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Oil Price Uncertainty and Stock Returns in Tehran Stock Exchange as a sanctioned emerging market: An ARDL Bounds Testing Approach

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Abstract

The purpose of this paper is to investigate the relationship between uncertainties of crude oil prices, and the Tehran Stock Index (TEPIX), under the conditions of economic sanctions, in the Tehran Stock Exchange. Using a Bounds Testing Approach of Autoregressive Distributed Lag (ARDL) model, research has been done during the period from 2012 to 2022. The results show that short and long-run oil price movements do not have relationship with market returns. Inflation does not have relationship with the market returns in the long run but have negative relationship in the short time. Changings of dollar prices has positive relationship with the market returns in the short and long run. Also, there is negative relationship between economic sanctions and stock index in the long run and not in the short run. This is one of the few empirical researches on the relationship between oil price uncertainty and stock returns in the context of Iran market and the first empirical research that studies the relationship in an economy under economic sanctions. The findings have significant policy implications for policymakers as they provide a reasonable explanation for the oil-based economy countries' stock market responses to various oil price changes. Considering the extension of sanctions to countries like Russia in recent years, results of this research will be able to shed light to economic situation of countries under similar sanctions.

Keywords Oil price Uncertainty, Economic Sanctions, Tehran Stock Exchange, ARDL Bounds Testing Approach.

Paper type Research Paper

1. Introduction

The capital market include the stock market is one of the most important markets in each country. The market is affected by other sectors of the economy (Bams *et al.,* 2017), including oil prices especially in countries with an oil-based economy. The stock market embedded many affecting variables. Although in some countries, these variables are almost constant, but the level of financial market impacts varies from a country to another (Li and Du, 2023). The developing economies are often dependent on non-productive resources to fund, while developed countries are producers, and these products are traded in domestic and overseas markets. Iran as a developing country is also dependent on oil revenues. As a result, oil prices are a major factor affecting the economy (Dagar and Malik, 2023). Therefore stock exchange also is affected as part of this economy.

Many economists believe that an increase in oil prices will trigger economic growth and increase inflation in oil-importing countries. This issue can be examined in different ways. On the one hand, rising oil prices have results in scarcity of energy as raw materials for manufacturing firms, which will increase the cost of firms to buy new capital goods, and in the long run will reduce the company's manufacturing capacity of economic entities in industrialized countries. This suggests a decrease in total supply and a rise in prices (Aharon *et al.,* 2023). On the other hand, if consumers expect a temporary increase in energy prices, they may decide to have fewer savings, which will reduce investment and raise prices. These countries, with more costs and risks, are fluctuating due to raising uncertainty from oil prices, which also affects stock prices (Anyars and Adabor, 2023).

The second group is the oil exporting countries, having rich natural resources, including oil and gas, which earn huge revenues from exports. These revenues may be due to a sudden increase in oil prices at a certain point in time (wind fall gains) (Maghyereh and Awartani, 2016). Earning extra income from oil exports and rising oil prices will create a phenomenon called "Dutch Disease" in these countries. This term was first used in 1977 by the London economist to

describe these situations. In the 1970s, some countries, such as UK and Iran, experienced this situation (Olanubi, 2023). For oil-exporting countries, higher oil prices will have a positive effect on more revenue and wealth. Also, higher oil prices will mean the immediate transfer of wealth from oil importing countries to oil exporting ones. If the governments of the oil exporter spend excess revenues to buy domestic goods and services, this will lead to the recovery of the economy, which may have a positive impact on the stock market (Samadi *et al.,* 2009).

Iran has a single-product economy with high dependence on oil and these revenues account for the major part of the country's income. Considering that changes in oil prices will result are country's income variations, the impact of these fluctuations on economic growth is essential; because economic growth is one of the main pillars of the development of each country (Shaykhmahmodi and Massoudnia, 2023). Iran's economy depends significantly on foreign exchange earnings from crude oil exports, and this dependence has been widespread throughout the entire fabric of this economy for many years to come (Mozafari, 2010). Therefore, it is important to examine the effects and consequences of oil price fluctuations on stock price index.

This research enriches the existing body of knowledge by investigating how both the level and volatility of crude oil prices influence the Tehran Stock Exchange (TSE). Critically, our analysis extends beyond the mere direct relationship between oil valuations and market performance; it simultaneously incorporates the roles of the US dollar exchange rate and domestic inflationary pressures—areas that remain conspicuously under-researched within the Iranian economic context. Furthermore, we advance this field of inquiry by introducing an entirely novel dimension: the economic repercussions of sanctions, a factor that has, to date, received no systematic attention in the relevant empirical literature. The main objectives of research are as follows:

- Investigating the trend of return on TSE overall index with an emphasis on the impact of crude oil price fluctuations.

- Investigating the effect of sanction on oil price - TSE return relationship.

Previous studies have examined the effects of oil price shocks and uncertainty on stock returns in various international markets, using different econometric methods and data sets. However, there is a lack of research on whether oil price uncertainty and dollar price and inflation rate affects stock returns in an emerging market under sanction, such as Iran. Iran is a major oil-exporting country that faces significant economic and political challenges due to the sanctions imposed by the US and other west countries. The sanctions have disrupted Iran's oil production and exports, as well as its access to international financial markets. Therefore, it is important to investigate oil price uncertainty influences the Iranian stock market, and whether the sanctions affect this relationship. This paper aims to fill this research gap by using monthly data from 2012 to 2022 and applying an econometric approach that captures the asymmetric and nonlinear effects of oil price uncertainty, dollar price, inflation rate and sanction on stock returns.

