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Modeling the Effects of Macroeconomic Variables on the Stock Market: An Application of Non-linear Distributed Autoregression Model

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Abstract:

Objective: This study investigates the effects of macroeconomic variables on the stock market (stock price index).
Methods:
The effects of macroeconomic variables including global gold and oil pric, exchange rate, interest rate, economic growth rate on the Iranian stock market has been investigated by using a non-linear distributed autoregression model.
Results:
The results indicated that the relationship between oil price and oil price index in the short term and long term is direct and inverse, respectively. The effect of the exchange rate on the stock price index is direct in the short and long term. In such a way that a long-term positive shock will lead to an increase of 0.87 percent and a negative shock of the exchange rate will lead to a decrease of 8.6 percent of the index. The effect of the positive interest rate shock in the short and long term on the stock price index is insignificant. Meanwhile, the negative shock of the mentioned variables will lead to a 0.12 percent decrease in the stock price index and in the short and long term on the positive shock of the gold price on the stock price index is insignificant. On the other hand, with a one percent decrease in the price of gold, the stock price index will increase by 0.12 percent.
Conclusions:
In terms of our resuls, economic growth has positive relationship with the stock price index. This result is in line with the results indicate that a one percent increase in economic growth, the stock price index will improve by 0.09 percent and with a one percent decrease in the economic growth rate, the stock price index will decrease by 0.1 percent.

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1- Introduction

In Iran, as a country that is moving in the direction of economic privatization, the only sustainable way to provide internal resources for investment in high-yielding economic activities is the capital market. The stock price is one of the most important signals in directing resources and liquidity towards the pooling of resources. In addition to this, the connection between international markets has attracted more attention to financial markets because it can create important consequences in terms of financial risk management and the allocation of funds and diversity in the investment portfolio and assets (Mansi et al., 2021). Moreover, it is possible to control the effect of crisis contagion in times of crisis due to financial and economic instabilities (Arori et al., 2011). Moreover, because it should not be forgotten that stock markets around the world are connected to each other and the examination of each stock market in the world is an important issue (Capra et al., 2022). The factors that affect the stock price can be divided into two parts, internal and external factors. Themost effective internal factors are dividend policy, capital structure, quality of financial information, company management, industry, currency dependenc, and commodity status, major price changes of final products and approvals of the general meeting of shareholders. On the other hand, the external factors that can affect the stock price can be economic factors such as interest rate, exchange rate, monetary policies and financial policies, government debt, cultural and social factors, the limitations of companies, the performance of the stock exchange organization in the field of legislation and their implementation (Bakhshaei, 2014). We believe that the financialization of goods, especially crude oil, gold, the volume of transactions and the development of commodity markets lead to attention to various markets, especially financial market (Mensi et al., 2024). The fluctuations of oil price, gold price and exchange rate in the stock markets in Germany, Japan, Taiwan and China are the same and are not unrelated to each other (Mohammadi et al., 2024). It should also be noted that stock market fluctuations are dependent on several factors, which can also refer to the currency market, coin or gold market, oil revenues and inflation rate (Jafarzadeh Dolatabadi and Ehsani, 2015).

This paper aims to investigate the effects of macroeconomic variables on the stock market. Our results show that the effect of the exchange rate on the stock price index, the effect of the positive interest rate shock in the short and long term on the stock price index is insignificant and on the positive shock of the gold price on the stock price index is insignificant.

The reast of the paper organized as follow: In section 2 the literature review is provided and in section 3 previous studies is provided. Section 4 presents the data and methodology. Section 6 presents estimation results, and section 7 concludes the paper.

2. Literature review

There are different views regarding the relationship between exchange rate changes and stock prices. A point of view based on the economic flows that take help from the trade balance of the countries and the current account of the countries in such a way that any changes in the exchange rate lead to changes in the international competition and the trade balance of the countries and economic real variables. These can affect production and income, future and current flows of companies and stock price challenge.

Another point of view is related to the view that originates from the capital account, which means that with an increase in the exchange rate, the wealth of domestic investors decreases and the demand for money decreases along with the interest rate. With the decrease in the interest rate, the outflow of capital to foreign markets increases and causes a decrease in the value of the domestic currency and an increase in the exchange rate (Bakhshani, 2014). Micro points of view also state that exchange rate fluctuations lead to stock price changes, but macro points of view state that stock market mechanisms determine the exchange rate (Arfoi Weben, 2017). Moreover, stock price fluctuations will create inefficiency in this capital market. This inefficiency and creating a crisis in the financial markets will also cause price jumps and price jumps in stock prices (Molaei et al., 2016).

Previous studies show that the negative effects of exchange rate fluctuations can affect labor productivity and if this happens in economies with weak financial development, it will lead to more fluctuations (Mohammadi et al., 2018). It stabilized the exchange rate, but this action is costly due to price stickiness, and it is impossible to imagine that this adjustment can be made with the help of relative price adjustment (Khatai and Mousavi Nik, 2009).

