IJEP International Journal of New Political Economy

DOI: 10.52547/jep.2.2.257

Investigating the Nonlinear Effects of Price and Volatility in Gold, Oil and Exchange Rate on the Stock Price Index in Iran (Using NARDL and MRS-GARCH Methods)

Sorayya Peyghan[1], Farshid Pourshahabi*[2], Azim Nazari[3]

ARTICLE INFO

Article history:
Date of submission: 30-06-2021
Date of acceptance: 31-10-2021

JEL Classification:
C01
C58
G15

Keywords:
Stock Price Index
Gold, Oil
Exchange Rate
MRS-GARCH
NARDL.

ABSTRACT

The purpose of this study is to investigate the nonlinear effects of prices and the volatility of gold, oil, and exchange rate variables on the stock price index in Iran from March 2008 to April 2019. In this regard, first, the volatility of oil, gold, exchange rate and stock price index variables are calculated using the MRS-GARCH technique and then the relationship between these variables is investigated using a Nonlinear Autoregressive Distributed Lag model (NARDL). The results indicate that oil and gold price variables have positive and negative effects in the short and long run on the stock price index in Iran, but the volatility of these two variables does not have a significant effect on the stock price index. The results also show that exchange rate depreciation exerts a negative and significant effect on the stock price index in the short and long run, but the exchange rate increase in both periods does not have a significant effect on the stock market. Therefore, the exchange rate has an asymmetric effect on the stock price index, while the results indicate the positive and significant effect of volatility of stock price index on the stock price index.

1. Introduction

A glance at the macroeconomic structure of a country and its markets suggests that capital markets represent one of the most basic markets in each

1. M.A in Economics, University of Bojnord, Bojnord, Iran
2. Assistant Professor in Economics, University of Bojnord, Bojnord, Iran, pourshahabi.f@gmail.com (Corresponding Author)
3. Assistant Professor in Economics, University of Bojnord, Bojnord, Iran

economy. The most commonly used investment decision-making method in the stock market is the analysis of stock price trends. In this regard, the stock price index reflects the general trend of stock market movements. In fact, the success rate and failure in the capital market are determined by the price index trend.

One of the factors affecting stock market returns is oil price and oil price fluctuations. Oil and its products are primary sources of energy in world production processes. Therefore, fluctuations in the oil price can affect the production cost and profitability of manufacturing companies. Since oil is one of the most important sources of revenue for many exporting countries, price and instability can affect capital markets in these countries. In many countries, with poor oil revenues management, rising oil prices have been accompanied by growing government revenues and monetary base, which exert a leverage effect (Mamipour, 2015).

One determinant of stock returns is the gold price. When the risk is high due to uncertainty, for example when there is rising volatility and uncertainty in the stock market or long fluctuations in oil prices, most investors are pushed to the precious metals market, especially gold, considering it as a safe option during the crisis. Historically, gold has been shown to be a reliable investment path for long-term investment. Investing in gold mitigates the effect of inflation and depreciation of money (Hoang, 2015).

The exchange rate is another factor affecting the stock market's returns. The relationship between stock prices and exchange rates has received growing attention of economists, as they both play an important role in developing a country's economy. In recent years, due to increased international diversity, the correlation between market returns and gradual removal of barriers to capital inflows and currency constraints in emerging economies, these two markets have become interdependent (Aydemir, 2009). In an open economy, exchange rate is a key variable because of its interconnectedness to other internal and external variables, which exert many effects on domestic and foreign economic policies and economic developments.

Therefore, this research seeks to investigate the effect of oil, gold and price variables on the stock market to provide solutions for stock market development. So far, many studies have been conducted on the effect of oil prices, gold prices and exchange rates on the stock price index in Iran. But none of them has studied the nonlinearity and instability of these variables at the same time.

This study tries to investigate the nonlinear effects of prices and the volatility of gold, oil, and exchange rate variables on the stock price index in Iran from March 2008 to April 2019 and the MRS-GARCH technique and the Nonlinear Autoregressive Distributed Lag model (NARDL) is used for estimation purposes. The NARDL model used in this research is a new technique for detecting nonlinear and asymmetric relationships between economic variables in the long run and short term.

The first part of the research describes theoretical foundations of the study. In the second part, a review of previous studies is made and the third part discusses the study model. The impact of each variable and the model estimation are examined in Section 4. Finally, conclusions are drawn in Section 5 along with a discussion of policies recommendations.

2. Literature Review

The stock market is affected by several interlinked factors, including economic, political, and social developments, which are in a complex relationship. The major factor influencing investors' decision-making in the stock market is the stock price index. According to economic theories, stock prices are determined by expected cash flows. Hence, any factor affecting the expected discounted cash flow must have a significant effect on stock prices. Stock prices are shaped by two groups of factors known as external and internal factors. The former represents external events and decisions that are beyond the control of the company's management but have a bearing on the stock price.

External factors are divided into three categories: economic factors, political and military factors, and cultural and behavioral factors. Economic factors and their prediction exert a significant impact on the type and amount

of investment. Some of the factors that act on stock prices are inflation rate, interest rate, exchange rate, tax rate, credit policy of banks, and availability of supportive instruments in the stock market. On the other hand, internal factors are variables affecting the stock price, which are mainly related to a company's operations and the decisions made by the company and its components. These factors include earnings per share (EPS), share dividend per share (DPS), price/income ratio (P/E), increased capital and etc.