Given the importance and originality of this topic, the present study examines how fluctuations in both heavy and light crude oil prices relate to equity returns within Iran's stock market. Our work makes several distinctive contributions to the existing scholarship. To begin with, the bulk of prior research in this domain has been overwhelmingly centered on the United States and China. In contrast, our investigation stands among the rare empirical efforts that explore the oil price–stock return nexus in an oil-exporting nation at the aggregate market level, employing a Bounds Testing methodology. Furthermore, we adopt the Autoregressive Distributed Lag (ARDL) framework, which affords us the ability to capture both short-run dynamics and long-run equilibrium effects of oil price variations on market performance. Lastly, given the notable paucity of studies addressing the role of economic sanctions within Iran's capital markets, our findings offer much-needed empirical grounding to deepen comprehension of this complex and understudied phenomenon.

This paper may bear policy implications for stock market authorities. Armed with the data and figures on fluctuations in oil prices, dollar price and inflation rate particularly affect stock market indices, policymakers at both the firm and country levels, could have better informed decisions pertained to future business planning, possibly in their attempts of controlling fluctuations of oil prices, as well as maintaining economic growth and its stability. Also the effect of economic sanctions on the stock market is an interesting topic for research. For ease of navigation, this paper is divided into five main parts. We begin, after this introduction, with a discussion of the relevant theories and a walkthrough of what earlier researchers have discovered. Next, we detail how the study was carried out—covering both the analytical tools we used and the financial data we collected. Following that, we present what our model actually revealed, interpreting the numbers and their meaning in plain terms. We wrap things up in the final section, where we distill our core conclusions and offer practical suggestions for policymakers who might act on our results.

2. Theoretical Framework and Literature Review

This paper examines the relationship between oil prices and stock markets. It reviews the literature on both topics and identifies the main internal and external factors that influence stock prices. The literature also analyzes the complex and time varying causal effects between oil and stock markets, using different types of data and methods. The literature in general finds that oil price volatility affects stock market volatility and oil price forecasting, and that the impacts vary depending on the net oil-importing or net oil-exporting status of the country.

Stock prices are influenced by many factors, both internal and external to the company. Oil prices are one of the external factors that have a complex and time varying impact on stock markets, depending on the type of data, the direction of causality, and the nature of oil price changes. Oil price volatility also affects stock market volatility and oil price forecasting. Various methods are proposed to assess real investment decisions under uncertainty, especially in the oil industry (Fotros and Hoshidari, 2015).

In general, the first and most important factor that influences the investor's decisions in the stock markets is the stock price index. Therefore, having knowledge about the factors affecting stock prices is very important (Karimzade *et al.,* 2009). Naturally, there are many factors in shaping the information and views of the market sides and ultimately the stock price of the companies. Part of these is internal and some of them stem in the status of variables beyond the scope of the domestic economy. Accordingly, the factors affecting stock prices can be categorized endogenous and exogenous. Internal factors include factors affecting stock prices related to corresponding company's operations and decisions. These factors consist of earnings per share (EPS), dividend per share (DPS), price/income ratio (P/E), raising capital, stock split, and other in-company factors. External factors are out of the control of the company's management and affect the company's activities, unavoidably. These factors are events, transactions, and out-of-company decisions that affect stock prices.

Fluctuations in crude oil prices can profoundly shape investor behavior by influencing real economic activity and key macroeconomic indicators—including output growth, price levels, household consumption, and related variables—given that market sentiment remains highly responsive to shifts in the broader economic landscape (Ding et al., 2017; He, 2020; He et al., 2019; Ye et al., 2020; Jiang and Liu, 2021). Bouri et al. (2017) further affirm that oil price movements exert a significant influence on equity market performance.

The intricate and often non-stationary connection between petroleum markets and stock exchanges has drawn mounting interest from financial media, investment communities, policy circles, academic researchers, and the broader public in recent years. Motivated by this widespread attention, Degiannakis et al. (2018) undertook a comprehensive survey of the extant literature on this relationship. Their review reveals that the majority of empirical work concentrates on the directional influence of oil markets upon stock markets. However, they conclude that the nature and strength of causal linkages are highly contingent upon several factors: whether analysis employs aggregate market indices, sector-specific portfolios, or firm-level observations; whether the equity markets under consideration belong to net oil-importing or net oil-exporting

economies; whether oil price changes are modeled as symmetric or asymmetric; and whether the focus rests on anticipated versus unanticipated price shocks. Additionally, their synthesis indicates that oil price volatility tends to propagate into stock market volatility, while incorporating stock market performance measures consistently enhances predictive accuracy for both oil prices and their associated volatility. The authors also pinpoint a number of promising directions for future inquiry.

In a related contribution, Xiao et al. (2018) explore how oil price uncertainty—operationalized through the newly developed Oil Volatility Index (OVX)—affects stock returns in China. Employing quantile regression techniques, they find that OVX exerts its most pronounced influence during bearish market phases, with these effects being both negative and asymmetric in nature. Notably, they also observe that China's refined oil pricing reform attenuated the strength of the OVX–return relationship.

Uncertainty is an unpredictable change in an economic variable, and since these changes cannot be predicted in the future, it can have a great impact on other economic variables, so it cannot be treated with the same as a stereotype (marginal) problem, but it should be considered as the text, and accepted as an ever-present fact, and the theory and mechanism must be developed to counteract it (Moradpour Owladi *et al.,* 2012).

Although oil shocks can have a negative impact on the stock market due to uncertainties in financial markets, this issue depends on the nature of the shock (the demand side or supply side). If the shock is on the demand side, markets can have a positive response to this shock, and if the shock is derived from the supply side, the market response can be negative (Fotros and Hoshidari, 2015).

Theoretically, oil shocks can affect different channels on the stock price index, but the most worried concerns are the effects of oil price fluctuations on macro variables and the economic environment of the community. Economic theory suggests that the price of each asset should be determined by its discounted cash flow (Samadi *et al.,* 2009). An increase in oil prices due to rising oil revenues in

oil exporting countries has a positive impact on the economic performance of these countries (Merrill and Orlando, 2020).

