we found that oil price uncertainty affects sectoral stock returns negatively during the period under investigation. The results indicate that the sectoral stock returns are dependent on the oil price fluctuations in Turkey. We also found that the industry sector's returns are the most affected returns from the change in oil prices while the service sector is the lowest one. These findings imply that the shocks can be characterised by supply-side shocks in the Turkish case since Turkey is a net oil-importer country.

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