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Research Article

Asymmetric Effects of Oil Price, Exchange Rate and Money Volume on Stock Returns of Tehran Stock Exchange

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Abstract
The main purpose of the present study is to investigate and analysis the impact of oil price fluctuations and exchange rates as well as monetary policies on the performance of the Tehran stock exchange. To this end, monthly information on the variables of oil price, exchange rate, liquidity and stock returns in the Tehran Stock Exchange in the period of April 2008 to March 2020 were collected. The results of the research model estimate using the nonlinear Markov switching approach indicated that the exchange rate in both regimes has a positive and significant effect on market stock returns. Oil price fluctuations in the first regime have a negative and significant effect, and in the second regime, it has a positive and significant effect on market stock returns. Finally, the share of monetary instruments as an indicator of monetary policy in changes in stock returns was estimated to be less than 10%.
Keywords: Stock returns, Oil prices, Exchange rates, Monetary policy, Markov switching

Introduction

Achieving long-term and continuous economic growth requires the equipping and optimal allocation of financial resources at the level of the national economy, and this is not easily possible without the help of financial markets, especially large and efficient capital markets (Asgar Shamsi et al., 2021). One of the important components of financial markets is the stock market, which has played a significant role in economic prosperity or recession, and any recession or prosperity in this market has been accompanied by significant changes in economic variables, policies and decisions (Nobre and Neves, 2019; Salmani Bishak et al., 2015). stock market of a country is an important fragment of economic activity because it is regarded as a reflection of social mood of a country as well as a pointer to her economic strength and development (Sanusi and Kapingura, 2022). This market plays a very important role in the process of economic growth and development by facilitating and transferring funds from savers to investors (Amoah et al., 2020). Therefore, the stock exchange mechanism is one of the financing tools for manufacturing companies. Therefore, recognizing the factors affecting the mechanism of this market, such as macroeconomic variables, can play an important role in predicting stock market behavior and therefore the possibility of appropriate policy (Asgar Shamsi et al., 2021).

The stock market index can be considered as one of the objective manifestations of the macro-financial situation in a society that acts as a barometer to predict economic changes in

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economic activities (Fama, 1990). Changes in the total stock price index follow changes in the amount of shares traded and their price changes (Asgar Shamsi et al., 2021). These changes are due to internal and external factors or internal and external factors Among the external factors affecting the profitability and stock value of companies listed on the stock exchange are macro monetary and financial variables that can affect the performance of these companies (Egbunike and Okerekeoti, 2018; Rahnama Rodposhti et al., 2012). The problems caused by the increasing fluctuations of the exchange rate, especially when the implementation of the plan is carried out by obtaining foreign exchange facilities through banks, creates an uncertain environment for investors and makes investors unable to make decisions about future investments more easily and with more confidence and possibly suffer unpredictable losses. When the exchange rate increases over time, the companies that invest by taking foreign currency loans and the foreign currency income from their exports is not significant, are practically unable to repay the bank facilities. If the total elasticity of export and import is greater than one, the increase in the exchange rate will strengthen the competitiveness of domestic companies in global markets (Seifollahi and Seifollahi, 2021). On the other hand, exchange rate fluctuations may affect the discount rate. In addition to the exchange rate, oil prices are another important factor that affects the volume of production in manufacturing companies; Oil price shocks and the monetary policy response of oil-producing economies have been the subject of important theoretical research in the modern literature (Delpachitra et al., 2020). This affects not only the countries that need to import petroleum products, but also the economic variables in the producing countries (Köse and Ünal, 2020).

In the case of exporting countries, rising oil prices increase government revenues and ultimately help the manufacturing and industrial sectors. On the other hand, rising oil prices increase costs in importing countries and consequently increase related operating costs (Talha et al., 2021; Becken and Lennox, 2012). Therefore, in Iran, where there is a is single-product economy based on oil revenues and derives most of its revenues from oil sales, oil price fluctuations strongly affect the country's income level and subsequent economic growth (Heidarzadeh Hanzaee and Farahani, 2019). Therefore, understanding the shape and strength of this relationship is important for investors to plan appropriate investment strategies. Following the asset pricing theory, oil prices are considered as a risk factor for stock markets (Mokni, 2020).