The competition between oil producers continued to pacify as the price went down. Hence, OPEC's price-control policy, which was implemented through the establishment of quotas for its members, was defeated. In 1990, due to the outbreak of the Gulf War and the Iraqi invasion of Kuwait, followed by Kuwait's discontinuation of oil production, the continued rise in oil prices has had a staggering effect on the world economy. In addition, an increase in global oil consumption and a 50% decline in Russian oil production in the first half of the 1990s, although resulting in rising oil prices, did not last to the 1997-1998 financial crisis in Asia (Esmaeil Nia and Shafiei, 2009).

A diverse body of empirical work has sought to disentangle the intricate links between oil price uncertainty and stock market behavior across different national contexts and methodological frameworks. Caporale et al. (2015), for instance, focus on China, employing a weekly panel of ten sectoral indices from January 1997 to February 2014 to trace how the influence of oil price ambiguity on stock prices has waxed and waned over time.

Shifting attention to Africa's largest oil producer, Abeng (2018) examines the Nigerian case, where he explores how shocks emanating from oil price uncertainty ripple through both sectoral stock return volatilities and real GDP. His study distinguishes itself through a series of methodological innovations: it breaks down the aggregate oil effect into sector-specific components, incorporates variance-based (second-moment) analysis, capitalizes on high-frequency micro-data, and cross-validates results using multiple estimation techniques. Beyond these analytical contributions, Abeng offers concrete policy prescriptions, calling for proactive oil price surveillance, foreign exchange market stabilization, and the gradual elimination of structural bottlenecks—particularly inadequate infrastructure and the economically distortive fuel subsidy regime.

Adopting a broader cross-country lens, He et al. (2022) investigate the OVX's capacity to shape the risk-return tradeoff in both oil-importing and oil-exporting

stock markets, utilizing extended GARCH-M models. Their results reveal a consistent pattern across country groups: oil price uncertainty exerts a palpable influence on the risk-return dynamic. When uncertainty subsides, a positive correlation between risk and return tends to emerge; conversely, when uncertainty escalates, this positive relationship typically deteriorates and frequently flips to negative in the majority of countries sampled. Moreover, the authors find that variations in uncertainty generally suppress the risk-return linkage, with the asymmetric dampening effect being substantially more acute in exporter economies over the full study period. The authors also probe the crisis-sensitivity of their findings, comparing the 2008 global financial meltdown with the subsequent recovery phase. Intriguingly, they discover that post-crisis markets proved more vulnerable to OVX shifts than during the crisis itself—likely because the extraordinary chaos of the financial implosion rendered all other sources of uncertainty comparatively less salient.

The temporal conditioning of oil-stock relationships receives careful attention from Tse (2022), whose empirical work reveals that the dampening effect of oil price uncertainty on stock returns is a phenomenon of the post-2002 era, achieving statistical significance only over the 2003–2020 span; the preceding 1984–2002 period, by contrast, yields no such relationship. The inverse dynamic—stock market uncertainty influencing oil returns—proves inconsequential across both intervals. Tse further notes that oil price ambiguity assumes heightened relevance during financial crisis episodes, although he finds no robust bidirectional causality in either returns or volatilities between the two markets.

Expanding the geographical canvas, Rodríguez Benavides et al. (2019) turn their attention to Mexico, where they investigate the transmission of international oil price uncertainty into domestic equity valuations. Their results suggest that the immediate effect is negligible; however, a more nuanced picture emerges over the short run, as the Mexican stock market displays asymmetrical responses to positive versus negative oil price shocks.

Completing this triad of country-specific studies, Ahmad (2019) surveys six Gulf states, examining both the level and the variability of oil prices as determinants of stock market outcomes. The evidence he assembles points to a consistent conclusion: irrespective of the specific Gulf market under consideration, oil price changes and their associated volatility leave a significant imprint on stock returns.

The impact of oil prices on stock returns in oil-exporting countries occurs through several channels, which are as follows:

1. Increased Government Expenditures: With rising oil prices in oil-exporting countries, government revenues are rising dramatically. In most oil-exporting countries, there is no proper mechanism for using oil revenues, and these increases in foreign exchange earnings are transmitted directly to the state budget and increase government spending. As government expenditures increase, aggregate demand in the economy increases, and through this process, capital increases in firms, thereby increasing stock returns (Aharon *et al.,* 2023).

2. Adjustments in exchange rates: another channel affecting mechanism of rising oil prices on the macroeconomic situation of oil-exporting countries is reflected in their economic structure. The rise in oil prices in general leads to the transfer of income from importing countries to exporting countries, and changes the trade balance of countries. The effect of rising oil prices on the economies of the OPEC member countries depends on several factors, most notably how to use and spend oil revenues (Basher and Sadorsky, 2006).

The high oil prices face the oil-exporting countries with the problem of how to use and reap the revenues generated by the sale of oil. These countries will be able to reduce their previous foreign debts from these sources and, on the other hand, they can save surplus in the reserve funds for future costs; they will also be able to finance capital projects but, as discussed in the previous sections, it should not be assumed that the effect of the high oil prices on the economies of oil exporting countries is always contrasting the importing ones (Behboudi *et al.,* 2009). According to the above, another way of leaking the effects of oil

price volatility into the economies of the oil-exporting countries is referred to their economic structure. In the economic literature, the problem created in these structures is described as Dutch disease and the main cause of these problems is the exchange rate fluctuations. The Dutch disease actually refers to the problems caused by anti-industrialization, which emerged in the Netherlands for the first time since the exploration of natural gas reserves in the early 1960s. In general, Dutch disease occurs when the country gains huge foreign monies. This money can be in form of loans and borrowings from foreign sources or the income generated by rising prices for natural resource exports, such as oil and gas. When this income is injected into the economy, with the assumption of its absorption from the channel of monetary and fiscal policies, the demand side of the domestic economy will grow rapidly, and subsequently prices will upward, so that these price increases depend on the supply reaction with respect to the excess demand (Dagar and Malik, 2023). On the other hand, additional trade demand is provided for goods traded through imports, but in contrast, the increase in demand for non-tradable goods because of the nature of these types of goods in international trade, which cannot be fitted and be imported to secure the demand, causes their prices to rise, and, given the real exchange rate, with the relative increase in the prices of non-tradable goods with respect to tradable ones, the exchange rate will be reduced, or in other words, the national currency will be strengthened. The decline in the real exchange rate reflects the fact that the cost of domestic production of commodities has grown to tradable commodities and, if global price stability is in place, such a decline in the real exchange rate leads to a sharp decline in international competitiveness and reduces the efficiency of national firms (Anyars and Adabor, 2023).

