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The Impact of Crude Oil Price Returns on the Stock Index Returns A Case study: Tehran Stock Exchange & Istanbul Stock Exchange

Ebrahim Abbasi
Associate Professor, Faculty of Social Sciences and Economics, Alzahra University, Tehran, Iran

Samira Asadian
Master of Business-Financial Management, Faculty of Social Sciences and Economics, Alzahra University, Tehran, Iran.
asadian.samira88@yahoo.com

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Abstract

This study aims to investigate the relationship between crude oil price returns and stock market index returns of an exporter (Iran) and an importer (Turkey). Using daily data of West Texas Intermediate (WTI), Brent crude oil spot prices, and one-four month futures prices for the WTI; Tehran Stock Exchange Price Index (TEPIX), Tehran Stock Exchange Dividend and Price Index (TEDPIX), the Dividend and Price Index for the Istanbul Stock Exchange gathered during the period of 2000-2010; the relationship is analyzed by two models of the Constant Conditional Correlation (CCC) and the Dynamic Conditional Correlation (DCC). The findings reveal that the DCC is predominant over the CCC for Turkey, which means there is a non-constant conditional correlation. In contrast, the findings show the predominance of CCC for Iran. Among the spot markets, stock market volatility is better defined by the Brent than the WTI. For futures markets of the WTI, a better relationship with longer maturity confirms the financial markets as being long-term. Finally, no evidence is found for one- or bi-directional volatility spillovers (interdependencies) between the markets.

Keywords: Spot Markets, Futures Markets, Tehran Stock Exchange, Istanbul Stock Exchange, Conditional Correlation

1. Introduction

For years, societies have moved to a market-oriented business, and among this, financial markets play a crucial role. Mobilization of financial markets to resources and promoting small and large investors are the important parameters affecting the countries' economic development. During the past 20 years, crude oil has gained the largest share of trading volumes in commodity markets. In the same period, oil-trading markets have converted from simple physical transactions to more complex financial activities [1]. On the other hand, energy is now an integral part of social developments so that rising energy costs will result in lower oil consumption rate, and reduced labor and capital productivity, leading to economical downturns [2]. Over the last few years, a bidirectional relationship has established between crude oil and stock markets, so any manufacturing unit in the international economy is seriously depend on energy resources [3]. Recent turmoil in energy markets has sparked renewed interest in studying the interaction between the energy markets and emerging financial markets [4]. However, a little research has addressed the impact of crude oil prices on stock markets in importing countries such as Turkey, and also on exporting countries like Iran.

Regarding:

- Difficulty in accurate prediction of correlation between crude oil and stock markets,
- Rare research conducted on comparing stock markets between exporting and importing countries, and
- Ignoring Iran as an important global crude oil exporter;

It found that data mining of correlation between crude oil price returns and the indices of Tehran and Istanbul stock exchange is useful. The study is as following: Section 2 reviews the theoretical basics and literature review. Section 3 discusses research methodology. Section 4 presents hypotheses, while section 5 covers data analysis and hypothesis test. Finally, section 6 provides main conclusion and remarks.

2. Review on Theoretical Basics and Literature

Many studies have been conducted regarding the relationship between crude oil and stock markets; however, there is no research on describing and classifying the literature in this area. This section will first review the literature, and then present a three-stage classification scheme for the subject.

(2)1 **Actuarial Approach:** The assumption of this approach based on a deterministic environment and the concept of fair price of financial asset [5]. Indeed, the intrinsic value of stock is equal to the discounted sum of expected cash flows that likely reflects large economic events affected by oil shocks [6]. Sizes of inflation and real activity play great role in analyzing the behavior of real stock returns [7]. Industrial production rate can be considered as a major variable for cash flows in analyzing the relationship between oil and stock markets [8]. Oil price shocks can impose an effect on corporate cash flows and discount rate through inflation rate and expected real interest rate [9].