Oil prices have also become one of the most volatile variables in the market due to various events that have taken place in recent decades, a complex pattern of oil price evolution, especially in relation to understanding its relationship with other economic variables, has been considered considered by economists and researchers (Hamilton, 1983, 1996; Mork et al., 1994; Barsky and Kilian, 2004; Ratti and Vespignani, 2016; Mokni, 2020). An outstanding work on oil price shocks and macroeconomic performance was written by Hamilton (1983). Since then, significant works have been published on oil prices and their impact on stock exchanges in major oil-producing countries (Köse and Ünal, 2020). Another variable affecting the stock market index is the monetary policies imposed by the central bank. Monetary policy can, through its monetary instruments, have direct and immediate effects on financial markets, including the stock market, and thus stabilize or destabilize financial markets and, consequently, have a positive or negative effect on the real economy. Monetary policy announcements have a significant bearing on stock markets. These announcements provide information about the future state of the economy and affect corporate cash flows and risk-adjusted discount rates, which affect stock markets. Empirical evidence shows that monetary policy decisions have led to increased stock market volatility and reduced implicit volatility. Thus, these announcements contain relevant information about the value of financial assets and therefore affect the valuation of these assets and increase their volatility. Therefore, recognizing the factors affecting the mechanism of this market, such as macroeconomic variables, can play

an important role in predicting stock market behavior and therefore the possibility of appropriate policy (Asgar shamsi et al., 2021).

Since the early summer of 2011, the Iranian economy has witnessed a very special situation as a result of sanctions, the effects targeted subsidies, the increasing growth of liquidity over the years and other factors. After a long time of managing the exchange rate in the country, the instability dominated this market. The unprecedented indexes of the Tehran Stock Exchange also initiated in 2012 (Zeinedini et al., 2022; Harjoto et al., 2021)). Due to the recession of economic activities and high inflation, entering the stock market, coin market or foreign exchange market as investment alternatives were in front of investors with hot money in their hands (Fallahi and Jahangiri, 2015). Iran, on the other hand, is an important oil-exporting country in which the government owns oil resources. Therefore, the changes in the oil market have a decisive role in the country's fiscal policies and budgets. The oil sector, on the one hand, provides the foreign exchange needed by the private and public sectors to strengthen the flow of capital, and on the other hand, provides a large part of the revenue for the general government budget. Iran's national economy is highly dependent on revenues from oil exports, and since these revenues are a function of two factors of world oil prices and the volume of oil exports, so the oil price variable has a higher degree of erogeneity among macroeconomic variables (Fotros and Hoshidari, 2016). Thus, one of the most important issues in the oil sector is the discussion of oil prices and its price fluctuations that any unexpected increase or decrease in oil prices leads to changes in oil revenues, which in turn directly affects the country's economy, and failure to implement proper economic policies will lead to crises and economic imbalances.

Therefore, according to the principle that investors engage in investment activities with the aim of obtaining returns and always carefully consider the existing and potential risks in their calculations and then proceed to make decisions, and since the Iranian economy, and in particular, the stock exchange market, are strongly affected by fluctuations in oil prices and exchange rates, it is necessary to be aware of the price uncertainties of these two economic variables. On the other hand, over the years, Iran's economy has experienced great growth in liquidity. Monetary policy plays an important role in guiding the cash flow through its significant effects on the cash flow in the country.

Therefore, in this research, we examine the simultaneous effect of oil price fluctuations and monetary and currency policies on the returns of companies' shares, which can be considered an innovation in this research, on the one hand, considering the existing sanctions that are continuously is intensifying, the continuous investigation of this issue with the Markov switching method, which examines different regimes, can have different results from other researchers conducted in this direction, in addition to that, In this research, it is investigated whether these fluctuations have asymmetric effects on the stock returns of companies or not?

Oil and the stock exchange market

Oil is one of the most important natural resources in the modern economy. Changes in oil prices can have a significant impact on economic activities such as employment, investment and stock market returns (Bhatia and Basu, 2020). In fact, oil is one of the essential materials in the production process of many goods and services. In general, oil price shocks affect a country's economic activity in two ways. One is through the impact on the supply of the economy, which in principle is manifested over the years and manifests itself by affecting the production capacity of the country. The other is through the impact on aggregate demand, which can have an impact on the country's economic activities in the short term. Economists do not see not only negative shocks in oil prices but also positive shocks in favor of oil-exporting countries. Most governments, under the influence of negative shocks in oil prices, are forced to impose more restrictions on the import of goods and services in order to meet the country's essential needs

and timely repayment of foreign obligations through foreign exchange savings. Given that in developing countries, including Iran, the bulk of their imports are capital goods and raw materials required by the manufacturing sector, restrictions on imports can have adverse effects on the manufacturing sector. The inevitable result of such conditions will be the emergence of inflationary pressures, rising exchange rates, economic recession and rising unemployment in society. Positive shocks to oil prices will otherwise negatively affect the economies of oil-exporting countries. The negative effects of price fluctuations, incorrect price forecasting and the consequent increase in risk in decision-making and misuse of easy resources (as a result of a sudden increase in oil prices) are some of the factors that may eliminate the possible positive effects of positive shocks of oil prices (Zaroki et al., 2018).