Since the developing countries, especially the oil-exporting ones, are seeking to be industrialized, the price volatility of oil is more important for them, because on the one hand, their needs for oil and energy are increasing in the direction of industrialization, and on the other hand, for oil-exporting countries, oil revenues are their main source of income. Because the resources of the developing

countries are higher energy, they are more affected by oil price changes (Basher and Sadorsky, 2006).

Broadstock and Filis (2014) investigated the relationship between oil prices and stock returns for both the United States and China over the period 1995 to 2013, using the correlation method, and concluded that the correlation between these two variables is clear and varies over time. They argued that China is more flexible in dealing with oil shocks.

The preceding review of the literature, combined with the stated research objectives, affirms that the connection between oil prices and stock returns represents a vibrant and policy-salient domain of inquiry, with evidence accrued from multiple economies attesting to its cross-border relevance. Our empirical findings carry a clear normative implication: deepened awareness among both investment communities and regulatory bodies concerning the transmission channels of oil price fluctuations would enhance the precision of their forward-looking assessments, thereby equipping them to absorb and offset the disruptive effects of oil-market turbulences. With this theoretical and empirical groundwork in place, the following two hypotheses emerge naturally from our analytical framework:

1. There is a positive relationship between heavy and light crude oil prices and Tehran Stock Exchange overall index (TEPIX).

2. There is a negative relationship between sanctions and Tehran Stock Exchange overall index (TEPIX).

3. Research Method

The research takes a correlative methodology in terms of nature and content, to analyze the correlation relationship using the secondary data includes the TSE index and oil prices, dollar price and inflation rate. This research has been conducted within the framework of deductive-inductive reasoning. The reason for using the correlation method is the discovery of relations between variables. In the present study, the correlation between fluctuations of the price of crude oil, also dollar price and inflation rate and Tehran Stock Exchange Index is calculated under the conditions of economic sanctions.

On the other hand, the present study is post-event (semi-experimental) that is, based on the analysis of past and historical information (the status of the return on the TSE index). Moreover, this research is an archival as well as analytical study based on the analysis of time series data. However, the research is applied and descriptive-correlational study in terms of aims and methods. In this study, oil price uncertainty have been considered and used to calculate the oil closing prices in each trading day of month. To capture the oil price fluctuation effects on the overall index of TSE (TEPIX), the monthly data and the latest figures from 2012 to 2022 are used.

In order to collect secondary information, the archival method has been used. The information related to theoretical foundations has been extracted from books, magazines, and specialized Persian and Latin papers and databases. To test the research variables relationship, the autoregressive distributed lag (ARDL) model has been used. This model is well illustrated by fluctuations of price of crude oil.

3.1. Econometrics Model

According to theoretical foundations, the model to examine the effect of oil price uncertainty on stock returns of the listed companies in the TSE during the period of 2012-2022 was monthly determined and derived in which measure the oil price impacts on the return on the overall index of TSE.

The following model (1) as an econometric model was used to examine the relationship between dependent variable and explanatory variables:

$$\mathrm{TEPIX}_t = \alpha_1 + \delta_2 \mathrm{HEAVYOIL}P_\mathrm{t} + \delta_3 \mathrm{LIGHTOILP}_\mathrm{t} + \delta_4 \mathrm{OVOLUME}_\mathrm{t} + \delta_5 \mathrm{DOLLARP}_\mathrm{t} + \delta_6 \mathrm{INFLATION}_\mathrm{j} + \varepsilon_\mathrm{t} \quad (1)$$

The model's explanatory variables are the Iran heavy and light crude oil prices (HEAVYOILP) and (LIGHTOILP), as well as the volume of barrels of Iran's oil exports (OVOLUME). It should be explained that empirical studies in Iran about the effects of sanctions, especially in finance, have rarely been done. In those few studies, the sanctions variable is often used as a dummy variable. For the first time, the present study has used the volume of Iran's exported oil

barrels by means of a ratio variable, as a proxy to measure sanctions. Because one of the main goals of the sanctions imposed on Iran, according to Nephew (2023), as the main architect of the sanctions against Iran, was their effect on reducing Iran's oil exports. Consequently, the greatest impact and effectiveness of sanctions is seen in the number of barrels of exported oil. Therefore, the further and more severe the sanctions, the less the number of barrels of oil exported. Furthermore, basic macroeconomic variables influencing stock market in Iran include dollar price (DOLLARP), and the inflation rate as a measure of inflation (INFLATION), has been employed as control variables. Tehran Stock Exchange Index (TEPIX) was used as the dependent variable.