(2)2 **Absence of Arbitrage Opportunities (AAO):** The concept of AAO is illustrated by the inequality between prices, which surely assumes that there is no potential to benefit with zero initial endowment. According to the AAO, deterministic inequality restrictions are imposed on asset pricing [5]. Regardless whether the world capital market is up or down, the international arbitrage pricing theory models a negative bidirectional dynamic relationship between the oil futures price growth and the world capital market as represented by the Morgan Stanley Capital Index (MSCI) [10].

(2)3 **Equilibrium Models:** This approach considers market prices as the product of balanced supply and demand of total assets. Due to assumptions about investor's behavior and traded volumes, equilibrium models are more complicated [5]. There is a significant and negative non-conditional relationship between market-beta and emerging-stock market returns; also, oil price risk has a great role for pricing of stock indices in these markets [11].

(2)4 **Efficient Market:** A standard definition for market efficiency states that today's price of an asset includes all information about that; it means that current price contains information about people expectations about the future [12]. Some evidences confirm the consistency of market efficiency theory for the daily data for the spot and two-month futures crude oil prices and for prices of gasoline and heating oil traded on the New York Mercantile Exchange (NYMEX) [13]. About the information transmission between the London International Petroleum Exchange (IPE) and the New York Mercantile Market, it found that the NYMEX was a true leader in the crude oil market [14].

(2)5 **Effects of Microeconomic Variables:** Among the most effective market parameters are microeconomic variables, which should be always evaluated in studying different relationships. The significance of using oil prices expressed in domestic currency may cause to capture the sensitivity of the individual country stock market to changes in the oil price [15]. Energy prices in general, and oil prices in particular are likely to have a potential effect on the costs of factor inputs for many listed firms and therefore on their stock price behavior [16].

(2)6 **Predictability of Volatility:** The efficiency of portfolio management and risk control depend on the accuracy of some forecasted variables, such as asset prices and their time varying variance (called the volatility) [5]. Ahmadian (2005) referred to the Morrison Forecast (1987) as one of the oil pricing predictors under perfect competition and perfect monopoly. The author means the floor price in the perfect competition, and the highest possible price in the perfect monopoly [17]. A hybrid prediction based on implied volatility and GARCH can obtain more excellent results. Implied volatility yielded the best in-sample and out-of-sample forecasts, while historical volatility forecasts were superior to their GARCH counterparts in the out-of-sample forecasts [12].

The history of relationship between crude oil and stock markets investigated in three subtitles: the effect of oil markets on corporate stock prices (Corporate); the effect of oil markets on stock market indices (Stock Exchange); and predications conducted on this field (Forecast).

a. **Corporate:** The oil futures market's volatility has a matching resonant or volatility-echoing effect on the stock of the oil exploration, production, and domestic integrated companies, and a volatility-dampening effect on the stock of oil international integrated and oil and gas refining and marketing companies [18]. Oil price shocks have no statistically significant effect on real returns of most stock indices in Chinese market, exceptionally on the manufacturing index and some oil companies [19]. Prices of technology stocks and crude oil markets each are the Granger causality of stock prices in energy corporate [20].

b. **Stock Exchange:** Oil prices and volatility both have great role in effecting real stock returns [21]. The short-run bilateral causal relationships among weekly stock index returns of the Gulf Cooperation Council (GCC) and oil markets are limited and mostly unidirectional. However, the positive shock of Saudi Arabia has a positive impact for all GCC countries [22]. Except the same nation with significant volatility spillover to the oil markets, the Gulf stock markets receive volatility from the oil market [23]. The Net Oil Price Index (NOPI) plays a significant role in determining volatility on real stock market returns [16]. Oil market shocks generate the largest effect on the variation of Italy stock market returns; whereas the idiosyncratic demand shocks affect stock returns in Canada at a weaker level of significance [24]. Since Iraq war in 2003, correlations between all commodities are increasing; although correlations of S&P 500 index are decreasing [25]. Greek stock markets receive a significant, negative impact from oil prices [26]. Qatar and United Arab Emirates among the GCC countries and the United Kingdom from developed countries show more responsiveness to oil shocks [27]. Oil prices exercise a negative effect on all stock markets, regardless of the origin of the oil price shock [28]. In general, stock markets reveal no significant reaction to energy-related events [29]. The Granger causality of global oil prices could not change the total market return [30].