2-1. Impact of Oil Prices and its Fluctuations on the Stock Market

According to Gisser and Goodwin (1986), raising oil prices increase production costs in the absence of alternatives to production. The growing production costs affect cash flow and reduce stock prices. According to Huang et al. (1996), oil prices can directly affect the impact of future cash flows or influencing them indirectly through the interest rate of future cash flows. An increase in oil prices will reduce interest rates in the stock price formula, which is used for stock valuation. Rising oil prices often reflect inflationary pressures that central banks can control by raising interest rates (Henriques and Sadorsky, 2008).

According to the studies of Filis et al. (2011), Aloui et al. (2012), and Guesmi and Fattoum (2014), being a net importer or exporter in the crude oil market has a bearing on the stock price response to oil price shock. Also, their analysis suggests that stock prices in oil-exporting countries and oil-importing countries can respond positively and negatively to long-term and short-term oil prices.

2-2. Impact of Gold Price on Stock Market Fluctuations

Over the past two decades, the world has witnessed several economic crises such as the Asian exchange crisis in 1997, the Russian-Brazilian crisis between 1998 and 1999, the global financial crisis in 2007-2008 and the European debt crisis in 2010-2011. The events have considerably increased stock market fluctuations and the risk of portfolio investment. Therefore, investors look for strategies to minimize investment risk and improve risk returns and returns on asset portfolios during the financial crisis. More

precisely, investors have developed a tendency for a more diverse defense strategy by investing in secure assets such as gold.

The gold price reflects the interplay of supply and demand in a market where there are many potential buyers and sellers in the presence of the flow. Since gold is a good indicator of inflationary pressures, the gold price climbs during inflation in the currency market or political instability, encouraging individuals to select this type of asset in their asset portfolio to maintain its value. Of course, speculation in the gold market is one of the reasons that affects the demand for gold, which in short turn is a major cause of price fluctuations in this market. Therefore, the gold market, along with other asset markets, can affect the stock market index. Thus, when gold prices rise, investors' willingness to invest in the stock market is decreased and therefore stock returns drop. A such, gold price and stock returns are assumed to be reversely correlated (Jansen et al, 2010).

2-3. The Effect of Exchange Rate and Its Fluctuations on the Stock Market

There is no general agreement about the dynamic relationship between exchange rate and stock price. Theoretically, this dynamic relationship can be examined with two approaches: models proposed by Dornbusch and Fischer (1980), focused on equilibrium of current account trade balance. Proponents of this model state that exchange rate changes affect international trade and trade balance, and thus affect actual economic variables such as production and national income, current and future cash flows of companies and their stock prices. According to this model, depreciation of domestic currency (increased exchange rate) will make local companies more competitive by lowering the price of their exports in a comparative international market. The greater domestic commodity's advantage and consequently increase in exports also lead to higher incomes, which in turn increases the stock prices of companies. Therefore, in these models, the exchange rate affects the stock price with a positive relationship.

The second approach to the equity-oriented model proposed by Branson (1993) and Frankl (1983) suggests that stock market innovation is influenced

by demand through wealth and liquidity effects. The tumble in stock prices will reduce the wealth of domestic investors, which in turn reduces demand for money with lower interest rates. Lower interest rate leads to the outflow of capital towards overseas markets, assuming that other conditions are constant, depreciation of domestic currency and appreciation of exchange rate, which indicates a negative relationship between exchange rate and stock price. According to Gavin's (1989) monetary model, unlike the above two models, there is no relationship between exchange rate and stock price. Therefore, as suggested by the above three theoretical models, theoretical studies are unable to provide a definite conclusion regarding the relationship between foreign exchange market and stock prices.

3. Research Background

Payand Najafabadi et al. (2012) examined the effect of the global oil and gold price on the Tehran Stock Exchange, using the ARIMA-Copula model. Their research showed that there was no direct relationship between the global gold price and Tehran stock exchange index. However, the Tehran Stock Exchange Index is not independent of world oil prices. That is, oil price decline has a negative effect on the Tehran Stock Exchange and the Iranian economy.

Najafabadi et al. (2020) examined the impact of oil and gold prices' shock on Tehran stock exchange market (TSE). ARIMA-Copula used and data are from Januray 1998 to Januray 2011. They concluded that there is no significant direct relationship between gold price and the TSE index. But the TSE is indirectly influenced by other factors. Also, the TSE is not independent of the volatility in oil price.

Ciner et al. (2013) examined the dynamic correlation between oil, gold, currencies, bonds and stocks using daily US and British data. Their results indicated that the stock market continues to play its traditional role as a cover for the stock market. The gold market can be considered as a cover against exchange rate fluctuations. The interesting outcome that they reported is that when the exchange rate falls significantly in the United States and the United Kingdom, gold acts as a safe haven, which confirms the role of gold as a monetary asset.

Mamipour and Vaezi (2015) investigated the nonlinear relationship between oil price, gold price and Iranian stock market returns using monthly data. For this purpose, they have been used MS-VECM non-linear co-integration method. According to their review, the relationships between variables studied can be analyzed under three situations of severe recession, mild recession and prosperity. The results show the significant and negative effect of oil revenues on stock returns under all three regimes; however, the relationship between gold price and stock market return varies over time relative to market conditions.

Beckman et al. (2015) examined whether gold acted as a cover for stocks. In general, their findings indicated that the gold market was very important to policy makers and investors, and is a useful element for diversification.

Raza et al. (2016) examined the asymmetric effect of gold prices, oil prices and related changes on emerging markets. Experimental results have shown that gold price has a positive impact on stock market prices in emerging economies of BRICS, while exerting a negative effect on Mexican, Malaysian, Thailand, Chile, and Indonesian stocks. In general, oil price has a negative effect on the stock markets of all emerging economies. Both in the short and long run, gold and oil fluctuations have a negative effect on stock markets in all emerging economies. The results indicate that stock markets in emerging economies are more vulnerable to bad news and unfortunate events, which lead to adverse economic conditions.