The methodological foundation of this research rests upon the Autoregressive Distributed Lag (ARDL) model, a widely respected econometric tool introduced by Pesaran and Shin in 1995. Its enduring popularity in applied economics and financial research is no accident: the ARDL approach offers a suite of compelling advantages over its predecessors. Perhaps its most celebrated feature is its indifference to the integration order of the variables—a departure from classical cointegration techniques that demand strict I(1) stationarity. Under the ARDL umbrella, the investigator may proceed with confidence whether the data series are stationary at levels, I(0), or after one round of differencing, I(1). This flexibility is complemented by the method's remarkable performance in small samples, where it produces reliable estimates that many alternative procedures would compromise through systematic bias. Beyond these foundational strengths, the ARDL framework empowers researchers to transcend the short-term/long-term dichotomy, offering simultaneous visibility into immediate adjustment dynamics and enduring equilibrium relationships. Importantly, it also provides a coherent statistical foundation for testing the existence of cointegration, thereby confirming whether the variables move together in a stable, predictable fashion over the long haul. After short-term shocks are applied to the model, the ECM model could also be used to compute the speed of adjustment to the long-run equilibria. Also, because of the lack of correlation between the residuals in the ARDL model, as mentioned by Pesaran et al., 2001, endogeneity problems do not arise in this model. A noteworthy methodological

virtue of the ARDL bounds testing approach is its lack of stringent preliminary requirements—unlike traditional cointegration techniques, it does not necessitate that all variables be integrated of the same order prior to estimation. Nonetheless, the estimation of long-run coefficients demands prior verification of cointegration among the series, a condition evaluated through the computation of F-statistics within the bounds testing framework. The decision rule operates as follows: the calculated F-statistic is compared against two critical values—an upper bound and a lower bound. If the estimated statistic exceeds the upper critical value, the null hypothesis of no cointegration is rejected in favor of a stable long-run relationship. If, however, the statistic falls below the lower critical bound, the null hypothesis cannot be rejected, indicating the absence of cointegration (Pesaran et al., 2001). For the purposes of this study, equation (1) is expressed in ARDL form as model (2), which specifies the relationship linking Iran's heavy and light crude oil prices, the barrel volume of Iran's crude oil exports, and the Tehran Stock Exchange Index.

$$\Delta \mathrm{TEPIX} = \beta_0 + \sum_{i=1}^{n} \gamma_{1,i} \Delta\, \mathrm{TEPIX}_{t-i} + \sum_{i=0}^{n} \gamma_{2,i}\, \Delta \mathrm{HEAVYOILP}_{t-i} + \sum_{i=0}^{n} \gamma_{3,j}\, \Delta \mathrm{LIGHTOILP}_{t-i} + \sum_{i=0}^{n} \gamma_{4,i}\, \Delta \mathrm{OVOLUME}_{t-i} + \sum_{i=0}^{n} \gamma_{5,j}\, \Delta \mathrm{DOLLARP}_{t-i} + \sum_{i=0}^{n} \gamma_{6,i}\, \Delta \mathrm{INFLATION}_{t-i} + \theta_1 \mathrm{TEPIX}_{t-i} + \theta_2 \Delta \mathrm{HEAVYOILP}_{t-i} + \theta_3 \Delta \mathrm{LIGHTOILP}_{t-i} + \theta_4 \Delta \mathrm{OVOLUME}_{t-i} + \theta_5 \Delta \mathrm{DOLLARP}_{t-i} + \theta_6 \Delta \mathrm{INFLATION}_{t-i} + \varepsilon_t \quad (2)$$

The null hypothesis of no cointegration between variables is: $H_0: is\ \theta_1 = \theta_2 = \cdots = \theta_7 = 0$ and the alternative hypothesis is $H_1: \theta_1 \neq \theta_2 \ldots \neq \theta_7 \neq 0$. The determination of lag length represents an essential preliminary step in ARDL estimation, with several information-theoretic criteria available to guide this selection—namely, the Akaike Information Criterion (AIC), the Schwartz Bayesian Criterion (SBC), and the Hanna-Quinn Criterion (HQ). This paper elects to employ the Schwartz Information Criterion (SIC) for lag selection in equation (2), a choice motivated by its consistency properties and its suitability for the present sample size. Upon establishing the existence of cointegration through the bounds testing procedure, the ARDL model specified in equation

(3) is subsequently utilized to estimate the long-run equilibrium coefficients and their associated statistical significance.

$$\mathrm{TEPIX} = \beta_0 + \sum_{i=1}^{p} \gamma_{1,i}\, \mathrm{TEPIX}_{t-j} + \sum_{i=0}^{q} \gamma_{2,i}\, \mathrm{HEAVYOILP}_{t-i} + \sum_{i=0}^{s} \gamma_{3,i}\, \mathrm{LIGHTOILP}_{t-i} + \sum_{i=0}^{v} \gamma_{4,i}\, \mathrm{OVOLUME}_{t-i} + \sum_{i=0}^{t} \gamma_{5,j}\, \mathrm{DOLLARP}_{t-i} + \sum_{i=0}^{h} \gamma_{6,i}\, \mathrm{INFLATION}_{t-i} + \varepsilon_t \quad (3)$$

The Schwartz (SIC) criteria were used to identify the appropriate lag values in equation (3). Finally, coefficients of the short-run model and error-correction term (ECM) are assessed by the following model (4):

$$\mathrm{TEPIX} = \gamma_0 + \sum_{i=1}^{p} \gamma_{1,i}\, \Delta\mathrm{TEPIX}_{t-i} + \sum_{i=0}^{q} \gamma_{2,i}\, \Delta\mathrm{HEAVYOILP}_{t-i} + \sum_{i=0}^{s} \gamma_{3,i}\, \Delta\mathrm{LIGHTOILP}_{t-i} + \sum_{i=0}^{v} \gamma_{4,j}\, \Delta\mathrm{OVOLUME}_{t-i} + \sum_{i=0}^{t} \gamma_{5,i}\, \Delta\mathrm{DOLLARP}_{t-j} \sum_{i=0}^{h} \gamma_{6,i}\, \Delta\mathrm{INFLATION}_{t-j} + \varphi ECM_{t-1} + \vartheta_t \quad (4)$$

Equation (4) introduces the error correction term (ECM_{t-1}), which captures the notion that fluctuations in the dependent variable arise from two distinct sources: the disequilibrium from the long-run equilibrium path—as reflected in the error correction component—and the short-term perturbations induced by the remaining explanatory variables. This specification effectively bridges the short-run dynamics and the long-run behavior of the variables under investigation. The optimal lag structure for this model is determined following the same procedure as in equation (2), with the Schwartz Information Criterion (SIC) serving as the selection metric. In this framework, the coefficients denoted by γ represent the short-run dynamic parameters, while φ—the coefficient attached to the error correction term (ECM_{t-1})—signifies the speed of adjustment toward long-run equilibrium following a deviation.

