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CRUDE OIL AND STOCK MARKET PRICES: EVIDENCE FROM AN EMERGING MARKET

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ABSTRACT
This paper aims to examine the relation between crude oil and stock market prices for an emerging market, Turkey. Using daily data of Turkish stock market, we examined the relation between oil prices and alternative stock market indicies with Toda Yamamoto (1995) and generalized impulse response analysis. Previous studies fails to find any cointegrating relation running from oil prices to stock market indicies in Turkey. However, it is found in this study that oil prices Granger cause BIST100 index, together with alternative stock market indicies namely the BIST Manufacturing and BIST Technology Index. Findings indicate that oil prices increase the power of forecasting the alternative stock market indicies in Turkey. These results may have important implications for decision-making by investors and national policymakers.
Keywords: Oil Prices, Stock Prices, Toda Yamamoto, Generalized Impulse Response Analyses, Emerging markets.

ÖZET
Bu çalışmanın amacı gelişmekte olan piyasalardan biri olan Türkiye için petrol ve hisse senedi fiyatları arasındaki ilişkinin test edilmesidir. Petrol fiyatları ve farklı pay piyasası endeksleri arasındaki ilişki günlük veirler kullanılarak Toda Yamamoto (1995) nedensellik ve etki tepki analizleri kullanılarak günlük veriler bazında incelenmiştir. Türikiye üzerine yapılan geçmiş çalışmalarda petrol fiyatlarından pay piyasasına doğru bir nedenselliğin varlığı ortaya konulamamıştır. Ancak, bu çalışma kapsamında elde edilen bulgular petrol fiyatlarından BIST 100, BIST Üretim ve BIST Teknoloji endekslerine doğru nedenselliğin varlığına işaret etmektedir. Bulgular petrol fiyatlarının pay piyasası endekslerinin tahmin edilme gücünü arttırdığını ortaya koymaktadır. Elde edilen sonuçların yatırımcılar ve politika geliştirenler açısından önem taşıdığı düşünülmektedir.
Anahtar Kelimeler: Petrol Fiyatları, Hisse Senedi Fiyatları, Toda Yamamoto Yaklaşımı, Etki Tepki Analizleri, Gelişmekte Olan Piyasalar.

1. Introduction

Oil prices have great effects mainly on the economies of oil importing countries. Many economic acitvities are driven by the shocks to the oil prices in these countries. In particular, oil prices is not only a crucial factor of the production in today's economic world

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but also a leading indicator of the financial activites of the oil importing economies. Though, the degree of its' effect is mainly related to the openness of that economy, oil prices certanly create a risk for the firms established in these economies. Gisser and Goodwin (1986: 95) point out two main mechanisms of the risk transmission of oil price to the firm performances. First, increase in oil prices result in an increase in production costs, driving down the returns. Second, shocks to the oil prices creates inflation pressure on the economy, forcing the interest rates go up and stock prices go down. Hence, it is expected that the effect of oil price shocks on firms is negative. Using daily data os US for the period 2001 to 2007, Henriques and Sadorsky (2008) investigate the relation between stock market and oil prices. They find that oil prices Granger cause energy stock prices, where technology stock price shocks having a larger effect. Hence, it is seen that contegrating relationship may exist between oil and stock market prices of the firms that use little oil or even do not depend on oil such as techonology firms.

The aim of this paper is to investigate the effect of oil price shocks on altarnative stock market indicies of an emerging market, Turkey. We use the daily data of BIST 100 index and two sub indicies namely the BIST Manufactuing index, BIST Technology index. To the best of authors knowledge, this is the first study examining the granger causality between oil prices and alternative stock market indicies namely, manufacturing and Technology index. The rest of this paper proceeds as follows. Section 2 focuses on the brief summary of literature. Data and methodology is explained in section 3. Emprical results are presented in section 4 and finally, conclusions and policy implications are summarized in section 5.

2. Literature Review

It is seen in literature that majority of the previous studies analyzed the effect of oil prices on the economies of developed countries. In their pioneering study, Chen et al. (1986) cannot find any contegrating realtion between these two variables for the US market. However, using monthly data of US market for 1947–1996, Sadorsky (1999) examined the relation between oil prices and economic factors and concluded oil prices significantly affect stock returns. Moreover, Sadorsky (2001) find that oil price shocks result in an increase in stock price of the Canadian oil industry firms for the period between 1983 and 1999. Ewing and Thompson (2007) examine the relation between oil prices and stock market returns for the US using the monthly data of the period January 1982 through November 2005, and find that oil prices improves the forecasting power of stock market prices.