c. **Forecast:** Based on the forecast accuracy, the GARCH-type models seem to perform better than the implied volatility (IV) obtained from inverting the Black equation [31]. By examining the usefulness of several ARIMA-GARCH models to model and forecast the conditional mean and volatility, it is found that forecast results are often complicated; however, the APARCH model performs mostly better than the others [32]. The nonlinear GARCH-class models are more effective than the linear ones in capturing the long-run dynamics of crude oil price volatility [33].

3. Research Methodology

Here, the research contains variables associated with the Tehran and Istanbul stock markets, and the major world crude oil markets. For stock markets, two countries –Iran and Turkey–are selected as the oil exporter and importer, respectively. For oil markets, two major world markets –WTI and Brent– with spot and futures prices are used. Variables include spot prices for the WTI (WTISPOT); spot prices for the Brent (BRENTSPOT); one-four month futures prices for the WTI (WTIFUTURE1, WTIFUTURE2, WTIFUTURE3, WTIFUTURE4); the Tehran Stock Exchange's (all-shares) Price Index (IRANTEPIX); the Tehran Stock Exchange's Dividend and Price Index (IRANTEDPIX); price index for the Istanbul Stock Exchange (TURKEYPRICE); and return index for the Istanbul Stock Exchange (TURKEYRETURN). The samples collected from the websites of the U.S. Energy Information Administration (EIA), Tehran stock Exchange, and Istanbul stock Exchange as the following websites. The research conducted during the period from 2000 to 2010, covering 1,408 data items.

1. Oil series available at (http://eia.doe.gov/)
2. Tehran indices available at (http://tse.ir/)
3. Istanbul indices available at (http://ise.org/)

For Turkey, stock market indices and world crude oil prices were obtained for five working days (from Monday to Friday) by US$; whereas for Iran, stock market indices were extracted for five working days (from Saturday to Wednesday) by Rial. The Maximum likelihood Estimation applied.

Conditional correlation models provide both conditional variance and conditional correlation matrix individually [34]. Bollerslev (1990) introduced a new class of MGARCH (multivariate GARCH) models with a constant conditional correlation [35]. Let Y_t denote the $N \times 1$ time-series vector of interest with a time-varying conditional covariance matrix, H_t, i.e.,

$$Y_t = E(Y_t|\psi_{t-1}) + \varepsilon_t \qquad Var(\varepsilon_t\,|\psi_{t-1}) = H_t, \tag{1}$$

Where ψ_{t-1} is the σ-filed generated by all the available information up through time *t-1*, and H_t is almost surely (a.s.) positive definite for all *t*. Also, let h_{ijt} denote the ij^{th} element in H_t, and Y_{it} and ε_{it} the i^{th} element in Y_t and ε_t, respectively.

$$h_{ijt} = \rho_{ij}(h_{iit}h_{jjt})^{1/2}, j = 1, \cdots, N\,, i = j+1, \cdots, N \tag{2}$$
$$h_{iit} \equiv \omega_i \sigma_{it}^2, i = 1, \cdots, N \tag{3}$$

Where ω_i is a positive time invariant scalar and $\sigma_{it}^2 > 0$ a.s. for all *t*. Given (2) and (3), the full conditional covariance matrix, H_t, may be partitioned as $H_t = D_t \Gamma D_t$. Where D_t denotes the $N \times N$ stochastic diagonal with elements $\sigma_{1t}, \cdots, \sigma_{Nt}$, and Γ is an $N \times N$ time invariant matrix with typical element $\rho_{ij}\sqrt{(\omega_i\omega_j)}$. Assuming conditional normality, the log likelihood function for the general heteroskedastic model in (1), apart from some initial condition, will be as follows:

$$L(\theta) = -\frac{TN}{2}\log 2\pi - \frac{1}{2}\sum_{t=1}^{T}(\log|H_t| + \acute{\varepsilon}_t H_t^{-1}\varepsilon_t) \tag{4}$$