Exchange rate changes affect international competitiveness and trade balance and consequently, income and production, and oil prices can also affect different sectors of stocks such as energy, industries, and finance (Zou et al., 2021). The exchange rate can affect the stock price index in several ways: 1- If the exchange rate decreases, it will lead to inflationary expectations and will eventually lead to a decrease in the stock price. A higher nominal exchange rate in the short term will be accompanied by a decrease in the price ratio, which indicates that the lowprice ratio means higher domestic prices. In addition, the decrease in the nominal exchange rate leads to high inflationary expectations and an increase in negative news. 2- Foreign investors do not want to invest their assets in money whose value is decreasing because they are not sure about the return of their capital. Therefore, the sale of shares by foreigners will lead to a decrease in the share price. 3- In addition to the mentioned cases, if a company is an importer or exporter, it will show different reactions to exchange rate fluctuations, or if the owner is a domestic or foreign company, it will show different reactions and

behaviors to exchange rate fluctuations. Because with the weakening of the domestic currency, the costs of the importing companies will increase and this will lead to an increase in the stock price and a decrease in its purchasing power and ultimately a decrease in the stock price. Also, the price of crude oil can depend on the performance of the stock market and the performance of the macroeconomics (Sujit and Rai, 2023). Moreover, if an industry has a high exchange rate, it will reduce the stock price by increasing the exchange rate and increasing the production costs, and this process will lead to a decrease in the cash flow of the company's future earnings (Azerbaijani et al., 2016).

Exchange rate fluctuations are also related to long- term growth, in such a way that if the financial markets are not developed, it will lead to a decrease in growth. The experience of Bangladesh in the period from 1980 to 2012confirms that exchange rate fluctuations are a barrier to innovation and decrease Bangladesh's growth (Mohammadi et al., 2018).

Some studies results show that the GDP is one of the factors that affect the total stock price index in such a way that during the economic boom, investors are confident about the confidence in the investment and also the profitability of the activities, leading to an increase in the wealth expected from increasing demand and willingness to invest in all kinds of assets such as stocks (Ebrahimi, 2018).The relationship between financial market and economic growth rate is more visible in the difference between developed and developing countries (Fisher, 1930) and financial markets contribute a lot to economic development and accumulation of physical capital (Gourley and Shaw, 1995).

Since interest rate determines the expected return to an asset, and also since the stock market and stock market have forward-looking prices, therefore, any decrease in the interest rate will lead to an increase in the intrinsic value of the companies shares. Moreover, the interest rate is one of the factors that can determine the daily value of the stock, if the interest rate decreases, the intrinsic value of the stock will increase (Ebrahimi and Mehrzad, 2020).

Changes in interest rates can affect stock prices in two ways. First, an increase in the interest rate leads to an increase in the investor's expectation for an increase in the interest rate. Second, if the interest rate increases, it leads to an increase in the cost of capital for companies and investors, which reduces the profits of companies. In such a situation and in inflationary conditions, the nominal profit of the companies increases and the price of the company's assets increases, and the shares, which are a type of assets of the companies, lead to an increase in the value and price. In inflationary condition, on one hand

central bank increases the interest rate to deal with inflation on the other hand, in order to attract savings through the stock market, companies give a higher yield (Pedram et al., 2015).

Gold price changes have important implications for global economies and financial markets in such a way that the analysis of the movement of the price of

gold and other markets such as financial markets is as vital importance (Qarib, 2021). Buying and holding gold also creates akind of asset portfolio diversification (Garber, 1990). From a policy perspective, the increase in the price of gold also has caused concern about whether the fall in the price of gold will have consequences for financial stability in the future or not (Tripathy, 2016). The studies of the stock market of Germany, the USA, Japan, Taiwan, and China also show that there are a common accumulation between the fluctuations in the price of crude oil and the price of gold in the world markets, and the exchange rate that only places the dollar against other currencies and a There is a long-term stable relationship between the mentioned variables and the stock market of the mentioned countries (Mohammadi et al., 2024, Wang et al., 2010, Sari et al., 2010, Kim and Dilts, 2011).

Gold is a type of asset for the stability of monetary policy, which can protect against the decline in the value of assets when the stock market is declining (Mensi et al., 2024). In addition to these studies, some researchers have shown that the stock market is related to the growth of crude oil and gold prices, and oil price shocks in the United States also affect the stock market. Sadorsky (1999) shows that, the effect of crude oil price on the stock market is negative while the relationship between the price of gold and the stock market cannot be determined definitively (Hossein et al., 2013), but in the European and Japanese markets thereis a negative relationship between the price of gold and the stock market, which means that there is no long-term equilibrium between the price of gold and the stock market (Smith, 2022). This negative relationship between the price of gold and stock returns is also true for Turkey (Boyoksalvarci, 2010).

According to the review of the studies carried out in line with the variables affecting the stock market and also the selection of the most important variables. This paper, tries to examine the effects of each of them on the stock market according to the macro variables. Therefore, in the next parts of the paper we will discuss the method of conducting the research and finally discuss the results of the estimate model.

3. Previous studies

Many studies have been conducted with the aim of investigating the relationship between economic variables, including exchange rates, oil and gold prices, interest rates, and economic growth rates with the stock price index.

Abouwafia et al (2015) in a study for the East Asian region in the period from 2003 to 2012 by applying a SVAR model show that monetary policy and real exchange rate shocks have significant effects on stock prices in the short term.

Najaf and Najaf (2016) investigate the effects of oil and gold prices on the Indian stock market during the period from 2003 to 2011. The results indicate that there

is no significant long-term relationship between the global oil price and the gold price and the stock market.

Al-Ameer et al. (2018) examines the relationship between the price of gold and the stock market, for the Frankfurt Stock Exchange market in the period from 2004 to 2016. They conclude that there is a correlation between the Frankfurt Stock Exchange index and the price of gold in global markets. There is a significant long-term relationship the financial crisis, there is between the world price of gold and the Frankfurt Stock Exchange index in the long term, and during the financial crisis and after it, the same significant relationship exists in the long term.