4. Empirical Findings

4.1. Descriptive Statistics

Table 1 presents a summary of the descriptive statistics for the variables employed in this study. The descriptive measures are further detailed in Panel A

of Table 2, while Panel B of the same table displays the correlation matrix illustrating the pairwise relationships among the variables.

Table 1. Summary statistics of variables for the period of 2012–2022.

Variables	HEAVYOILP	LIGHTOILP	DOLLARP	INFLATION	OVOLUME	TEPIX
Panel A: Descriptive statistics						
Avg	71.47	72.01	06173.7	0.028	1416000	415243.2
Median	64.25	65.05	38512.50	0.016	1443500	83796.45
Maximum	122.50	122.80	368276.0	0.700	2545000	1961622.
Minimum	17.20	14.90	6117.00	-0.003	350000	24400.90
Std. Dev	26.34	26.07	100263.6	0.066	685410	560700.1
Panel B: Correlation matrix						
HEAVYOIL	1.00					
LIGHTOIL	0.99	1.00				
DOLLAR	-0.14	-0.19	1.00			
INFLATION	0.26	0.23	0.50	1.00		
VOLUME	0.10	0.15	-0.68	-0.37	1.00	

Source: research findings

As the summary statistics show, the average price of a barrel of heavy crude oil during this period was around 71.5$, with a maximum of 122.5$ and a minimum of 17.2 $. The average price of a barrel of light crude oil during this period was around 72$, with a maximum of 122.8$ and a minimum of 14.9$. The average of the number of barrels of Iran's oil exports barrel of oil equivalent was 1,416,000bbl, with a maximum of 2,545,000bbl and a minimum of 350,000bbl. The empirical findings reveal that, with a few exceptions, the pairwise correlations among the variables remain relatively modest. The limited instances of higher correlation values suggest some degree of co-movement between those particular variables. Overall, however, the generally low correlation coefficients indicate that multicollinearity among the explanatory variables is unlikely to pose a significant concern for the estimation.

4.2. Variable Stationary Test

Stationary or reliability of time series variables are of undeniable importance in the subject of econometric estimates. In this section, the stationary of variables is examined using Augmented Dickey Fuller (ADF) unit root test. This test examined two hypotheses:

- Null hypothesis: the variable has a unit root.
- Alternative hypothesis: the variable is lack of unit root.

Stationary test results of the model variables using the ADF in table 2 show that apart from INFLATION, all variables are non-stationary at the level form. And all of the other model variables are stationary at the first-differenced form and none of the variables are I(2) series. Consequently, we could use ARDL bounds testing procedures to consider the long-run cointegration between energy prices and investor sentiment.

Table 2. Augmented Dickey-Fuller (ADF) Unit Root Test

	At level		**First difference**		**Integration Order**
Variables	**t-Statistic**	**Prob**	**t-Statistic**	**Prob**	
TEPIX	-0.185	0.936	-8.558	0.00	I(1)
HEAVYOILP	-2.779	0.064	-8.148	0.00	I(1)
LIGHTOILP	-2.253	0.188	-9.265	0.00	I(1)
DOLLARP	-0.026	0.953	-7.482	0.00	I(1)
INFLATION	-4.664	0.0002	----	----	I(0)
OVOLUME	-1.690	0.433	-11.352	0.00	I(1)

Source: research findings

4.3. Dynamic estimation of the model

Estimating the dynamic relationship between TEPIX, Iran heavy and light crude oil, volume, and other variables, has been shown in table 3 and indicating that explanatory variables explain 99 percent of the dependent variable. The findings point out that the price of volume and dollar price affect TEPIX. On the other hand, heavy and light oil prices and inflation does not have statistically significant influence on the TEPIX index.

Table 3. Results of estimating the dynamic relationship with ARDL model (1, 0, 0, 0, 0, 1)

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob**
C	0.361	0.288	1.253	0.212
TEPIX(-1)	0.921	0.022	41.189	0.000
OVOLUME	-0.069	0.016	-4.157	0.0001
LIGHTOILP	0.323	0.202	1.601	0.112
INFLATION	-0.013	0.011	-1.152	0.251
HEAVYOILP	-0.333	0.195	-1.704	0.090
DOLLARP	0.451	0.116	3.874	0.0002
DOLLARP(-1)	-0.354	0.117	-3.018	0.0031
R^2=0.99	F=4446.12 (000)	D.W=1.65		
Diagnostic tests				
Test	χ^2	Prob		
Serial Correlation	6.041	0.109		
Heteroscedasticity	1.958	0.161		

Source: research findings

In the context of ARDL estimation, the selection of an appropriate lag structure constitutes a critical methodological decision. Employing the Schwartz-Bayesian Criterion (SBC) as the guiding metric—which imposes a penalty for additional lags in favor of parsimony—the optimal specification identified for the model is ARDL (1, 0, 0, 0, 0, 0, 1). This criterion was deliberately chosen for its ability to balance goodness-of-fit against model complexity, thereby facilitating a judicious lag selection.

The lower portion of Table 3 reports the battery of diagnostic tests conducted to validate the estimated model. The Durbin-Watson and Breusch-Godfrey tests collectively confirm the absence of serial correlation in the residuals, as evidenced by p-values exceeding the conventional 0.05 threshold (χ^2 p-value > 0.05). Similarly, the ARCH test results indicate that the residual variance is homoscedastic, with the associated p-value also surpassing the 0.05 significance level. Regarding the assumption of normally distributed errors, Brooks (2019) contends that when the sample size is sufficiently large and other classical regression assumptions are satisfied, formal testing for residual normality becomes unnecessary and may be dispensed with.