Where, θ denotes all the unknown parameters in ε_t and H_t. In many applications, a more parsimonious representation is often obtained by GARCH (p,q) model, cf. Bollerslev (1986, 1987), [35] where

$$Var_t(\varepsilon_{it}) = h_{iit}.$$
$$= \omega_i + \sum_{j=1}^{q}\alpha_{ij}\varepsilon_{it-j}^2 + \sum_{j=1}^{p}\beta_{ij}h_{iit-j}. \tag{5}$$

Dynamic conditional correlation model is a new class of multivariate GARCH estimators that can best viewed as a generalization of the constant conditional correlation (ccc) estimator [35]. In Bollerslev model, $H_t = D_t R D_t$, $D_t = diag\{\sqrt{h_{i,t}}\}$ and R is a correlation matrix with conditional correlations. The dynamic correlation model differs only in allowing R to be time varying: $H_t = D_t R_t D_t$.

Parameterization of R have the same requirements as H, except that the conditional variances must be unity. The matrix R_t remains the correlation matrix. The log likelihood estimator can be expressed as:

$$r_t|\Im_{t-1} \sim N(0, H_t),$$
$$L = -\frac{1}{2}\sum_{t=1}^{T}(n\log(2\pi) + \log|H_t| + \acute{r}_t H_t^{-1} r_t) \quad (6)$$

And, the conditional variance, h_{it}, can be defined as a univariate GARCH model as the below:

$$h_{it} = \omega_i + \sum_{k=1}^{q} \alpha_{ik}\varepsilon_{i,t-k} + \sum_{l=1}^{p} \beta_{il} h_{i,t-l}. \quad (7)$$

Finally, data items estimated by the CCC and DCC models, as well as through two submodels of GIR and IGARCH.

4. Hypotheses

The **first hypothesis** includes the following:

(1)1 There is constant conditional correlation between crude oil markets and the Tehran and Istanbul stock exchange markets.
(1)2 There is dynamic conditional correlation between crude oil markets and the Tehran and Istanbul stock exchange markets.

The **second hypothesis** includes the following:

(2)1 Changes in the Tehran stock exchange's indices can define well by world crude oil prices.
(2)2 Changes in the Istanbul stock exchange's indices can define well by world crude oil prices.

The **third hypothesis** includes the following:

(3)1 Conditional correlations and volatility spillovers on Tehran/Istanbul stock exchange markets can define well by oil spot prices.
(3)2 Conditional correlations and volatility spillovers on Tehran/Istanbul stock exchange markets can define well by oil futures prices.

The **forth hypothesis** includes the following:

(4)1 Volatility spillovers from oil markets are toward Tehran stock exchange.

(4)2 Volatility spillovers from oil markets are toward Istanbul stock exchange.