Jane and Biswal (2016) investigated the relationship among global price of gold, crude oil and exchange rate in the Indian stock market. In this study, dynamic contemporary relationships were analyzed using DCC-GARCH models (standard, exponential, threshold). The results of their study exhibited that the fall in gold and crude oil prices brought down Indian stock indices and support gold as investment assets among investors.

Bams et al. (2017) examined the potential effect of uncertainty about the price of oil and gold on the stock market. Their results show that with rising uncertainty in the stock market, oil and gold yielded negative returns in various industries. In general, intensifying uncertainty is associated with a

decline in stock prices, because rising uncertainty complicates stock valuation and investment decisions.

Kanjilal, and Ghosh (2017) examined the dynamic link between global crude oil and gold prices following the 2008 global financial crisis using a vector error correction model based on weekly crude oil prices obtained from Brent and Gold in the period of 2009-2015. The results indicated a significant relationship between gold and oil prices, with gold acting as an investment cover against inflation.

Biglar Beigi (2018), investigated the impact of oil, gold and currency on Tehran Stock Exchange (TSE) using conditional heteroscedastic models. ARCH and GARCH models used to capture the behavior of the volatility. The results show that Tehran index is more vulnerable to earliest behavior of the Tehran exchange market than the market shocks.

4. Data and Methodology

This study explores the effect of gold price, oil price, exchange rate and their volatility on stock prices in Iran during March 1985 to March 2018. For this purpose, a single-equation method called asymmetric (nonlinear) distributive disturbances algorithm (NARDL) was used. The asymmetric ARDL model used in this research is a new technique for identifying nonlinear and asymmetric relationships between economic variables in the long and short run. This technique was proposed and developed by Shin et al. (2011), as an extension of the linear ARDL model. One advantage of the NARDL model is its high flexibility, as it provides valid outcomes whether its variables are I(0), I(1), or a combination of both (Nusair, 2016). This method is also capable of solving problems of removing a variable and eliminating the correlation problem. Meanwhile, considering that these models generally lack problems such as serial autocorrelation and endogeneity, their estimates will be unbiased and efficient.

In the NARDL model, variables are decomposed into positive and negative values. The nonlinear distributed regression model (NARDL) is as follows:

$$\Delta y_t = \mu + \rho y_{t-1} + \theta^+ x_{t-1}^+ + \theta^- x_{t-1}^- + \sum_{j=1}^{\rho-1} \alpha_j \Delta y_{t-j} + \sum_{j=0}^{q-1} \pi_j^+ x_{t-1}^+ + \pi_j^- x_{t-1}^- + \varepsilon_t \quad (1)$$

This study investigates the nonlinear effects of oil and gold price and exchange rate volatility on the stock price index. Raza et al. (2016) proposed four models as follows:

$$SP_t = f(ER_t^+, ER_t^-, GP_t, OP_t, SV_t) \quad (2)$$

$$SP_t = f(ER_t, GP_t, OP_t, OV_t^+, OV_t^-) \quad (3)$$

$$SP_t = f(ER_t^+, ER_t^-, GP_t, OP_t, GV_t) \quad (4)$$

$$SP_t = f(ER_t^+, ER_t^-, GP_t, OP_t, EV_t) \quad (5)$$

In the above relations, SP is the stock price index of the Tehran Stock Exchange, ER_t^+ is positive exchange rate variation, ER_t^- is negative exchange rate variation, GP_t is gold price, OP_t is oil price, SV_t is uncertainty of stock price Tehran Stock Exchange Index, OV_t^+ is positive oil price volatility, OV_t^- is negative oil price volatility, EV_t is exchange rate volatility and GV_t is gold price instability.

Equation 2 is an estimate of the impact of oil prices, gold prices, exchange rates and stock price index volatility on the stock price index. The error correction model for this model is as follows:

$$\Delta SP_t = \alpha + \rho_1 SP_{t-1} + \rho_2 ER_{t-1} + \rho_3 GP_{t-1} + \rho_4 OP_{t-1} + \rho_5 SV_{t-1} + \sum_{k=1}^{n1} \beta_k \Delta SP_{t-k} + \sum_{k=0}^{n2} \delta_k \Delta ER_{t-k} + \sum_{k=0}^{n3} \varphi_k \Delta GP_{t-k} + \sum_{k=0}^{n4} \theta_k \Delta OP_{t-k} + \sum_{k=0}^{n5} \pi_k \Delta SV_{t-k} + \mu_t \quad (6)$$

And by dividing the exchange rate variable into two groups, positive and negative changes:

$$ER_t^+ = \sum_{j=1}^{t} \Delta ER_j^+ = \sum_{j=1}^{t} \max(\Delta ER_j, 0)$$

$$ER_t^- = \sum_{j=1}^{t} \Delta ER_j^- = \sum_{j=1}^{t} \min(\Delta ER_j, 0)$$

The regression model with NARDL model is obtained as follows:

$$\Delta SP_t = C + \rho_1 SP_{t-1} + \rho_2 ER^+_{t-1} + \rho_3 ER^-_{t-1} + \rho_4 GP_{t-1} + \rho_5 OP_{t-1} + \rho_6 SV_{t-1} + \sum_{k=1}^{n1} \beta_k \Delta SP_{t-k} + \sum_{j=1}^{t} \delta_{1.k} \Delta ER^+_{t-k} + \sum_{j=1}^{t} \delta_{2.k} \Delta ER^-_{t-k} + \sum_{k=0}^{n3} \varphi_k \Delta GP_{t-k} + \sum_{k=0}^{n4} \theta_k \Delta OP_{t-k} + \sum_{k=0}^{n5} \pi_k \Delta SV_{t-k} + \mu_t \quad (7)$$