Park and Ratti (2008) examine the same realtion for US and European countries using VAR analysis for the period between 1986 and 2005 and found that oil prices increases the forecasting power of the stock market returns. Using daily datta, Gogineni (2010) investigates the effect of oil price shocks on different stock market indicies. He find that not only share prices of the firms using oil but also the firms using trivial amount of oil respond to changes to oil price shocks in US. Using monthly data of eight developed

countries (UK, US, Australia, Canada, France, Germany, Italy and Japan) with VECM, Apergis and Miller (2009) find that oil prices cannot increase the power of forecasting stock market indicies.

However, the number of studies for the emerging markets is quite low. Papapetrou (2001) finds that stock returns in Greece respond to shocks in oil prices. Maghyereh (2004) examine the oil price-stock market relation for the 22 developing countries and cannot find any contregrating relation running from the oil prices to the stock market returns. Sarı and Soytaş (2006) show that oil prices is not a significant factor in forecasting the stock market prices in Turkey. Basher and Sadorsky (2006) find that stock market prices in 21 emerging markets (Including Turkey) repsond to oil price shocks with daily data. Soytaş and Oran (2011) argue that oil prices may affect the volatility rahter than the mean value of the stock market returns and examine granger causality for Turkey. Using Cheung–Ng approach, they find that voatility of the stocks responds to shocks in oil prices but mean stock prices do not.

3. Data and Methodology

We use the daily data on world oil prices, BIST 100 index, BIST Manufacturing and BIST Technology Index for the time period 02.01.2001-30.10.2013, 3216 observations in total. Closing price data of 100 index, BIST Manufacturing and BIST Technology Index are retrieved from Republic of Turkey Central Bank Electronic Data Distribution System (http://www.tcmb.gov.tr). Daily crude oil prices are utilized from West Texas Intermediate (WTI) released at the end of the pipeline of Cushing, Oklahoma. Crude oil prices are in U.S. dollars per barrel and retrieved from U.S. Energy Information Administration (http://www.eia.doe.gov). The natural logarithms of all data are used in five working days per week and all holidays are excluded. Therefore LOP, LSP100, LSPM, LSPT represent the natural logarithims of crude oil, BIST 100, BIST Manufacturing, BIST Technology price index respectively. Summary statistics are given in Table 1. It is seen that among the stock market indecies, Technology index has the lowest deviation.

Table.1 Data summary statistics

	LOP	LSP100	LSPM	LSPT
Mean	4.059994	10.35896	10.17382	9.300198
Median	4.181134	10.56106	10.33272	9.220862
Maximum	4.978869	11.44228	11.20882	10.45674
Minimum	2.862201	8.876218	8.573315	8.289951
Std. Dev.	0.501707	0.690860	0.658538	0.539832
Skewness	-0.478839	-0.515540	-0.429912	0.405019
Kurtosis	2.016182	1.944640	2.018584	2.125261
Jarque-Bera	252.5959***	291.7056***	228.1316***	190.4583***
Observations	3216	3216	3216	3216

Superscripts ***, ** and * represent significance at 1% and, 5% and %10 levels.

The correlation matrix between the series are given in Table 2. As expected, it is seen that BIST national 100 index is almost perfectly correlated with BIST Manufacturing index. However, it is relatively low correlated with BIST Technology index. Results indicate higher correlation between oil prices and BIST 100/BIST Manufacturing index however, relatively lower correlation for BIST Technology index. However, these high correlations cannot indicate any causality.

Table.2 Correlatiom matrix

	LOP	LSP100	LSPM	LSPT
LOP	1			
LSP100	0.927435	1		
LSPM	0.931912	0.992065	1	
LSPT	0.672476	0.786181	0.807953	1

There are number of way to examine the causality, however, toda Yamamoto (1995) procedure can be applied to the series irrespective of the orders.Hence, series could be either integrated of the different orders or not cointegrated or even both. We apply augmented VAR procedure of the Toda and Yamamoto (1995) approach to investigate the causal relationship between oil and stock market prices. The advantage of Toda and Yamamoto (1995) estimation procedure is that it does not require pre testing for contegration. Hence it avoids order of integration selection problem (Giles, 1997). The difference of this estimation procedure is that highest order of integration is added to the to examine the causal relation. Hence, $VAR(k+d_{\max})$ is estimated where k is the optimal lag length and $d_{\max}$ is the maximum order of integration, and a modified Wald statistics is used. In this manner, we estimate the following $VAR(k+d_{\max})$ system for Turkey.

$$S_t = \alpha + \beta_1 S_{t-1} + \beta_2 S_{t-2} + \ldots \beta_{k+d} S_{(t-k+d)} + U_t$$

where S_t is (lop, lsp100, lspm, lspt), α is the vector of constants, β_i is coefficients matrices, and U_t is white noise residuals.