4.4. Bounds tests for cointegration

The cointegration among variables will be investigated using the Pesaran ARDL-bound testing approach (Pesaran *et al.,* 2001). Table 4 provides the calculated F-statistics at various significance levels and crucial values. As earlier stated, if the estimated F-statistic is above the critical value, the null hypothesis of no cointegration is rejected. At a 5% and 1% level of significance, the F-statistics is far above the critical value (5.33> numbers in I(0) and I(1)). Consequently, the null hypothesis positing the absence of cointegration is decisively rejected. This finding provides empirical confirmation that the variables under investigation share a stable long-run equilibrium relationship.

Table 4. F-Bounds tests for the existence of a long-run cointegration

F statistics	Critical bounds	I(0)	I(1)
5.33	10%	2.08	3

	5%	2.39	3.38
	1%	3.06	4.15

Source: research findings

4.5. Long-Run Estimation

Following the confirmation of a long-run cointegrating relationship among the variables, the long-run coefficients are estimated utilizing equation (3), with the results presented in Table 5. The estimation outcomes reveal that while the coefficients associated with both heavy and light crude oil prices fail to attain statistical significance, the coefficient for the Dollar price is positively signed and statistically significant. Conversely, the coefficient for the volume of crude oil exports (measured in barrels) is statistically significant but carries a negative sign. These findings imply that, over the long term, neither heavy nor light oil prices exert a meaningful influence on the Tehran Stock Exchange Index within the Iranian equity market. The dollar price coefficient of 1.233 implies that a one percent increase results in a 1.233 percent increase in Tehran stock index (TEPIX) in the long term. Also the volume coefficient of -0.884 implies that a one percent decrease in the number of barrels of Iran's oil exports results in a 0.884 percent decrease in Tehran stock index (TEPIX) in the long term.

Table 5. ARDL long-run coefficient

Variable	Coefficient	Std. Error	t-Statistic	Prob
HEAVYOILP	-4.232	2.902	-1.458	0.147
LIGHTOILP	4.107	2.960	1.387	0.167
DOLLARP	1.233	0.172	7.156	0.0000
INFLATION	-0.165	0.136	-1.209	0.229
OVOLUME	-0.884	0.296	-2.980	0.003
C	4.584	4.144	1.106	0.270

Source: research findings

The fact that Iran as a country under consideration economic sanctions is an oil exporter so explains the results on the relationship between economic sanctions and the Tehran stock index (TEPIX). It is a fact that most of the major oil companies in Iran are state-owned and have not listed in the stock market, therefore oil industries make up a small part of the companies on the Tehran Stock Exchange, so the increase in the price of crude oil does not have much effect on the index of the Tehran Stock Exchange. On the other hand, Tehran Stock Exchange is known for being commodity-oriented, so considering that a large part of the products of such companies are exported, the increase in the

price of the dollar has a direct effect on the increase on the index of Tehran Stock Exchange. On the other hand, the tightening of economic sanctions will increase the production and export costs as well as the exchange costs of listed companies, which will reduce the profits of such companies and naturally cause a decrease in the stock market index.

4.6. ECM Test and Short-Term Dynamic Relationship

Table 6 presents the short-run estimation results alongside the error correction term (ECM) coefficient. The short-run findings largely mirror those of the long-run analysis in terms of sign direction and remain consistent with theoretical expectations. In the short term, as in the long term, heavy and light oil prices along with the inflation rate exert no statistically significant influence on the Tehran Stock Exchange Index.

A critical component of the short-run dynamics is the estimation of the ECM coefficient. The lagged error correction term ($ECMt_{-1}$) carries the expected negative sign (-0.084) and is statistically significant, thereby corroborating the existence of a cointegrating relationship among the variables. Additionally, the Dollar exchange rate exhibits a positive and significant effect on the Tehran Stock Exchange Index in the short run; however, as anticipated, the magnitudes of the estimated short-run coefficients are smaller than their long-run counterparts. Finally, the coefficient for economic sanctions does not achieve statistical significance in the short-run specification.

Table 6. Short Run Dynamic of ARDL and ECM Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob
C	0.586	0.113	5.169	0.0000
D(OVOLUME)	-0.038	0.041	-0.934	0.351
D(LIGHTOILP)	0.181	0.175	1.037	0.302
D(INFLATION)	-0.023	0.011	-1.932	0.055
D(HEAVYOILP)	-0.057	0.189	-0.302	0.763
D(DOLLARP)	0.473	0.114	4.136	0.0001
ECM (-1)	-0.084	0.016	-4.985	0.0000
R^2=0.31	F=8.430 (000)	D.W=1.53		

Source: research findings

The coefficient of $ECMt_{-1}$ indicates the speed of the adjustment from the short-run to the long-run equilibrium in response to external shocks. An error

correction coefficient falling within the range of 0 to -1 indicates convergence toward the long-run equilibrium trajectory. In the present case, the estimated $ECMt_{-1}$ coefficient stands at -0.084. This implies that approximately 8.5% of any disequilibrium originating from shocks in the preceding month is corrected and reverts to the long-run equilibrium path within the current month.

4.7. Model stability test

As a final diagnostic step, the stability of the estimated model was assessed using the CUSUM test. The corresponding plot, presented in Figure 1, demonstrates that the CUSUM statistics remain well within the 95% confidence bounds throughout the sample period. Consequently, the null hypothesis of coefficient stability cannot be rejected at the 5% significance level over the 2012–2022 timeframe.