5. Data Analysis and Hypothesis Test

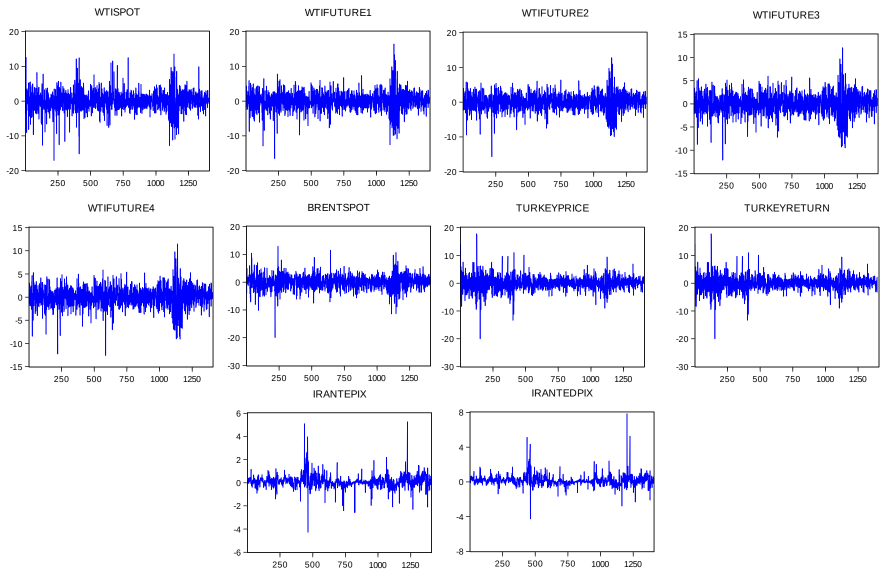

Fig. 1- Returns of Crude Oil Prices and Stock Market Indices

First, daily returns were calculated by a continuous compound basis defined as $r_{ij,t} = ln(p_{ij,t}/p_{ij,t-1}) * 100$. Where, $p_{ij,t}$ and $p_{ij,t-1}$ are the closing prices or crude oil price *i* of market *j* for days *t* and *t-1* respectively. The data return diagram in figure 1, clearly illustrates the ARCH effects, since each small volatility clusters and large volatility clusters placed beside.

Table 1- Descriptive Statistics of Variables

variables	mean	SD	Normality test		
			skewness	kurtosis	Jarque-Bera
WTISPOT	0.002	2.871	-0.210	4.520	1208.900
WTIFUTURE1	-0.036	2.600	-0.253	4.500	1202.900
WTIFUTURE2	-0.030	2.360	-0.319	3.458	725.490
WTIFUTURE3	-0.027	2.217	-0.292	2.698	447.250
WTIFUTURE4	-0.029	2.153	-0.444	3.420	732.630
BRENTSPOT	-0.037	2.490	-0.342	4.997	1492.200

variables	mean	SD	Normality test		
			skewness	kurtosis	Jarque-Bera
IRANTEPIX	0.101	0.550	1.005	17.697	18610.000
IRANTEDPIX	0.147	0.592	2.739	32.916	65322.000
TURKEYPRICE	-0.053	2.549	0.110	7.792	3564.800
TURKEYRETURN	-0.059	2.549	0.108	7.796	3568.100

Then, data items evaluated in terms of primarily descriptive statistical features and stability metric in table 1. Obviously, for all returns the mean values are negative, except for the WTI spot return, and two indices of Tehran Stock Exchange. Based on the standard deviation, the TSE indices have the lowest historical volatility. Oil price returns have negative skewness whereas Iranian and Turkish stock market indices show positive skewness. In addition, the Jarque-Bera statistics indicates that the assumption of normality has rejected because the value of the kurtosis is larger than three. This can be seen as evidence for existence of (G)ARCH effects [37].

Table 2 - Results for ADF & KPSS Tests

variables	ADF			KPSS	
	No intercept & time trend	Intercept & no time trend	Intercept & time trend	Without trend	With trend
WTISPOT	-38.989	-38.975	-39.001	0.000	0.000
WTIFUTURE1	-38.581	-38.575	-38.612	0.000	0.000
WTIFUTURE2	-38.940	-38.933	-38.967	0.000	0.000
WTIFUTURE3	-38.969	-38.962	-38.995	0.000	0.000
WTIFUTURE4	-39.130	-39.124	-39.155	0.000	0.000
BRENTSPOT	-38.179	-38.173	-38.166	0.000	0.000
IRANTEPIX	-25.969	-26.610	-26.636	0.000	0.000
IRANTEDPIX	-25.581	-26.745	-26.831	0.000	0.000
TURKEYPRICE	-38.848	-38.864	-39.046	0.000	0.000
TURKEYRETURN	-38.845	-38.856	-39.042	0.000	0.000

The bold numbers show the significance at the 5% level.