4. Emprical Results

The unit root test results are shown in Table 3. It is seen that all varialbes are I(1). Using the LR information criteria, optimal lag length (k) and maximum lag length ($d_{\max}$)

is determined to be (6) and (1) respectively. Hence the VAR lag structures $(k+d_{\max})$ are found to be (7). In this manner, we estimate $VAR(7)$ system for Turkey.

Table.3 Unit Root Test Results

		ADF	PP	KPSS
Intercept	LOP	-1.555029 (1)	-1.541582	5.764747***
	LSP100	-1.252394 (0)	-1.263461	6.279809***
	LSPM	-1.348562 (0)	-1.349219	6.346521***
	LSPT	-0.613568 (0)	-0.726257	4.392066***
Intercept and trend	LOP	-2.696961 (1)	-2.664324	0.756058***
	LSP100	-2.321475 (0)	-2.366329	0.831038***
	LSPM	-2.437596 (0)	-2.444156	0.738464***
	LSPT	-2.342008 (0)	-2.435409	0.712549***
Intercept	DLOP	-62.09677 (0)***	-62.08855***	0.047508
	DLSP100	-56.57045 (0)***	-56.58291***	0.056551
	DLSPM	-56.03088 (0)***	-56.02967***	0.072599
	DLSPT	-55.61487 (0) ***	-55.69886***	0.173524
	DLOP	-62.08855 (0) ***	-62.45979***	0.031936
Intercept and trend	DLSP100	-56.56517 (0) ***	-56.57746***	0.035402
	DLSPM	-56.02785 (0) ***	-56.02648***	0.039800
	DLSPT	-55.62838 (0) ***	-55.70782***	0.054320

D and L are first difference and natural log operators, respectively. Superscripts ***, ** and* represent significance at 1% and, 5%, %10 levels, respectively. Lag lengths are stated in Parantheses and determined using SIC.

Toda Yamamoto estimation results are presented in Table 4. The block exogenity results indicate that oil prices granger cause BIST 100, BIST Manufacturing and BIST Technology index. Moreover, it is also seen that Turkish stock market index granger cause oil prices. Hence, we see unidirectional causality between oil prices and BIST 100, BISTM, whereas bidirectional causality between BIST Technology index and oil prices. These results indicate that though the correlations between the BIST indicies are high, ther eis no causality between them. These results indicate that oil prices increase the forecasts of the different BIST index in Turkey in the long run. Though Toda Yamamoto estimation procedure is a powerful long term calusality test, it cannot give any information about short term.

Table.4 Block Exogenity Test Results

	LOP	LSP100	LSPM	LSPT
LOP	-	0.876049	4.964541	15.84700**
LSP100	35.29887***	-	10.49693	5.768737
LSPM	41.38044***	3.330004	-	6.170149
LSPT	33.28442***	3.030518	10.32467	-

Table should be read in rows. In particular, the significant statistic 15.84700 rejects the non-granger causality running from BIST Technology index to oil prices. Superscripts ***, ** and * represent significance at 1%, 5% and 10% levels respectively.

Hence, we apply Generalized impulse response analysis to see the temporary effects in the short run. The generalized impulse response analyses results are depicted through Figure 1 to Figure 4. Figure 1 indicates the response of oil price to shocks in stock market index. It is seen that none of the impulse response functions is signficant. Hence, inline with long run, short tun analysis do not indicate any impact of stock market index on oil prices.