Amaresh and Anandasayanan (2019) in an empirical analysis of the effect of economic growth on the performance of the stock market, conducted for the country of Sri Lanka in the period from 2002 to 2019 concluded that economic growth has a positive effect on the stock market and 83% of Stock market changes are explained by economic growth. They also showed that there is a strong and positive significant relationship between economic growth and stock market.

Ezeibekwe (2021) in a study period of 1981-2017 and applying Vector Error Correction (VECM) concluded that the development of the stock market in Nigeria through the capital market is directly related to the GDP rate in the long term. The stock market is not transparent to Nigeria's GDP and economic growth rate in the long term. The size of the Nigerian stock market and the rate of economic growth also related.

Moosavi et al. (2019) in a study entitled Analysis of the impact of economic growth and asymmetric information and the capital market on investors' confidence using the GARCH method for Iran in the period from 1991 to 2016 show that in the short and long-term economic growth has a positive effect on the level of trust and increasing the prosperity of the capital market.

Al Shamari et al. (2019) in an investigation the impact of exchange rate, oil price and gold price on the stock market of Kuwait in the time period from 1996 to 2017, and approve the wavelet analysis method show there is a positive relationship between the stock market and the exchange rate in all frequencies. The correlation of stock market and oil price is also decrease after removing the effect of exchange rate. Regarding the price of gold, there is only a short-term negative relationship with the stock market in critical periods.

Ali et al. (2020) in a study titled exchange rate, gold price and stock market relationship with the MGARCH quantile regression approach conclude that in the period from 2001 to 2018 the effect of exchange rate and gold price fluctuations on daily performance or monthly shares are negative.

Bai et al. (2021) in an investigation of the effect of oil prices on the US stock market, in an analytical study and historical comparison of data on oil prices and US stock returns how the price of oil is stable, it has little effect, but when the

price of oil is more volatile, it has a greater effect on stock returns. Moreover, the price of crude oil affects CPI and PPI which in turn affects US interest rates on the stockmarket.

Ai KY (2024) investigation the time-varying relationship between oil prices, stock market performance and Covid-19 in the United States, China and Malaysia byusing the Wavelet approach in the period from 2016 to 2022. Their results show that, there is a direct relationship between oil prices stock market price.

Al Rabadi (2024) in a study titled the relationship between oil prices and the stock market, using the VAR model there is a positive relationship between the influence of oil prices on the index in Jordan. Show that in the period of 2013-2022.

Tembelo and Ozyesil (2024) examines the relationship between oil prices and stock returns for OECD countries in the period from 2000 to 2022. They show that there is a positive and significant relationship between stock returns and oil prices.

Fadilia (2024) in a comprehensive analysis of gross domestic product, exchange rate, Dow Jones index and oil price in the period from 2018 to 2022 using the panel data regression method concluded that GDP has a negative effect on stock returns and currency devaluation has a positive effect on stock returns. Moreover, the Dow Jones industrial average has a positive effect on stock returns, and the global oil price also has a positive effect on stock returns.

Bhosal and Ghatam (2022) in a study for the Nepal in the period from 2010 to 2015 and using the VAR method concluded that there is no relationship between the price of gold and the stock market index in the long term.

Fichtner and Joyges (2024) study show that from 1991 to 2019 for the G7 countries and applying the ARDL model the relationship between stock prices and GDP is relatively unstable. Moreover, they find that a permanent one-percentage change of the stock pric increases the GDP about 0.2%, and this effect appears mostly within two to three years.

Kamongo (2022) concludes that there is a causal relationship between economic growth and stock market returns. Keny shows that current economic growth trends are a reliable indicator for Kenyan’s stock market returns.

El-Diftar (2023) in a sudy of the effect of exchange rate on stock market performance in the period 2019 to 2022 for emerging countries and using the GARCH model show that there is a strong significant relationship in the long term between exchange rate and stock returns.

Jafarzadeh Dolatabadi and Ehsani (2015) an investigation of the impact of macroeconomic variables on stock returns in Iran's stock market that the stock price index has a relationship with inflation. Inversely, it has a direct relationship

with oil income, the supply of rights, the price of coins and the nominal exchange rate.

Bhargawa and Kenko (2023) show that the exchange rates for the years 2000 to 2019 and using different models of the GARCH, EGARCH and TGARCH have an impact on the performance of the American stock market in such a way that the effects of the fluctuations in the Australian dollar and Euro rates spill over into the fluctuations of the S&P 500.

Uddin and Alam (2010) an investigation of the effects of interest rates on the Dhaka stock market for the period of 1992-2005, show that interest rates has a negative relationship with stock pricegrowth.

Al-Naif (2017), in an examines the relationship between interest rates and the stock market index for five Arab countries (Arabia, Jordan, Egypt, Oman, Qatar and Kuwait) for the period from 2014 to 2016, using the VAR model. He finds that the interest rate and the stock market index have a significant negative relationship with each other in Egypt, though this relationship is less in Qatar and Kuwait. In addition, the relationship between the interest rate and the stock market in Jordan and Oman is significantly positive.

Karimzadeh (2006) in a south show the long-term relationship between the stock price index and macroeconomic variables in the Iranian economy for the period from April 1990 to March 2003 and using vector autoregression model shows that stock price has a positive relationship with liquidity and a negative relationship with the real exchange rate and the real bank interest rate.

Abbasian et al. (2007) find that there is a positive relationship between the exchange rate and the trade balance in the long term, and the total index of the stock exchange has an inverse relationship with the inflation rate, liquidity and interest rate.