Prior to using data for fitting the models, it is necessary to ensure their stability. Result obtained from stability tests by using Augmented Dickey-Fuller generalized in three directions and the Kwiatkowski, Phillips, Schmidt and Shin generalized in two directions in table 2, indicates that whole data items in all cases have the significance at the 5% level with and without time trends.

Table 3- Data Estimations Using the CCC Model

Binary relationships			ARMA(1,1) -CCC-IGARCH(1,1)	Log-likelihood	ARMA(1,1) -CCC-GJR(1,1)	Log-likelihood
Between markets	WTISPOT	IRANTEPIX	-0.004	-4060.770	-0.012	-4066.490
		IRANTEDPIX	0.001	-4045.030	0.004	-4080.220
		TURKEYPRICE	0.092	-6418.380	0.099	-6422.660
		TURKEYRETURN	0.093	-6418.170	0.100	-6422.350
	WTIFUTURE1	IRANTEPIX	0.003	-3950.270	0.005	-3956.630
		IRANTEDPIX	0.001	-3936.130	0.009	-3976.470
		TURKEYPRICE	0.085	-6299.470	0.090	-6299.000
		TURKEYRETURN	0.085	-6299.010	0.090	-6298.440
	WTIFUTURE2	IRANTEPIX	-0.001	-3842.650	-0.002	-3847.770
		IRANTEDPIX	-0.007	-3828.660	-0.003	-3868.890
		TURKEYPRICE	0.088	-6188.520	0.093	-6187.240
		TURKEYRETURN	0.088	-6188.060	0.093	-6186.690
	WTIFUTURE3	IRANTEPIX	-0.002	-3761.210	-0.002	-3768.430
		IRANTEDPIX	-0.007	-3747.410	-0.002	-3788.380
		TURKEYPRICE	0.092	-6105.040	0.096	-6103.940
		TURKEYRETURN	0.092	-6104.600	0.096	-6103.410
	WTIFUTURE4	IRANTEPIX	-0.001	-3707.430	-0.001	-3711.760
		IRANTEDPIX	-0.005	-3693.700	-0.001	-3730.270
		TURKEYPRICE	0.092	-6055.290	0.096	-6054.490
		TURKEYRETURN	0.093	-6054.880	0.096	-6053.990
	BRENTSPOT	IRANTEPIX	-0.003	-3907.340	-0.004	-3908.560
		IRANTEDPIX	-0.003	-3897.820	0.007	-3929.890
		TURKEYPRICE	0.096	-6256.780	0.099	-6251.970
		TURKEYRETURN	0.096	-6256.290	0.099	-6251.370

The bold numbers show the significance at the 5% level.

Now, binary relationships examined between crude oil markets and stock markets. In order to fit data items by GARCH models, at first, the ARCH and GARCH effects should investigated. EViews6.0 is used to examine ARCH effects, and Oxmetrics6.0 is applied to test GARCH effects through a univariate model of ARMA(1,1)-GARCH(1,1), all data were statistically significant. As seen in Table 3, for Iran as the oil exporter, most constant conditional correlations are negative and statistically insignificant. Rather, for Turkey as the oil importer, these are positive and statistically significant. Turkey shows no difference of constant conditional correlations between two indices, whereas Iran has a smaller positive correlation coefficient for the relationship between WTISPOT-IRANTEDPIX. The TSE indices have positive correlation coefficients with WTIFUTURE1, and different results have obtained for correlation between two indices.