The impact of oil prices on the stock market varies depending on whether the country is an oil exporter or an importer. Huang et al. (1996) divided the theoretical and empirical relationship between oil prices and stock price indices into two general categories: 1) Given that oil is used as a production input in production processes, the increase in oil prices leads to increased production costs and this in turn affects the stock price index; 2) Oil prices affect the stock price index through the discount rate and in the form of expected inflation rate and real interest rate in such a way that rising oil prices in importing countries leads to increased domestic inflation and subsequently increase expected inflation rate, discount rate also increases, and as a result, leads to increase in stock price index. Economic literature states that countries with natural resources, such as oil and gas, earn huge revenues by exporting them indiscriminately. These revenues may be due to a sudden rise in oil prices at a certain point in time. Earning these incomes causes Dutch disease in these countries (Samadi et al., 2007).

In studies that have examined the linear relationship between stock price index and oil price, a clear relationship has not been determined, so that the results of research by Park and Ratti (2008), Miller and Ratti (2009), and Samadi et al. (2007) indicate the existence of the negative relationship between these two variables. Researchers, on the other hand, have also examined the nonlinear relationship between stock price indices and oil prices; Walid et al. (2011), Cologni and Manera (2009), using Markov switching nonlinear models regarding the relationships of stock market and exchange rate, the asymmetric effects of oil price shocks on G7 output growth, achieved relatively accurate results with a separation of the regimes. In general, studies in this regard can be divided into four main groups: The first group are studies that confirm a significant negative relationship between oil prices and stock returns, studies of Jones and Kaul (1996), Sadorsky (1999), Jammazi and Aloui (2010), Kelikume and Muritala (2019), Samadi et al. (2007), Hosseini Nasab et al. (2011), Fotros and Hoshidari (2016) are among these cases.

The second group proves that according to the available evidence, there is a positive relationship between oil prices and stock returns of companies, for example the research of El-Sharif et al. (2005), Mirhashemi Dehnavi (2016), Miladifar et al. (2020).

The third group acknowledges the relationship between oil prices and stock returns, but it varies depending on whether the relationship is positive or negative. The studies by Park and Ratti (2008), Kilian and Park (2009), Boldanov et al. (2016), Bastianin et al. (2016) are of these cases.

Finally, the fourth group proves that there is no significant relationship between oil prices and oil returns. The research of Apergis and Miller (2009), Miller and Ratti (2009) and Bouoiyour et al. (2017) are examples of this group.

Exchange rates and stock market

An increase in exchange rate fluctuations creates price uncertainty as well as interest rates, which can create a negative effect on the real sector of the economy. The reason for the negative

effect of the uncertainty caused by exchange rate fluctuations is that this uncertainty in prices causes the resource allocation mechanism in the economy to not work well and inefficient investment to be made. This will have a negative effect on the performance of the economy (Bakhshani, 2016). In general, the relationship between the exchange rate and the stock index is analyzed in both flow-oriented and stock-oriented models. The most important flow-oriented model is the model proposed by Dornbusch and Fischer (1980). According to this model, changes in exchange rates in the form of changes in the performance of export-oriented and import-oriented listed companies affect the stock index. In the form of flow-oriented model, the exchange rate has a positive effect on stock prices, which can be explained by improving the trade balance, and this requires increasing the share of companies in exports. In contrast, in stock-oriented models, the determinant of the exchange rate is the capital account. The most important of these models is introduced by Branson (1983) and Frankel (1983). According to this model, with a decrease in stock prices, the wealth of domestic investors decreases, leading to a decrease in demand for money and interest rates. As interest rates fall, capital outflows increase and the platform for exchange rates increases (Pavlova and Rigobon, 2007).