Azimi et al. (2009) shows that there is a long-term relationship between Tehran stock market price index and macroeconomic variables such as exchange rate, inflation rate, money supply, short-term and long-term interest rates, and industrial production index. By applying the Johansen-Jusilius method, they also show that the fluctuations of the exchange rate, inflation rate, volume of money and the amount of industrial production have positive effects on the changes in the price index of the Tehran Stock Exchange. The changes in the short-term interest rate and the long-term interest rate with the changes in the price index of the Stock Exchange Tehran has a negative relationship.

Ebrahimi and Shokri (2013) investigats the effects of macroeconomic variables on stock prices, emphasizing the role of monetary policy, using the structural vector error correction (SVAR) model in the period from the beginning of April 1999 to the end of March 2008. The results showed that stock prices in Iran are more affected by factors such as oil prices and the status of competing assets, the reliance of the financial sector structure on the bank, the lack of knowledge of the

capital market, the lack of diversification of securities, and the non-activity of the interest rate channel.

Heidari and Bashiri (2012) in investigation of the uncertainty relationship between real exchange rate and stock price index in Tehran Stock Exchange by applying a VAR-GARCH model to show that between the uncertainty variable of the real exchange rate and the stock price index has a negative relationship and there is no significant relationship between stock price uncertainty and exchange rate.

Zarra Nezhad and Motamedi (2012) in an examining the relationship between macroeconomic variables and total stock price index in Tehran Stock Exchange in the period of April 2016 to March 2017 and applying the Toda-Yamamoto causality method, Grangerian error correction test and cointegration technique Pesran, Shin and Smet's show that in the long run there is a positive relationship between the total stock price index and the exchange rate. According to the Toda-Yamamoto causality method, there is a one-way causal relationship from the two variables exchang rate and bank interest rate to the total stock price index and inflation rate, and there is also a one-way causal relationship from the bank interest rate to the exchange rate. Moreover, based on the Granger error correction method, there is a short-term causal relationship from the exchange rate, inflation rate, and interest rate to the total stock price index, but in the long term, there is a causal relationship from the exchange rate, oil shock, inflation rate, and interest rate to the index in whole stock market price.

Mehrabian and Changi (2013) show that in all periods the effect of the exchange rate on stock price index in Iran is more than its fluctuations, and the exchange rate and its fluctuations and the stock price index have a balanced relationship in the long term, and this relationship is significant in such a way that the exchange rate has a negative effect on the stock price index and its fluctuations have positive effect.

Jalaee et al. (2016) confirms that exchange rate shocks have directly affect on GDP so that the relationship between exchange rate shocks and GDP is significant and positive. Moreover, the consumer price index has a significant effect on the stock market performance.

Bakhshani (2016) inInvestigating the effects of exchange rate changes on stock prices and P/E ratio have come to the conclusion that the changes in exchange rates, have a positive and significant relationship with changes in stock prices and P/E rates.

Azarbaijani et al. (2018) show that applying a Non-linear ARDL (NARDL) model the decrease in exchange rate has a positive and significant effect in the short and long term on the stock price index, on the other hand, the increase in the exchange rate in both the short and long-term periods has not a significant effect on the stock market, and this is also in the sense of the asymmetric effect

of the exchange rate on the stock price index.
Kamerovafar and Hashemi (2016) in a reviewing and identifying the main variables affecting the total index of the Tehran Stock Exchange show that exchange rate, inflation, production growth and liquidity volume have a double effect on the total index of TSE.
Fadainejad and Farahani (2016) finds that with data from April 2014 to March 2014 and applying the method of multi-factor regression model, the exchange rate and the price of gold have an effect on total index of the TSE.
The review of previous studies shows that the majority of researches are one-dimensional or two-dimensional, and at our best knowledge there is no comprehensive study that simultaneously, in the form of a model, includes exchange rate, gold and oil prices, interest rates and economic growth as variables. On the other hand, explanatory and stock price index has not been studied as a dependent variable in the model.
The novality of this paper is applying of NARDL that examines the structural shocks and volatility and the relationship of selected variables. Moreover, the period time that we selected are more sensitive and more important due to its near tp present time.

4. Data and Methodology

This paper uses 6 variables including Stock Market Price, Oil Price, Gold Price, Interest Rate, Exchange Rate and GDP growth Rate during 1991-2022. In the modeling, all variables except RGDP and IR have been entered into the model in logarithm form. More details about the variables are revealed in Table (1).

Table 1. Variable Explanation

Variable	Description	Unit	Source
LSMP	Stock Market Price	Unit	CBI
LOLP	Brent Oil Price	$/ bbl	World Bank
LEXR	Exchange Rate	$/Rial	CBI
IR	Interest Rate	%	CBI
LGP	Gold Price	$/troy oz	World Bank
RGDP	Annual percentage growth rate of GDP (constant 2015)	%	World Bank

Source: Researcher's Calculation

1-4 Research Methodology

The NARDL model which was extended by Shin et al., (2014) has been used in some studies by aiming to survey the variables affecting the stock price market (Alamgir and Amin; 2021, Nusair and Olson; 2022, Sujit and Ray; 2023, and Belcaid; 2024). This model has some advantages like the ability of modeling for variables integrated of order zero (I_0) and one (I_1) and even combination of both (I_0) and (I_1) (Kartal et al., 2022). Furthermore, this method can be considered asymmetric linkage in the modeling. In deed positive shock and negative shock can have different effects (Sujit and Ray, 2023). Variables involved in the current

research are established based on the studies of Liu et al., (2022) and Sujit and Ray, (2023).