Equation 3 is an estimate of the impact of oil prices, gold prices, exchange rates and oil price volatility on the stock price index. The error correction model for this equation is given below;

$$\Delta SP_t = \alpha + \rho_1 SP_{t-1} + \rho_2 ER_{t-1} + \rho_3 GP_{t-1} + \rho_4 OP_{t-1} + \rho_5 OV_{t-1} + \sum_{k=1}^{n1} \beta_k \Delta SP_{t-k} + \sum_{k=0}^{n2} \delta_k \Delta ER_{t-k} + \sum_{k=0}^{n3} \varphi_k \Delta GP_{t-k} + \sum_{k=0}^{n4} \theta_k \Delta OP_{t-k} + \sum_{k=0}^{n5} \pi_k \Delta OV_{t-k} + \mu_t \quad (8)$$

And by dividing the oil price volatility variable into two groups, positive and negative changes:

$$OV^+_t = \sum_{j=1}^{t} \Delta OV^+_j = \sum_{j=1}^{t} \max(\Delta OV_j, 0)$$

$$OV^-_t = \sum_{j=1}^{t} \Delta OV^-_j = \sum_{j=1}^{t} \min(\Delta OV_j, 0)$$

The regression model with NARDL model is obtained as follows:

$$\Delta SP_t = \alpha + \rho_1 SP_{t-1} + \rho_2 OV^+_{t-1} + \rho_3 OV^-_{t-1} + \rho_4 GP_{t-1} + \rho_5 OP_{t-1} + \rho_6 GV_{t-1} + \sum_{k=1}^{n1} \beta_k \Delta SP_{t-k} + \sum_{k=0}^{n2} \delta_k \Delta ER_{t-k} + \sum_{k=0}^{n3} \varphi_k \Delta GP_{t-k} + \sum_{k=0}^{n4} \theta_k \Delta OP_{t-k} + \sum_{k=0}^{n5} \pi_k \Delta GV_{t-k} + \mu_t \quad (9)$$

Equation 4 is an estimate of the impact of oil prices, gold prices, exchange rates and gold price volatility on the stock price index. The error correction model for this equation is given below:

$$\Delta SP_t = \alpha + \rho_1 SP_{t-1} + \rho_2 ER_{t-1} + \rho_3 GP_{t-1} + \rho_4 OP_{t-1} + \rho_5 GV_{t-1} + \sum_{k=1}^{n1} \beta_k \Delta SP_{t-k} + \sum_{k=0}^{n2} \delta_k \Delta ER_{t-k} + \sum_{k=0}^{n3} \varphi_k \Delta GP_{t-k} + \sum_{k=0}^{n4} \theta_k \Delta OP_{t-k} + \sum_{k=0}^{n5} \pi_k \Delta GV_{t-k} + \mu_t \quad (10)$$

And by dividing the exchange rate volatility variable into two groups, positive and negative changes:

$$ER_t^+ = \sum_{j=1}^{t} \Delta ER_j^+ = \sum_{j=1}^{t} \max(\Delta ER_j , 0)$$

$$ER_t^- = \sum_{j=1}^{t} \Delta ER_j^- = \sum_{j=1}^{t} \min(\Delta ER_j , 0)$$

The regression model with NARDL model is obtained as follows:

$$\Delta SP_t = C + \rho_1 SP_{t-1} + \rho_2 ER_{t-1}^+ + \rho_3 ER_{t-1}^- + \rho_4 GP_{t-1} + \rho_5 OP_{t-1} + \rho_6 GV_{t-1} + \sum_{k=1}^{n1} \beta_k \Delta SP_{t-k} + \sum_{j=1}^{t} \delta_{1.k} \Delta ER_{t-k}^+ + \sum_{j=1}^{t} \delta_{2.k} \Delta ER_{t-k}^- + \sum_{k=0}^{n3} \varphi_k \Delta GP_{t-k} + \sum_{k=0}^{n4} \theta_k \Delta OP_{t-k} + \sum_{k=0}^{n5} \pi_k \Delta GV_{t-k} + \mu_t \quad (11)$$

Equation 5 is an estimate of the impact of oil prices, gold prices, exchange rates and exchange rate volatility on the stock price index. The error correction model for this equation is given below.

$$\Delta SP_t = \alpha + \rho_1 SP_{t-1} + \rho_2 ER_{t-1} + \rho_3 GP_{t-1} + \rho_4 OP_{t-1} + \rho_5 EV_{t-1} + \sum_{k=1}^{n1} \beta_k \Delta SP_{t-k} + \sum_{k=0}^{n2} \delta_k \Delta ER_{t-k} + \sum_{k=0}^{n3} \varphi_k \Delta GP_{t-k} + \sum_{k=0}^{n4} \theta_k \Delta OP_{t-k} + \sum_{k=0}^{n5} \pi_k \Delta EV_{t-k} + \mu_t \quad (12)$$