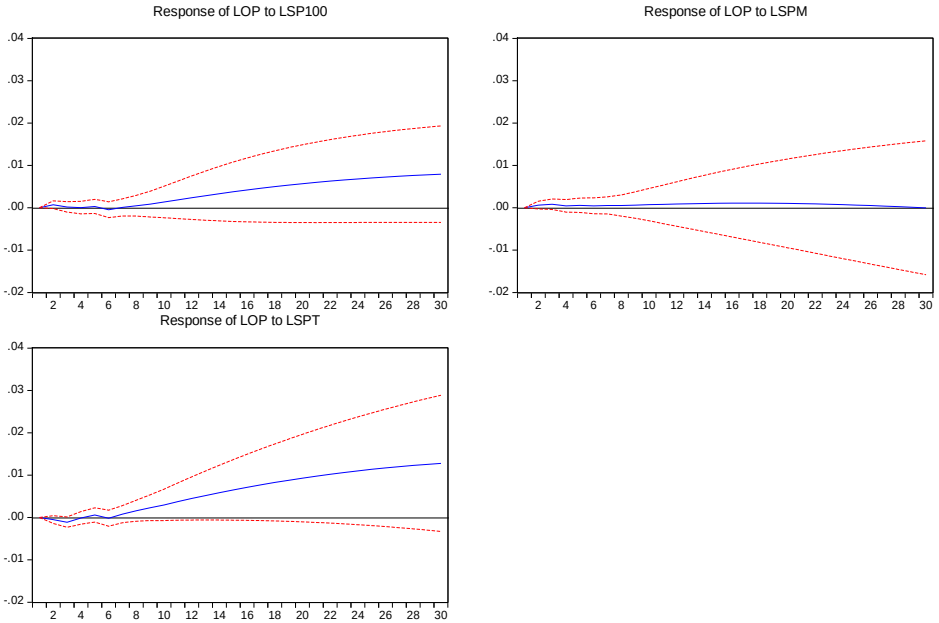

Figure 1 : Generalized Responses of Oil Prices to BIST 100, BIST Manufacturing and BIST Technology index

Figure 2 show the response of BIST 100 index to shocks in oil prices and BIST Manufacturing BIST Technology index. It is seen that none of the impulse response functions is signficant. Contrary to long term analysis, short term results donot indicate any impact of oil prices on BIST 100 index.

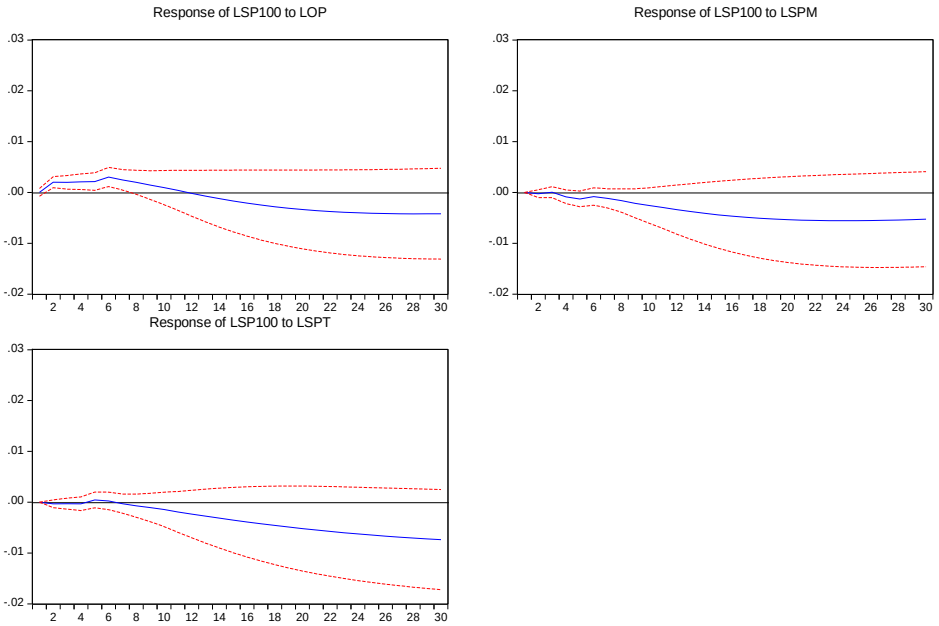

Figure 2 : Generalized Responses of BIST 100 to Oil Prices, BIST Manufacturing and BIST Technology index

Figure 3 shows the responses of BIST Manufacturing index to the shocks in oil prices, BIST 100 and BIST Technology index. In the short run, BIST manufacturing index responds to shocks in BIST 100. In particular, the impact is positive in the first 17 days and dies out after then.