$$\Delta \text{LSMP} = \alpha_0 + \vartheta_1 LSMP_{t-1} + \vartheta_2{}^{+} LOLP^{+}{}_{t-1} + \vartheta_2{}^{-} LOLP^{-}{}_{t-1} + \vartheta_3{}^{+} LEXR^{+}{}_{t-1} + \vartheta_3{}^{-} LEXR^{-}{}_{t-1} + \vartheta_4{}^{+} IR^{+}{}_{t-1} + \vartheta_4{}^{-} IR^{-}{}_{t-1} + \vartheta_5{}^{+} LGP^{+}{}_{t-1} + \vartheta_5{}^{-} LGP^{-}{}_{t-1} + \vartheta_6{}^{+} RGDP^{+}{}_{t-1} + \vartheta_6{}^{-} RGDP^{-}{}_{t-1} + \sum_{j=1}^{p-1} n_1 \Delta LSMP_{t-j} + \sum_{j=0}^{q-1} (n_2^{+} \Delta LOLP^{+}_{t-j} + n_2^{-} \Delta LOLP^{-}_{t-j}) + \sum_{j=0}^{q-1} (n_3^{+} \Delta \text{LEXR}^{+}_{t-j} + n_3^{-} \Delta \text{LEXR}^{-}_{t-j}) + \sum_{j=0}^{q-1} (n_4^{+} \Delta IR^{+}_{t-j} + n_4^{-} \Delta IR^{-}_{t-j}) + \sum_{j=0}^{q-1} (n_5^{+} \Delta \text{LGP}^{+}_{t-j} + n_5^{-} \Delta \text{LGP}^{-}_{t-j}) + \sum_{j=0}^{q-1} (n_6^{+} \Delta \text{RGDP}^{+}_{t-j} + n_6^{-} \Delta \text{RGDP}^{-}_{t-j}) + \varepsilon_t$$

Equation (1)

(1) In equation ϑ_1 , ϑ_2, ϑ_3, ϑ_4, ϑ_5, ϑ_6 are tsterm coefficien-short and n_1, n_2, n_3 , n_4, n_5 and n_6 are long term coefficients. LSMP is the stock price index, LOLP is the oil price, LEXR isthe exchange rate , IR is the interest rate, LGP is and the gold price RGDP is the economic growth rate. LOLP $^{+}$, LEXR $^{+}$ IR $^{+}$, LGP $^{+}$ andRGDP $^{+}$ Cumulative sum of positive minor changes andLOLP $^{-}$,LEXR $^{-}$,IR $^{-}$,LGP $^{-}$ andRGDP $^{-}$The cumulative total of minor changes is negative .

5. Model estimation and results

1-5 Unit Root Test

The outcome of stationary is revealed in Table (2). According to statistics, the variables including LSMP, LOLP, LEXR, IR, and LGP have unit roots and are (I1) in the PP and ADF tests. RGDP is (I0) stationary. Overall, based on the outcomes, the NARDL method is proper for investigating the effect of independent variables on dependent variables.

Table 2. The results of ADF and PP unit root tests

Variable	Description	ADF		Status	PP		Status
		Statistics in level	First Differences		Statistics in level	First Differences	
LSMP	Stock Market Price	-2.7	4.03 **	I_1	-1.7	-3.8 **	I_1
LOLP	Brent Oil Price	-1.85	-5.51 ***	I_1	-1.9	-5.2 ***	I_1
LEXR	Exchange Rate	-0.48	-4.55 ***	I_1	-0.48	-4.58 ***	I_1
IR	Interest Rate	-2.48	-4.97 ***	I_1	-2.55	-4.97 ***	I_1
LGP	Gold Price	-2.1	-2.59 **	I_1	-1.9	-2.6 **	I_1
RGDP	Annual percentage growth rate of GDP (constant 2015)	-5.1 ***	-	I_0	-3.9 ***	-	I_0

Note: ***, **, * indicate significance levels at 1%, 5%, and 10% respectively.
Source: Researcher's Calculation

2-5 BDS Test

The BDS test which developed by Broock et al., (1996) is one of the structural break test Zhang et al. (2023). According to Table 3, the null hypothesis can be rejected, indicating that the residuals are homogeneously and independently distributed. Therefore, a dynamic asymmetric framework such as the NARDL approach should capture the nonlinear relationship between the variables.

Table 3. BDS test results

Variable	Dimension 2	Dimension 3	Dimension 4	Dimension 5
LSMP	0.15 ***	0.23 ***	0.27 ***	0.32 ***
LOLP	0 14 ***	0.24 ***	0.33 ***	0.4 ***
LEXR	-0.15 ***	-0.23 ***	0.26 ***	0.24 ***
IR	0.13 ***	0.22 ***	0.28 ***	0.29 ***
LGP	0.15 ***	0.25 ***	0.29 ***	0.32 ***
RGDP	0.02 **	0.03 *	0.04 **	0.03

Note: ***, **, * indicate significance levels at 1%, 5%, and 10% respectively.
Source: Researcher's Calculation