And by dividing the exchange rate volatility variable into two groups, positive and negative changes:

$$ER_t^+ = \sum_{j=1}^{t} \Delta ER_j^+ = \sum_{j=1}^{t} \max(\Delta ER_j , 0)$$

$$ER_t^- = \sum_{j=1}^{t} \Delta ER_j^- = \sum_{j=1}^{t} \min(\Delta ER_j , 0)$$

The regression model with NARDL model is obtained as follows:

$$\Delta SP_t = C + \rho_1 SP_{t-1} + \rho_2 ER_{t-1}^+ + \rho_3 ER_{t-1}^- + \rho_4 GP_{t-1} + \rho_5 OP_{t-1} + \rho_6 EV_{t-1} + \sum_{k=1}^{n1} \beta_k \Delta SP_{t-k} + \sum_{j=1}^{t} \delta_{1.k} \Delta ER_{t-k}^+ + \sum_{j=1}^{t} \delta_{2.k} \Delta ER_{t-k}^- + \sum_{k=0}^{n3} \varphi_k \Delta GP_{t-k} + \sum_{k=0}^{n4} \theta_k \Delta OP_{t-k} + \sum_{k=0}^{n5} \pi_k \Delta EV_{t-k} + \mu_t \quad (13)$$

5. Empirical Results

5-1. Exchange rate volatility analysis using MRS-GARCH method

The server foreign sanctions, bank constraints, oil export bans and consequently the declining foreign exchange earnings and partial blockage of these resources, provided the ground for exponential rise of exchange rate, which gave rise to significant exchange rate fluctuations during this period.

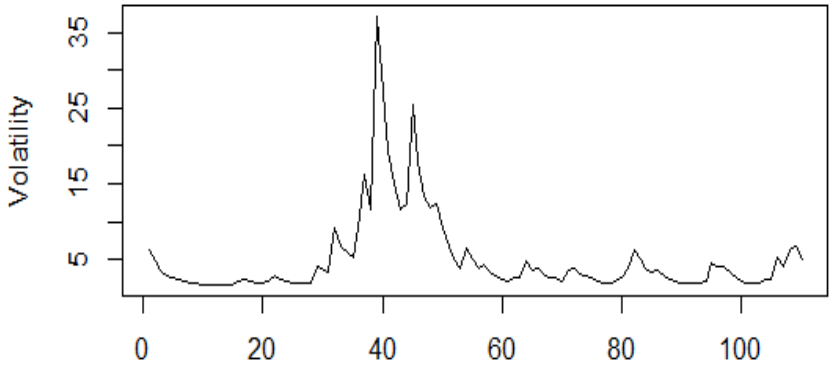

Fig 1. Exchange rate volatility during March 1985- March 2018

5-2. Stock market index instability analysis using MRS-GARCH method

As the global financial crisis in 2007 and 2008, the price for basic metals and oil fell sharply. At the same time, it compromised the profitability of listed companies in Iran, which were mostly commodity-based. In the beginning of 2011, Tehran Stock Exchange entered a stagnant phase. New sanctions were imposed on Iran, which hampered the economic operations of many industries and reduced their sales. In 2012, rising dollar prices, fluctuations in global prices the trend of gold prices and housing as parallel markets and other contributed to the growth of capital market. In the second quarter of 2013, the Tehran Stock Exchange dropped into in a downturn, which continued for two years. This downturn could be explained by an increase in interest rates and massive supply of shares by government companies. However, in 2015 and following the signing the Lausanne nuclear deal, the stock market took an upward turn.

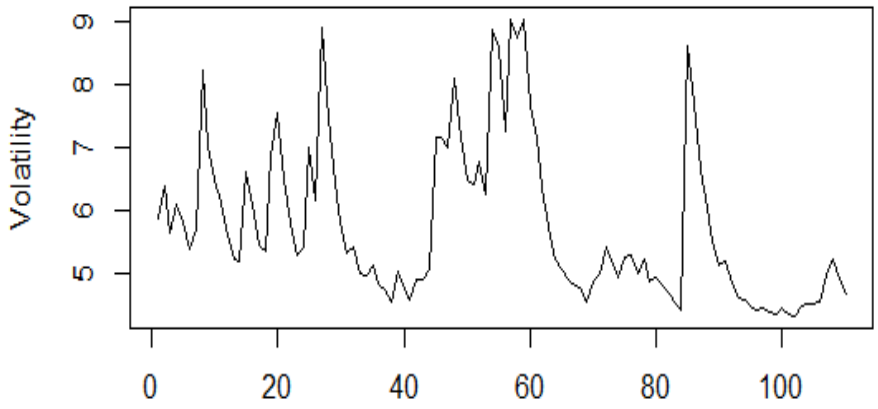

Fig 2. Stock market index volatility during March 1985- March 2018

5-3. investigate gold price volatility by using MRS-GARCH

By the end of 2011, gold price took a major leap. The jump came in the wake of European Union's endorsement of Iranian oil sanctions after the United States announced its new rounds of sanctions on Iranian central bank. The factors influencing the rise and fall of the gold price are linked to oscillation of gold price and the dollar against the Rial. Meanwhile, the role of gold price change speculations should not be overlooked.

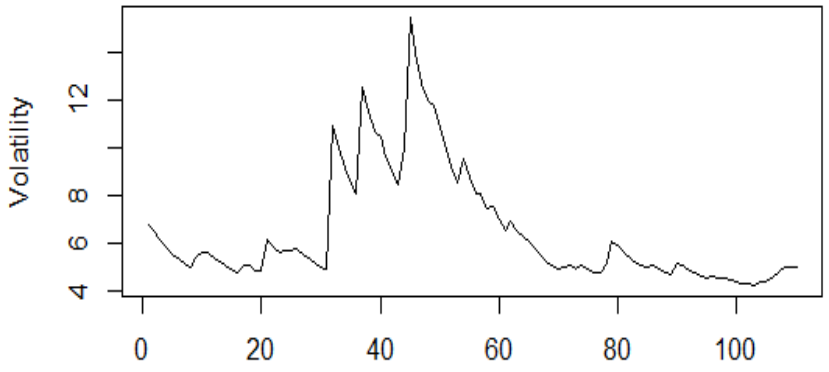

Fig 3. Stock market index volatility during March 1985- March 2018

5-4. investigate oil price volatility using MRS-GARCH

The formation of supply saturation, the first Gulf War, the peak of China's economic growth, the financial crisis of 2008, the oil leak by BP, the Arab Spring, the Iranian nuclear case, the OPEC oil war, the Yemeni civil war have been among the main causes of oil price fluctuations the leads to oil price volatility.