Table 4- Data Estimations Using the DCC Model

Binary relationships			ARMA(1,1) -DCC- IGARCH(1,1)	Log-likelihood	ARMA(1,1) -DCC- GJR(1,1)	Log-likelihood
Between markets	WTISPOT	IRANTEPIX	-0.004	-4060.770	-0.012	-4066.490
		IRANTEDPIX	0.001	-4045.030	0.004	-4080.220
		TURKEYPRICE	-0.093	-6412.320	0.101	-6418.330
		TURKEYRETURN	-0.094	-6412.010	0.101	-6417.990
	WTIFUTURE1	IRANTEPIX	0.003	-3950.270	0.005	-3956.630
		IRANTEDPIX	0.001	-3936.130	0.009	-3976.470
		TURKEYPRICE	0.088	-6293.590	0.098	-6293.790
		TURKEYRETURN	0.088	-6293.040	0.099	-6293.140
	WTIFUTURE2	IRANTEPIX	-0.001	-3842.650	-0.002	-3847.770
		IRANTEDPIX	-0.007	-3828.660	-0.003	-3868.890
		TURKEYPRICE	0.094	-6180.740	0.109	-6180.350
		TURKEYRETURN	0.095	-6180.160	0.110	-6179.680
	WTIFUTURE3	IRANTEPIX	-0.002	-3761.210	-0.002	-3768.430
		IRANTEDPIX	-0.007	-3747.410	-0.002	-3788.380
		TURKEYPRICE	0.099	-6096.740	0.112	-6096.310
		TURKEYRETURN	0.100	-6096.150	0.112	-6095.640
	WTIFUTURE4	IRANTEPIX	-0.001	-3707.430	-0.001	-3711.760
		IRANTEDPIX	-0.005	-3693.70	-0.001	-3730.270
		TURKEYPRICE	0.098	-6046.530	0.113	-6046.090
		TURKEYRETURN	0.099	-6045.970	0.114	-6045.430
	BRENTSPOT	IRANTEPIX	-0.003	-3907.340	-0.004	-3908.560
		IRANTEDPIX	-0.003	-3897.820	0.007	-3929.890
		TURKEYPRICE	0.094	-6239.660	0.116	-6236.590
		TURKEYRETURN	0.005	-6239.080	0.117	-6235.940

The bold numbers show the significance at the 5% level.

Table 4 shows dynamic conditional correlations between stock and crude oil markets. For Iran, the results are the same. However, Turkey reveals a statistically insignificant coefficients and difference correlation between two indices.

Table 5- Results for Coefficients in the DCC Model

Binary variables			ARMA(1,1)-DCC-GARCH(1,1)		ARMA(1,1)-DCC-GJR(1,1)	
			$\hat{\theta}_2$	$\widehat{\theta_1}$	$\hat{\theta}_2$	$\widehat{\theta_1}$
Between markets	WTISPOT	IRANTEPIX	0.000	0.514	0.000	0.001
		IRANTEDPIX	0.000	0.001	0.000	0.004
		TURKEYPRICE	0.006	6.586	0.015	0.971
		TURKEYRETURN	0.006	0.994	0.015	0.971
	WTIFUTURE1	IRANTEPIX	0.000	0.791	0.000	0.954
		IRANTEDPIX	0.000	0.690	0.000	0.018
		TURKEYPRICE	0.009	0.987	0.010	0.985
		TURKEYRETURN	0.009	0.987	0.010	0.984
	WTIFUTURE2	IRANTEPIX	0.000	0.716	0.000	0.001
		IRANTEDPIX	0.000	0.739	0.000	0.001
		TURKEYPRICE	0.011	0.985	0.014	0.980
		TURKEYRETURN	0.011	0.985	0.014	0.979
	WTIFUTURE3	IRANTEPIX	0.000	0.695	0.000	0.295

Binary variables		ARMA(1,1)-DCC-GARCH(1,1)		ARMA(1,1)-DCC-GJR(1,1)	
		$\hat{\theta}_2$	$\hat{\theta}_1$	$\hat{\theta}_2$	$\hat{\theta}_1$
	IRANTEDPIX	0.000	0.737	0.000	0.029
	TURKEYPRICE	0.011	0.985	0.015	0.977
	TURKEYRETURN	0.011	0.984	0.016	0.976
WTIFUTURE4	IRANTEPIX	0.000	0.685	0.000	0.411
	IRANTEDPIX	0.000	0.685	0.000	0.038
	TURKEYPRICE	0.012	0.984	0.018	0.974
	TURKEYRETURN	0.012	0.983	0.018	0.973
BRENTSPOT	IRANTEPIX	0.000	0.734	0.000	0.499
	IRANTEDPIX	0.000	0.800	0.000	0.007
	TURKEYPRICE	0.015	0.983	0.022	0.971
	TURKEYRETURN	0.012	0.988	0.023	0.970