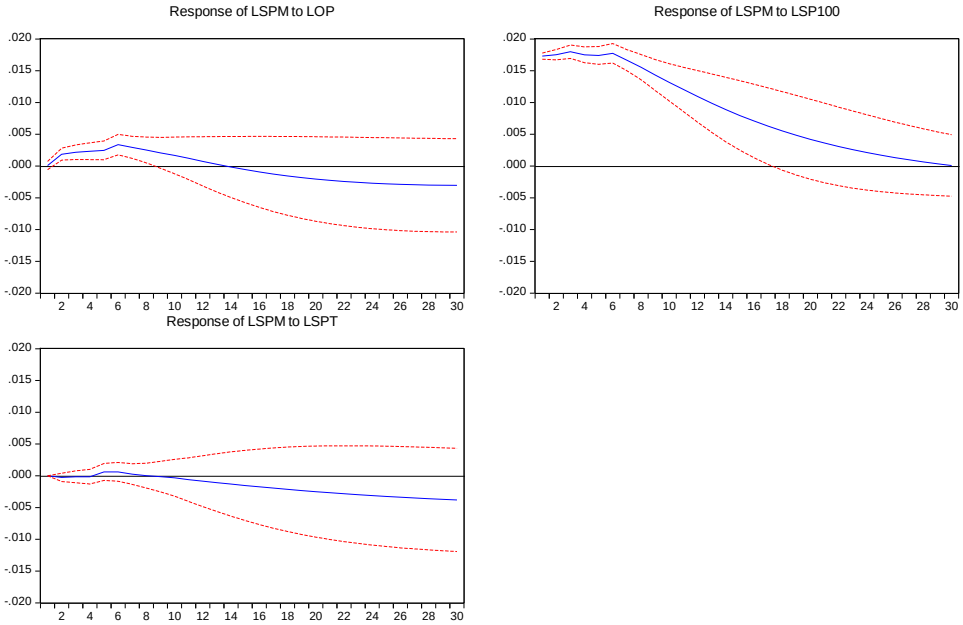

Figure 3 : Generalized Responses of BIST Manufacturing to Oil Prices, BIST 100 and BIST Technology index

Figure 4 indicates the responses of BIST Technology index to the shocks in oil prices and BIST 100 and BIST Manufacturing index. It is seen that the the initial impact of BIST Manufacturing index on BIST Technology index is positive for the first 18 days. Moreover, BIST Technology index reponds positively to the shocks in BIST Manufacturing index for the first 8 days and dies out after then.

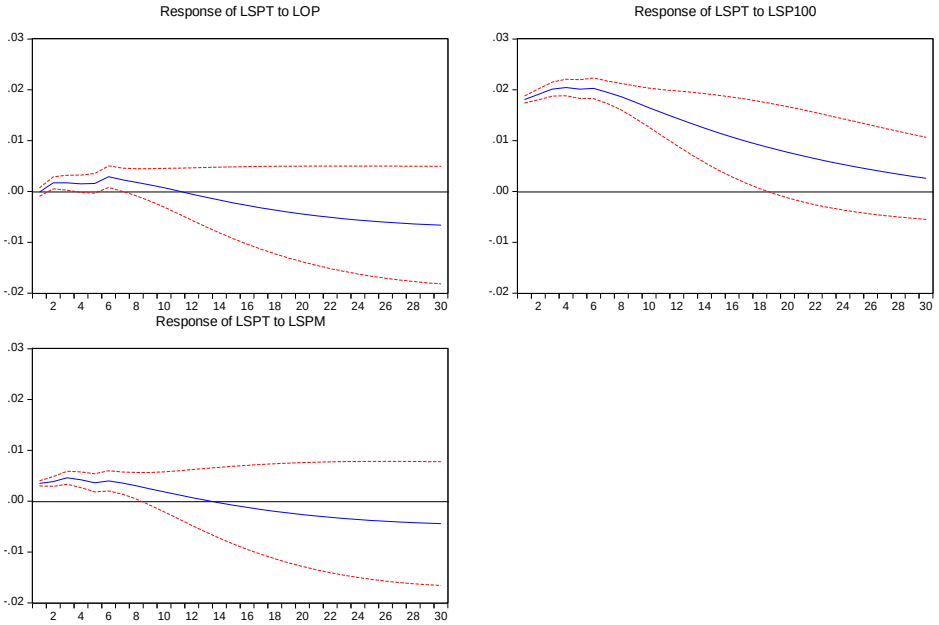

Figure 4 : Generalized Responses of BIST Technology to Oil Prices, BIST 100 and BIST Manufacturing index

5. Conclusion

In this study, we examine the long run relationship between oil prices and various stock market index of Turkey, namely, BIST 100, BIST Manufacturing and BIST Technology. In the long run, we find that all of the stock market index analyzed responds postively to the shocks in oil prices. This implies that oil prices improve the forecasting of the various stock market index in Turkey in the long run. However, in the short run there is no impact of oil prices on these stock market indicies. Though, there is no causality running any of the stock market indicies to another one, we see short run impacts on each other. In particular, it is seen that every stock market index has short term positive impact on other indicies.

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