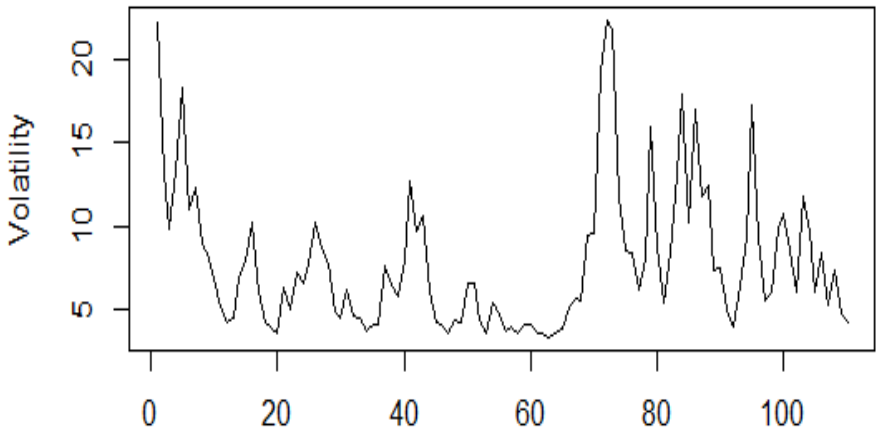

Fig 4. oil price volatility during March 1985- March 2018

5-5. Stationary Test

Before model estimation, the data should be monitored for unit root. In this study, Augmented Dickey Fuller (ADF), Phillips Peron (PP), KPSS root tests were employed to examine the stationary of variables. The results of these tests are presented in Table (1). As can be seen, the stock price index, oil price, gold price and market rates are not stationary at level; however, the volatility variables of the stock price index, oil price, gold price and exchange rate are stationary at level.

Table 1. Unit Root Test

Tests	ADF		PP		KPSS	
Variables:	Level	1 st Diff	Level	1 st Diff	Level	1 st Diff
Stock price	-0.754	-6.435	-0.517	-6.361	1. 122	0.066
	(0.827)	(0.000)	(0.882)	(0. 000)	(1.122)	(0.066)
Stock price	-6.899	-10.953	-6.911	-35.012	0.302	0.337
volatility	(0.000)	(0.000)	(0. 000)	(0.000)	(0.302)	(0.337)
Gold price	-0228	-7.772	-0.385	-8.006	0.9652	0.107
	(093)	(0.000)	(0.906)	(0.000)	(0.965)	(0.107)
Gold price	-8.435	-10.205	-8.425	-36.511	0.21	0.292
volatility	(0.000)	(0.000)	(0.000)	(0.000)	(0.20)	(0.292)
Oil price	-1.570	-8.009	-1. 492	-7.940	0.5053	0.4326
	(0.494)	(0.000)	(0.533)	(0.000)	(0.505)	(0.432)
Oil price	-8.559	-8.944	-8.509	-50.235	0.322	0.237
volatility	(0.000)	(0.000)	(0.000)	(0.000)	(0.322)	(0.237)
Exchange Rate	0. 266	-4.094	-0. 031	-9.617	1.1007	0.103
	(0.975)	(0.001)	(0.952)	(0.000)	(1.100)	(0.103)
Exchange	-4876	-9.434	-10.74	-30.762	0.1054	0.038
volatility	(0.000)	(0.000)	(0.000)	(0.000)	(0.105)	(0.038)

5-6. Bound Test

To examine whether there is a long-term relationship between variables, the bound test presented by Pessara, Shin and Smith (1996) was used. Using this test, a long-term equilibrium relationship between model variables was documented. According to the results, in Models 1, 2 and 4, the long-run relationship between variables is confirmed at a significant level of 10%. In other words, the null hypothesis (i.e. there is no long-term relationship between the variables) is rejected. The results of this test were negative for Model 3. Since F is a computation of Model 3 between the two lower and

upper bounds and the only way to examine the existence of a long-run relationship among the variables is the ECM test.

Table 2. Bound Test Results

Model	F Statistics
1	3.341
2	6.262
3	2.909
4	3.344

The results of models estimation are reported in Table (3). The asymmetry was tested by the Wald test. The results of the classical model hypothesis tests are also presented at the end of Table 3.

Table 3. NARDL estimation results

Models	1	2	3	4
		Short Run		
SP(-1)	1.295 (13.956)***	1.244 (13.857)***	1.234 (13.804)***	1.230 (13.706)***
SP(-2)	-0.346 (-3.878)***	-0.376 (-4.506)***	-0.437 (-5.331)***	-0.433 (-5.281)***
ER		0.071 (0.955)*		
ER(-1)		-0.045 (-0.519)*		
ER(-2)		0.168 (2/641)***		
ER+	-0.009		0.083	0.083