From Table 5, since $\hat{\theta}_1$estimates the impact of past shocks on current constant conditional correlations, and $\hat{\theta}_2$ indicates the previous dynamic conditional correlations effects, and because there are statistically significant dynamic correlations for Turkey, it can conclude that Turkey conditional correlations are not constant. For Iran, correlation coefficients are almost statistically insignificant and obtained lower values than Turkey. Now, the research hypotheses evaluated.

The first hypothesis: For the TSE, there is no difference between the CCC and DCC models based on the maximum likelihood statistics, and the GIR is the best submodel. For Turkey, the DCC model has priority over the CCC model for all cases. Furthermore, as $\hat{\theta}_2$ indicates the previous dynamic correlations for the DCC and most coefficients are statistically significant on the Istanbul stock exchange; it clearly means that conditional correlations for Turkey are not constant (Tables 3-5).

The second hypothesis: Based on the significant levels of coefficients and the maximum likelihood statistics, world crude oil markets can better define volatilities on the Istanbul stock exchange, which in turn justifies the importance of crude oil prices on Turkish stock markets (Tables 3-5).

The third hypothesis: According to significant coefficients obtained from fitting models for both Tehran and Istanbul stock exchange markets, details in spot and futures markets indicate that the Brent spot market defines well the stock markets volatilities than the WTI market. Among the WTI futures markets, when maturities are longer, the relationships will expressed much better, this confirms the financial markets as long-run maturity markets (Tables 3-5).

The fourth hypothesis: Due to the lack of statistically significance ARCH and GARCH effects in the models, except for WTISPOT-TURKEYPRICE and WTISPOT-TURKEYRETURN in the ARMRA(1,1)-DCC-IGARCH(1,1) model where previous conditional volatilities on the Istanbul stock exchange moves toward the WTI spot market, there is no evidence for one- or bidirectional volatility spillovers between returns of crude oil and stock markets. In this case, Iran (as the exporter) and Turkey (as the importer) show the same result (Table 5).

6. Conclusion and Remarks

The current research aims to evaluate the relationship between price returns of major crude oil markets and stock markets of an exporter (Iran) and an importer (Turkey). As pretests confirmed, data items were fitted by using two models of the Constant Conditional Correlation (CCC) (Bollerslev, 1990) and the Dynamic Conditional Correlation (DCC) (Engel, 2002) with submodels of IGARCH and GIR. The result indicated nonzero coefficients and asymmetric conditional distribution. Therefore, increasing in volatilities due to decreased prices was higher than increased prices for the equal magnitude. Empirical differences between the Tehran and Istanbul stock exchange market included: the TSE correlation coefficients were negative and smaller, and statistically insignificant, while the Istanbul stock exchange had positive and statistically significant coefficients and was nearly ten times larger than TSE. This result implied the small effects of oil prices on the TSE and large effects on the Istanbul stock market. The insignificant coefficient for the TSE may be the product of the effects of undetermined variables, like inflation and exchange rate. The present finding is consistent with other studies conducted by Jones and Kaul [8], and Choi and Hammoudeh [25] regarding the small and negligible effects of oil futures price returns on the market index and a better explanation of the TSE stock market volatility; also by Fama [7], Jones and Kaul [8], Aloui and Jammazi [16], and Hammoudeh and Choi [22] regarding the significant role of oil prices rising in determining the volatility on the Istanbul stock exchange, and by Choi and Hammoudeh [25] for studying the more volatility persistence of the Brent rather than the WTI.
It recommends conducting future research based on:

1. Real prices,
2. To evaluate the calendar effects of Iranian holidays and the working days of global crude oil markets,
3. To investigate the effects of Dubai oil market on the TSE, and
4. To study the lead and lag effects in the relationship between crude oil and stock markets.

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