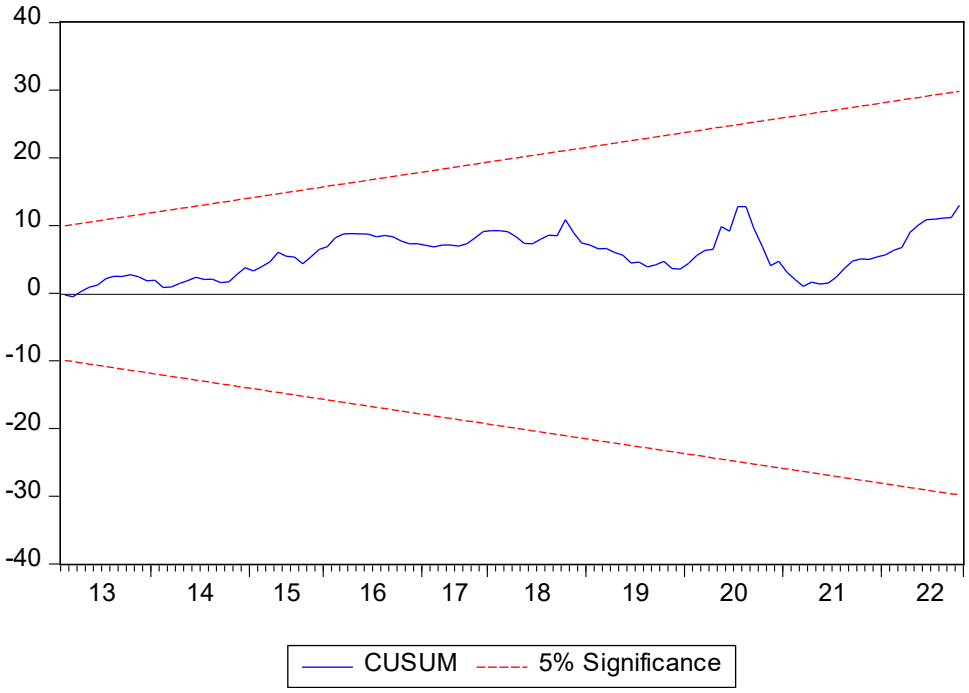


Figure 1. Stability tests by CUSUM

5. Conclusions and Recommendations

The purpose of this study was to examine the relationship between price fluctuations of Iran crude oil, and stock index, under the conditions of economic sanctions, in the Tehran Stock Exchange. The results of the estimation of the

autoregressive distributed lag (ARDL) model showed that heavy and light oil prices do not have relationship with the market returns in the short or long run, in Tehran Stock Exchange. As a result, the first hypothesis is rejected. The results contradict those of Ahmad (2019) that concludes oil price variations and volatility impact the stock returns in all the Persian Gulf stock markets; and Basher and Sadorsky (2006) which state that oil price risk impacts stock price returns in emerging markets. Of course, Iran is not included in their study. It can be concluded that oil prices would not lead to a relationship with the market returns in the long time or short time. In other words, with the occurrence of changing of Iran crude oil prices, the total stock index is not change. Iranian capital market activists know that oil companies are usually state-owned, and the increase and decrease in oil prices mainly affects other macro-economic variables, such as the government's income, and not the income of listed companies. Therefore, the findings of this research are compatible with field observations. It is obvious that the relationship between oil income and the stock market index can be different in each country, because the economic conditions and the presence of oil companies in the stock market of each country are not the same and have significant differences, and logically, in each country, the impact of an increase in the price of oil on the stock index, will also have different effects. These results are consistent with our priori expectations.

Also, the results showed that inflation do not have relationship with the market returns in the long run but have negative relationship in the short time, that shows the effects of rising inflation in increasing the money available to the public in short time (for example, due to the increase in grant loans or expansionary financial policies) in line with increasing the return on competing assets due to the speculative demand for these assets, accelerates the process of withdrawal from the stock market and its transfer to the competing parts and finally lead to stock market stagnation. Which may be explained by the rise in oil prices has led to the higher economic returns in competing financial assets (such as coins, gold, currencies, etc.) and consequently transfers of capital from the stock market to these sectors.

Moreover, the results showed that changing of dollar prices have positive relationship with the market returns in the short or long run, which is the expression of the income of stock exchange companies and as a result the increase of Tehran Stock Exchange index. The findings indicate that as Tehran's capital market is commodity-oriented, and usually exports with a higher dollar prices increase the income of export companies in Tehran Stock Exchange, which results in an increase in the index.

The results also, as we expected, confirm that there is negative relationship between economic sanctions and stock index in the long run and not in the short run. Unsurprisingly, the effects of sanctions appear in the long term. As a result, the second hypothesis is accepted. Due to the lack of a similar study that measured sanctions as a ratio variable, it was not possible to compare the results of second hypothesis of this study with previous studies.

The following recommendations can be provided to interested users:

Investors in the stock market as well as new investors in an oil country like Iran need to be aware of the effects of oil price fluctuations on the stock price index, and the volatility of the price index is not merely a criterion for assessing profitability and choosing new stocks. Given the fact that oil volatility is an exogenous factor that managers do not have any effect on it, corporate finance executives must focus on their actual performance and profitability in their assessment. On this basis, it is necessary to consider the short and long-term vision in analyzing and decisions so as not to mislead.

It is suggested that, in periods of stagnation with long-term sustainability in the stock market, if it coincides with the continuous increase in the world price of crude oil, by changing macroeconomic contraction and expansion policies, such as issuance of equity and debt securities, lowering interest rates, the development and diversification of a variety of new financial instruments, etc., the expansionary effects resulting from increased shocks of oil prices to the economy would be prevented and the increase in oil prices, as a continuation of the recession for the return on the stock market to be removed, and the stock market beat the recession.

Given the impact of oil price changes on stock returns, stock market investors, including real and institutional shareholders, investment companies and funds, need to take changes in oil prices into their investment decisions as an exogenous variable (determined on international markets) to create an optimal stock portfolio and determine the investment (short or long) horizons. It seems that reducing the dependence of the Iranian economy on oil revenues can help to reduce the risk of investing in the TSE and provide incentives for more investment in the stock market. The relationship between the oil price fluctuation and the return on the capital market in Iran should be checked to better clarify the effect of oil and its price fluctuations on Iran's economy. The effect of oil price fluctuations on the short-run and long-term returns of initially public offered stocks in TSE is also suggested for further studies.

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