	(-0.381)*		(1.765)*	(1.862)*
ER-	-0.118		-0.180	-0.175
	(-2.890)***		(-2.379)***	(-2.298)**
OP	0.025	0.057	0.073	0.072
	(2.386)***	(2.979)***	(3.714)***	(3.862)***
GP	-0.010	-0.126	-0.086	-0.084
	(-0.540)*	(-2.582)***	(-2.170)**	(-2.320)**
OV+		0.009		
		(1. 273)*		
OV-		0.003		
		(0.424)*		
SV	0.078			
	(15.951)***			
SV(-1)	-0.021			
	(-2.391)***			
EV				-0.003
				(-0.433)*
GV			0.001	
			(0.130)*	
C	-0.089	-0.118	-0.385	-0.381
	(-1.79)*	(-2.197)***	(-3.934)***	(-4.174)***
R2	0.99	0.99	0.99	0.99
F	7785.22***	1913.55***	2507.229***	2511.531***
		Long Run		
ER		1. 479		
		(5.687)***		
ER+	-0.180		0.409	0.413
	(-0.353)*		(1.899)*	(1.971)**
ER-	-2.296		-0.888	-0.869
	(-2.460)***		(-2.757)***	(-2.669)***

OP	0.484	0.437	0.361	0.359
	(3.291)***	(3.929)***	(5.610)***	(5.720)***
GP	-0.207	-0.958	-0.424	-0.415
	(-0.606)*	(-3.527)***	(-2.552)***	(-2.688)***
SV	1.104			
	(1.987)**			
OV+		0.074		
		(1.233)*		
OV-		0.026		
		(0.415)*		
EV				-0.016
				(-0.432)*
GV			0.005	
			(0.130)*	
C	-1.728	-0.902	-1.898	-1.885
	(-3.563)***	(-2.967)***	(-7.713)***	(-8.306)***
ECM	-0.051	-0.134	-0.178	-0.181
	(-6.912)***	(-5.061)***	(-4.028)***	(-4.164)***
W_{LR}^{ER}	2.384***		-5.545***	-5.676***
W_{SR}^{ER}	2.819***		4.174***	4.191***
W_{LR}^{OV}		-3.490***		
W_{SR}^{OV}		3.170***		
χ^2_{NORM}	5.145*	66.66***	13.521***	50.690***
χ^2_{LM}	1.814*	1.484*	0. 413*	0.508*
χ^2_{BPG}	1.713*	3.703***	2.106***	2.307***
χ^2_{RT}	0.254*	0.106*	0.134*	0./229*

*Significant at 10% ** significant at 5% and *** significant at 1%

The results exhibit that a fall in exchange rate exerted a negative and significant effect on the stock price index in both the short and long term. However, a rise in the exchange rate did not have a significant effect on stock price index in the short and long term. This shows that exchange rate has an asymmetric effect on stock price index in the short term. Nonetheless, the long-run rise of exchange rate has not had a significant impact on the stock price index. Given that the Iranian economy heavily relies on the import of inputs, with falling exchange rates, the cost of products declines, which in turn boost the margin of profit and interest of each share, and subsequently, push up the stock price of companies. On the other hand, given the competition of stock market and the foreign exchange market as financial rivals, with a fall in exchange rate, resources flow toward the stock market, which results in rising stock price index.

In Model 1, although the gold price coefficient indicates the negative effect of gold price on the stock price index, this coefficient is not statistically significant in both the short and long term in models 2, 3 and 4, however, this variable has a negative and significant effect on the stock price index both in the short and long term. When gold price increases (decreases), investors' willingness to invest in the stock market decreases (increases), leading to a tumble in stocks. Because gold is perceived as a safe and low risk asset with high liquidity, it is a major rival for investment stocks. Given the lack of developed stock market in Iran, and currency depreciation induced by domestic inflation, people prefer to protect their wealth against loss using high liquidity assets, such as gold.

In all four models, oil prices have a positive and significant effect on the stock price index in both the short and long term. The positive shock of oil prices is concerned with generating higher revenues in the oil-exporting country, which in turns increases costs and investment. This leads to escalated

productivity, which triggers a quick response to stock prices. Also, the volatility index of stock price index in Model 1 induces a positive and significant effect in the short term during the same period. This variable has a positive and significant effect on stock price index in the long term. Because rising exchange rates and inflation is accompanied with elevated instability of the stock market and augmented stock market volatility, the stock market rushes to buy stocks with speculative targets that leads to higher stock prices.

6. Conclusion and Policy Implications

In this research, the effect of volatility of oil price, gold price and exchange rate on stock price index of Tehran Stock Exchange was investigated. For this purpose, the MRS-GARCH method was used to calculate oil price gold price, exchange rate and stock price index volatility. Then, the effects of instability of oil price, gold price and exchange rate on stock price index was assessed by the NARDL method. During the study period (March 1985 to March 2018), the results of analysis suggested that in both the short and long term, the exchange rate increase did not have a significant effect on the stock price index, but the exchange rate drop was significant. Given that Iran's economy heavily depends on import of inputs, with falling exchange rates, corporate finance increased, and the increasing of investment and the expectation of economic growth could have a positive effect on economic activities. This upsurge of investments and expectations can raise the company's expected profits.

Oil prices have a positive and significant impact on the stock price index both in the short and long term. Since Iran is an oil exporter, rising oil prices will lead to additional revenues, resulting in increased expenditure and investment, which in turn boosts production and reduce unemployment. Under this condition, stock markets also respond positively to such events.

Gold prices in both the short and long term have a negative and significant effect on the stock price index. When gold price, increases (decreases) investors' willingness to invest in the stock market decreases (increases), As a result of the fall in stocks. The volatility of stock prices also induces a positive and significant effect on the stock price index. Moreover, the instability index of stock price index in Model 1 has a positive and significant effect in the long term. With rising exchange rates and inflation, instability of the stock market is raising, and as volatility increases, people rush to buy stock in the stock market, which in turn leads to an increase in stock prices.