3-5 Short-Run NARDL

The results related to the short- term estimation of the model is presented in Table (4). The results show that the oil price has a direct effect on the stock price index. In other words, the positive shock of the oil price will have a positive effect and the negative shock of the mentioned variable will have a negative effect on the stock price index. So that with a one percent increase and decrease of the mentioned variable, the stock price index will increase by 0.94 percent and decrease by 0.68 percent, respectively. Currency price also has a direct relationship with the stock price index. In other words, a positive exchange rate shock in the short term with a positive effect coefficient (0.37) and a negative exchange rate shock with a significant coefficient of 15.04% will lead to a decrease in the stock price index. The effect of a positive interest rate shock on the stock price index is positive but insignificant. On the other hand, the negative interest rate shock will lead to a 0.12% decrease in the stock price index. The effect of positive and negative gold price shock on the stock price index is positive. In such a way that with a one percent increase and decrease in the price of gold, the stock price index increases by 1.3 percent and 1.4 percent . But the effect of decreasing the price of gold has been greater. In other words, the negative effect of a negative gold price shock on the stock price index is stronger than the positive effect of a positive gold price shock on the stock price index. Finally, it was found that the effect of economic growth on the stock price index is also insignificant. The coefficient related to ECM (-1) or the error correction coefficient is also provided at table (4). In this study, the value of the coefficient (-1.04) was obtained, which is statistically significant considering the probability level (less than 0.05) and its negative value. This means that the adjustment process ¬of incoming shocks will be fluctuating.

Table 4. NARDL Short-Run Estimation Results

Variable	Coefficient	T-Statistics	Probability
DLSMP(-1)	0.54 ***	4.9	0.00
DLSMP(-2)	-0.59 ***	-6.3	0.00
DLOLP +	0.94 ***	4.3	0.00
DLOLP + (-1)	-1.8 ***	-7.7	0.00
DLOLP -	0.68 ***	4.4	0.00
DLOLP - (-1)	0.88 ***	3.7	0.00
DLEXR +	0.37 **	3.2	0.01
DLEXR + (-1)	0.53 ***	4.7	0.00
DLEXR -	-15.04 **	-5.2	0.00
DLEXR - (-1)	-5.9 **	2.7	0.02
DIR +	0.001	0.07	0.93
DIR-	-0.12 ***	-3.8	0.00
DIR - (-1)	0.25 ***	6.05	0.00
DLGP +	1.3 ***	4.2	0.00
DGP + (-1)	-0.8 ***	-3.5	0.00
LGP -	1.4 **	2.7	0.02
RGDP +	-0.007	-0.3	0.7
RGDP + (-1)	0.1 ***	5.7	0.00
RGDP -	-0.02	-1.4	0.17
RGDP - (-1)	-0.09 ***	-5.9	0.00
ECM (-1)	-1.04	-13.8	0.00

Note: ***, **, * indicate significance levels at 1%, 5%, and 10% respectively.
Source: Researcher's Calculation

The existence of the long-run linkage between variables has been confirmed by the Bound test results.

Table 5. Bound Test

F-Statistic	Significance	I0 bound	I1 Bound
7.7	10%	1.83	2.94
	5%	2.06	3.24
	2.5%	2.28	3.5
	1%	2.54	3.86

Source: Researcher's Calculation

4-5 Long-Run NARDL

The results related to long-term estimation are shown in Table (6). The relationship between the oil price and the stock price index is inverse in the long term, unlike the short term. In other words, a positive oil price shock with a coefficient of 0.91 will have a negative effect and a negative shock with a coefficient of

1.5 will have a positive effect on the stock price index. The relationship between the exchange rate and the stock price index is direct. With a one percent increase in the mentioned variable, the stock price index will increase by 0.87 percent and

with a one percent decrease in the exchange rate, the stock price index will decrease by a significant amount of 8.6 percent. The positive interest rate shock is insignificant and in contrast to the negative interest rate shock, it will have a positive effect on the stock price index. Therefor, with a one percent decrease in the interest rate, the stock price index will increase by 0.12 percent. The positive shock of the gold price on the stock price index is positive but insignificant. Moreover, the negative shock of the gold price will have a positive effect on the stock price index. If the gold price drops by one percent, the stock price index will increase by 0.12 percent. Economic growth also ¬has a direct relationship with the stock price index. In other words, with a one percent increase in economic growth, the stock price index will improve by 0.09 percent. On the other hand, with a one percent decrease in the economic growth rate, the stock price index will decrease by 0.1 percent.

Table 6. NARDL Long-Run Estimation Results

Variable	Coefficient	T-Statistics	Prob
LOLP $^{+}$	-0.91 ***	-4.5	0.00
LOLP $^{-}$	1.5 ***	6.01	0.00
LEXR $^{+}$	0.87 ***	8.1	0.00
LEXR-	-8.6 ***	-3.6	0.00
IR $^{+}$	0.001	0.07	0.93
IR-	0.12 **	2.7	0.02
LGP $^{+}$	0.47	1.5	0.15
LGP $^{-}$	1.3 **	2.8	0.02
RGDP $^{+}$	0.09 ***	3.9	0.00
RGDP $^{-}$	-0.1 ***	-4.36	0.00

Source: Researcher's Calculation

The survey of the existence of long-run asymmetric tests is shown in Table 7. The null hypothesis (long-run asymmetry) has just been rejected for LGP and has been validated for LOLP, LEXR, IR, and RGDP. Indeed, the effects of negative and positive shocks in gold price (LGP) will be the same (symmetric). Conversely, the effects of the positive and negative shocks of LOLP, LEXR, IR, and RGDP will be dissimilar.