According to the results of this study, it is suggested that the government should launch futures contracts on oil-based products to provide future price horizons for investors. In this way, to clarify the investment horizon for them and provide stable growth conditions for the market. The government can also control the volatility of gold prices by developing new financial instruments such as releasing future coin market, and offering Financial Derivatives in the coin market. Also, government design the exchange rate market by taking into account all actors along with presentation of new financial instruments in the foreign exchange market such as futures trading and currency options contracts to clarify future exchange rates. This will increase transparency in the market and lead to the development of the stock market. As far as the stock market is concerned, the expansion of new financial instrument such as the expansion of futures trading and the two-way market can provide an opportunity to curb currency fluctuations while retaining the appeal of the stock market.

References

Aloui, C., Nguyen, D.K., Njeh, H., (2012). Assessing the impacts of oil price fluctuations on stock returns in emerging markets. *Economic Modeling*. 29, 2686–2695.

Aydemir, O, Demirhan, E. (2009). The Relationship between Stock Prices and Exchange Rates Evidence from Turkey. *International Research Journal of Finance and Economics*, Issue 23.

Bams. D, Blanchard. G, Honarvar. I, Lehnert. T. (2017). Does oil and gold price uncertainty matter for the stock market?. *Journal of Empirical Finance*, 44: 270-285.

Beckman.J, Berger.T, Czudaj. R. (2015). Does gold act as a hedge or a safe haven for stocks? A smooth transition approach. *Economic Modelling*, vol. 48, PP. 16-24.

Biglar Beigi., A. (2018). Mathematical analysis of impact of oil, gold and currency on Tehran stock exchange, International Research Journal of Engineering and Technology, Fast Track Publications, 5 (9): 513-519.

Branson, W.H., (1983). Macroeconomic determinants of real exchange risk, In: Herring, R.J. (Ed.), *Managing Foreign Exchange Risk*, Cambridge University, Cambridge.

Ciner.C, Gurdgiev. C, Lucey. B, (2013). Hedges and safe havens: An examination of stocks, bonds, gold, oil and exchange rates. *International Review of Financial Analysis*, 29: 202-211.

Dornbusch, R., Fischer, S., (1980), Exchange rates and the current account. *The American Economic Review*, 70(5): 960–971.

Frankel, J. A. (1983). Monetary and portfolio-balance models of exchange rate determination. In J. S. Bhandari, & B. H. Putnam (Eds.), *Economic interdependence and flexible exchange rates*. Cambridge, MA: MIT Press. Handle.

Filis, G., Degiannakis, S., Floros, C., (2011). Dynamic correlation between stock market and oil prices: the case of oil-importing and oil-exporting countries. *International Review of Financial Analysis*. 20, 152–164.

Gavin, M., (1989). The stock market and exchange rate dynamics, *Journal of International Money and Finance*, 8(2): 181–200.

Gisser, M., & Goodwin, T. H. (1986). Crude oil and the macro economy: Tests of some popular notions: Note. *Journal of Money, Credit, and Banking*, 18, 95–103.

Guesmi, K., Fattoum, S., (2014). Return and volatility transmission between oil prices and oil-exporting and oil-importing countries. *Economic Modeling*. 38, 305–310.

Henriques, I., & Sadorsky, P. (2008). Oil prices and the stock prices of alternative energy companies. *Energy Economics*, 30, 998–1010.

Hoang. T.H.V, Lean. H. H, Wong. W, (2015). Is gold good for portfolio diversification? A stochastic dominance analysis of the Paris stock exchange. *International Review of Financial Analysis*, Vol. 42, pp. 98-108.

Huang, R. D., Masulis, R. W., & Stoll, H. R. (1996**).** Energy shocks and financial markets. *Journal of Futures Markets*, 16, 1–27.

Jain.A & Biswal. P.C, (2016). Dynamic linkages among oil price, gold price, exchange rate, and stock market in India**.** *Resources Policy*, Vol. 49, pp. 179-185.

Jansen, Dennis W. and Chunli Tsai, (2010). Monetary Policy and Stock Returns: Financing Constraints and Asymmetries in Bull and Bear Markets. *Journal of Empirical Finance*, 17: 981-990.

Kanjilal. K, Ghosh. S. (2017). Dynamics of crude oil and gold price post 2008 global financial crisis – New evidence from threshold vector error-correction model. *Resources Policy*, 52: 358-365.

Mamipour.S, Vaezi Jezeie.F (2015). Non-Linear Relationships Among Oil Price, Gold Price, and Stock Market Returns in Iran: A Multivariate Regime-Switching Approach**.** *Iranian Journal of Economic Studies*, 4(1): 101 – 126.

Najafabadi, A., Qazvini, M. and Ofoghi, R. (2012). The Impact of oil and gold prices' shock on Tehran stock exchange: a copula approach, *Iranian Journal of Economic Studies*, 1, 23-47.

Nusair, S.A., (2016). The effects of oil price shocks on the economies of the Gulf Cooperation Council countries: nonlinear analysis. *Energy Policy*, 91, 256–267.

Payandeh Najafabadi. Amir T, Qazvini. M, Ofoghi. R, (2012). The impact of Oil and Gold Price Shock on Tehran Stock Exchange. *Iranian Journal of Economic Studies*, 1(2): 23-47.

Pesaran et al. (1996). Testing for the existence of a long run relationship. DAE Working papers, No.9622.

Raza. N, Shahzad. S, Tiwari. A, (2016). Asymmetric impact of gold, oil prices and their volatilities on stock prices of emerging markets. Resources Policy, 49, 290-301.

Shin. Y., Yu, B. & Greenwood-Nimmo, M. (2011). Modeling Asymmetric Co-integration and Dynamic Multipliers in a Nonlinear ARDL Framework. Mimeo. Festschrift in Honor of Peter Schmidt, 281-314.