Table 7. Test to check long-run asymmetries

Variable	F-Statistic	P-Value	Outcome
LOLP	12.5 ***	0.00	asymmetric relationship
LEXR	8.2 ***	0.01	asymmetric relationship
IR	4.8 *	0.05	asymmetric relationship
LGP	0.68	0.43	symmetric relationship
RGDP	17.3 ***	0.00	asymmetric relationship

Source: Researcher's Calculation

5-5 Diagnostic Tests

After examining the long-term relationships, it is necessary to examine the diagnosis tests (Table 8) and the residual diagrams (CUSUM) and (CUSUMQ). According to the results the estimated model is confirmed in terms of heterogeneity, autocorrelation, normality and stability. Also, the diagrams It shows the stability of the model at the 5% level, because the line between the two critical limits has not crossed the limit.

Table 8. Diagnostic Tests

Test	F-Statistic	Probability	Outcome
Breusch-Pagan-Godfrey eteroscedasticity test	0.54	0.87	No heteroscedasticity
Breusch- Godfery Serial Correlation	23.4	0.15	No autocorrelation
Ramsey test	1.8	0.21	Correct functional form
Normality test	0.71	0.7	Normal

Source: Researcher's Calculation

The CUSUM and CUSUMQ as a proxy of model stability in the short and long term are revealed in Figure 1. The null hypothesis (instability) is rejected in the case where the graph line is between the critical value of the upper and lower limits, and the alternative hypothesis is accepted at a significance level of 5%, which shows that the model is stable (Koondhar et al., 2021). So, the model is stable because the line has not crossed the lower and upper lines.

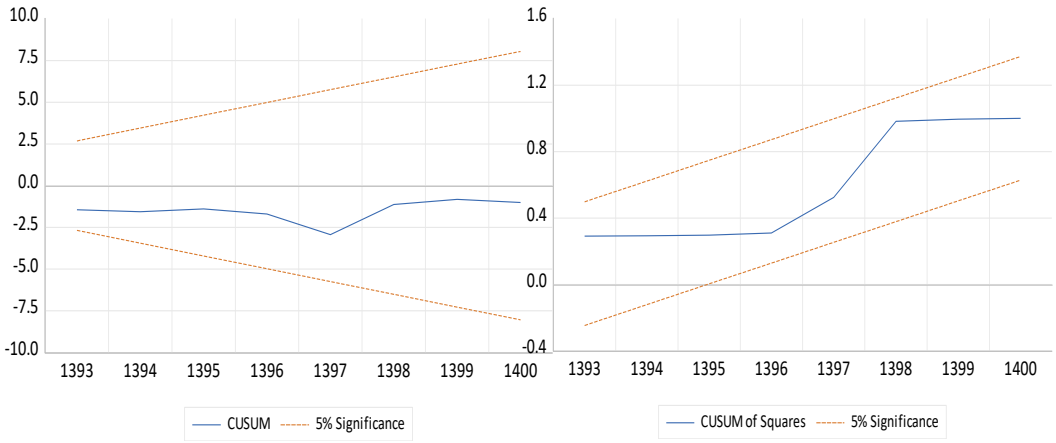


Figure 1. The CUSUM and CUSUMQ as a proxy of model stability in the short and long term

Source: Researcher's Calculation

7. Conclusion and Recommendations

The paper aims to investigate the effects of exchange rates, world gold, oil prices, interest rates, economic growth rates and Iranian economy during the years 1370-1401 by applying the NARDL model. The effect of oil price on the stock price index has been direct in the short term. In other words, an increase in the price of oil will lead to an increase in the stock price index, which is in line with the result of studies Cook Yu (2024), Al Ra Badi (2024), Ozisimil and Temblo (2024), Bai et al. (2022) and Fadilia (2024). In the long term, it has shown an inverse relationship between the mentioned variables. In other words, in the long term, unlike the short term, with the increase in the price of oil, the stock price index will decrease, which is in line with the studies of Najaf and Najaf (2016). As the price of oil is one of the factors affecting stock prices, it is one of the variables that plays a different role in exporting and importing countries, and it can affect the price of energy, and the price of energy can also affect the primary production factors of industries. The price of oil can affect the stock market by influencing the exchange rate and guiding the movement of the exchange rate on the stock market (Al-Shamari et al., 2020) and also any increase in the price of oil can lead to an increase in the CPI and PPI, especially in oil importer contries (Bai et al., 2021). On the other hand, this is while the increase in oil prices for oil exporting countries and OECD countries leads to an increase in stock returns (Ozismil and Temblo, 2024). In oil-rich countries that rely on foreign exchange income from oil sales (such as Iran), the increase in foreign exchange income can potentially be considered as a factor to strengthen the capital market. The short-term positive relationship between two variables also confirms this issue. Increasing incomes, increasing the amount of currency, improving the financial conditions of production companies can all lead to the strengthening of the capital market. However, international restrictions on the flow of foreign currencyinto the country, the increase in production costs due to the increase in energy prices, the lack of proper management in the capital market, and the existence of numerous economic uncertainties will lead to a decrease in the stock price index in the long term.

The currency price has a direct relationship with the stock price index in the short and long term. In other words, the decrease or increase in the exchange rate will lead to a decrease or increase in the stock price index, which is consistent with the results of the studies of Fadilia (2024), Al Shamari et al. Abadi (2015), Bakhdari et al. (2016), Jalali Naini and Qalibaf Assal (2015), Kamrafar and Hashemi (2016), Zare and Motamedi (2016) which is in line with negative effect on profitability.

An increase in the exchange rate can have a positive or negative effect on profitability. On the one hand, the increase can lead to an increase in the volume of working capital of companies because at first it increases the financial needs of production companies in order to provide resources and inputs. In this case, the company's activity should either be reduced or provided through financial

intermediaries. This issue itself leads to an increase in the cost of providing raw materials and intermediate materials and reduces the profit of the company. On the other hand, an increase in the exchange rate can lead to a change in the competitive position of producers. The increase in the exchange rate leads to an increase in the price of foreign goods and ultimately reduces its demand. This will reduce the price of domestic goods and lead to a decrease in imports and an increase in exports, which will ultimately increase production and profit and ultimately increase the stock price index.

A negative interest rate shock will lead to a decrease in the stock price index in the short term. But in the long run, the negative shock will have an increasing effect on the stock price index. These results are in line Al-Naif (2017) for the stock market of Egypt, Qatar and Kuwait. The amount of return on investment and the attractiveness of any economic activity can be recognized based on the interest rate. A decrease in the interest rate can lead to the outflow of capital and movement towards foreign markets in countries that have a high amountof exports, the low interest rate will help to increase exports and the export earnings can be reinvested in the industry. In such a way that if the bank interest rate is reduced and the society's liquidity is directed towards production, it will lead to an increase in production, exports and an increase in the intrinsic value of stocks due to a decrease in the discount rate in the valuation process (Ebrahimi and Mehrzad, 2020). For various reasons, including international sanctions sanctions, low quality and non-competitiveness of the goods and services produced, and its geopolitical position, which leads to numerous economic impulses, Iran has not had an active presence in the international economic arena, and this importantly, it has led to a low amountof exports. Therefore, reducing the interest rate in Iran does not necessarily mean directing resources to the capital market. Therefore, in order to manage this serious matter, correct and scientific policies, proper management of capital market and monitoring of capital flow are necessary.

The effect of positive and negative gold price shocks on the stock price index is positive in the short term. In the long term, however, the negative shock of the gold price will have a positive effect on the stock price index, which is in line of Al-Amir et al (2018). Therefore, examining the amount of increase or decrease in the price of gold has an impact on the financial stability (Tripathy, 2016) that is, when the volatility of the stock market is decreasing, gold can deal with the decrease in the value of assets (Mensi et al., 2024).

Finally, in the long term, economic growth has a direct relationship with the stock price index. With increasing economic growth, the price index will improve and with its decrease the price index will decrease. This result is in line with the studies of Mousavi et al. (2019) Amaresh and Anandasayan (2019), Kamongo (2022) and Fichner and Joyges (2024). Economic growth is a variable that is influenced by various factors, and its existence in the long term can lead to

economic stability, which leads to an increase in investment in the economy. The existence of economic growth in the long term, while reducing investment risks and uncertainties, will lead to the attraction of capital and investors to invest more. Therefore, the existence of economic growth can create investment and eventually increase the yield of stock prices in the stock market.

Considering that in the current study, the impact of selected variables affecting stock prices in the stock market was examined and evaluated in the long and short term, investors, policymakers and researchers needs to consider other influencing variables in future studies and investigations. In future studies had ever, for both types of floating exchange rates, government and market exchange rates, the model and the impact of each on the stock market can be examined. Moreover, in these studies, monetary and property policies adopted by monetary and financial policy makers can be considered.

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مدل‌سازی اثرات متغیرهای کلان اقتصادی بر بازار بورس به روش خودرگرسیون توزیع شده غیرخطی

چکیده:

هدف:

این پژوهش به بررسی اثر متغیرهای کلان اقتصادی بر بازار سهام (شاخص قیمت سهام) می‌پردازد.

روش تحقیق:

این پژوهش به بررسی اثر متغیرهای کلان اقتصادی شامل قیمت جهانی طلا و نفت، نرخ ارز، نرخ بهره، نرخ رشد اقتصادی بر بازار سهام ایران با استفاده از مدل خودرگرسیون توزیع شده غیرخطی می پردازد.

نتیجه:

نتایج نشان می‌دهد که رابطه بین قیمت نفت و شاخص قیمت سهام در کوتاه مدت و بلندمدت به ترتیب مستقیم و معکوس می‌باشد. تاثیر نرخ ارز بر شاخص قیمت سهام در کوتاه مدت و بلندمدت مستقیم بوده به گونه‌ای که شوک مثبت بلندمدت منجر به افزایش 0.87 درصدی و شوک منفی نرخ ارز منجر به کاهش 8.6 درصدی شاخص قیمت سهام می‌گردد. درحالیکه تاثیر شوک مثبت نرخ بهره در کوتاه مدت و بلندمدت بر شاخص قیمت سهام ناچیز است و این درحالی است که شوک منفی متغیرهای مذکور منجر به کاهش 0.12 درصدی شاخص قیمت سهام و در کوتاه مدت و بلندمدت شوک مثبت قیمت طلا بر شاخص قیمت سهام ناچیز می‌باشد. از سوی دیگر کاهش یک درصدی قیمت طلا می‌تواند شاخص قیمت سهام را 0.12 درصد افزایش دهد.

نتیجه گیری:

بنابراین رشد اقتصادی با شاخص قیمت سهام رابطه مثبت دارد و افزایش یک درصدی رشد اقتصادی منجر به افزایش 0.09 درصدی شاخث قیمت سهام می‌شود و با کاهش یک درصدی نرخ رشد اقتصادی، شاخص قیمت سهام به اندازه 0.1 درصد کاهش می‌یابد.

کلمات کلیدی: بازار بورس، متغیرهای کلان اقتصادی، مدل NARDL .