The important role of exchange rate changes in changes in stock returns has been shown in many studies; Among them are the studies of Yang and Doong (2004) for 7 industrialized countries, Phylaktis and Ravazzolo (2005) for Pacific countries, Pan et al. (2007) in the stock markets of 7 East Asian countries. Diamandis and Drakos (2011) also showed the undeniable role of exchange rates in influencing the stock price and evaluated the relationship between the two positively. Using the Markov regime change patterns, Chkili and Nguyen (2014) indicated that the exchange rate has a considerable impact on the stock market in both the quiet and turbulent periods of the recession and the boom.

The results of the studies by Fotros and Hoshidari (2016) showed that over time, there is a conditional correlation between oil price returns, gold price returns and foreign exchange price returns with the returns of the Tehran Stock Exchange index. The results of Botshekan and Mohseni (2018) support the existence of short-term positive conditional correlations of the dollar exchange rate, long-term fluctuations of the euro exchange rate and the existence of exchange rate overflow effects on the index of banks and credit institutions. The results of the study of Sarrafi Zanjani and Mehregan (2018) show the effect of increasing the dollar rate on both indicators in the short and long term as positive and significant and the effect of reducing it is insignificant. The findings by Jain and Biswall (2016) indicated that governments set taxes and duties to manage the effect of gold and oil imports on the exchange rate, which is also related to the country's economy and is most reflected in the stock market index.

Monetary policy and stock prices

Based on the following discounted cash flow model, stock prices are equal to the present value of dividends (Equation 1):

$$S_t = E_t\left[\sum_{j=1}^{k}\left(\frac{1}{1+R}\right)^j D_{t+j}\right] + E_t\left[\left(\frac{1}{1+R}\right)^k S_{t+k}\right] \quad (1)$$

Where E_t represents the conditional expectations based on the information available to stockholders at time *t*, *R* is the rate of return used by stock market partners for discounted future dividends and K is the investor time horizon. Monetary policy affects stock returns in two ways: First, a direct effect on stock returns by changing the discount rate, for example, a contractionary monetary policy increases the discount rate, which in turn reduces the stock price and thus less economic activity in the future; second, an indirect effect on the value of corporate

stocks by changes in expected future cash flows. Expansionary monetary policy is expected to increase the level of economic activity and stock prices to react in a positive direction. Therefore, it is assumed that there is a relationship between monetary policy and the real economy as a whole.

Since expansionary monetary policy increases economic activity, stock prices and stock returns, and contractionary monetary policy acts the oppositely, stock market participants therefore pay close attention to the expansionary or contractionary monetary policy. Theoretically, the relationship between money supply and the total stock price index is positive, because increasing liquidity increases the demand for assets, including stocks, so as demand for stocks increases, so does its price (Jahangiri and Hoseini Ebrahimabad, 2017).

Guo et al., (2013) studied the impact of monetary policy on the stock market, especially in developing countries, and believed that over the past decade, monetary policy in emerging economies (such as China) has become a tool for domestic and international changes in the economic environment. Monetary policy flexibility helps emerging economies cope with growing domestic and foreign uncertainty. Due to the inherent characteristics and problems of emerging economies, the stock markets of these economies are more easily affected by changes in government monetary policy than those of developed countries. These monetary policies increase the impact of government policies on stock fluctuations. Monetary policies are designed to affect macroeconomics, but these policies, like monetary shocks, indirectly affect the stock market, which these effects are considerably different over different time periods and business cycles. In some cases, stock market performance may even contradict traditional economic and financial theories.

Some examples of experimental studies on the relationship between monetary policy and the stock market are as follows: the studies of Lastrapes (1998), Ioannidis and Kontonikas (2008), Bjørnland and Leitemo (2009), Li et al., (2010), Aliyu (2011), Chatziantoniou, Guo et al. (2013). Evidence from research by Guo et al. (2013) shows that China's monetary policy has significant asymmetric effects on the stock market over different time periods and business cycles. The effect of interest rate shocks and legal reserve rates varies throughout business cycles, but the effect of money supply and exchange rate shocks is not different. Using event study analysis, Val et al. (2018) found that monetary policy has a significant effect on the stock market but accounts for a small percentage of stock market changes.

The findings by Fausch and Sigonius (2018) indicated that the overall changes in excess stock returns in Germany are due to revised dividend expectations, and that the stock market response to monetary policy shocks depends on the real interest rate situation. In periods when real interest rates are negative, an unexpected contractionary monetary policy reduces the additional stock returns. Aleemran and Aleemran (2013) concluded that the growth of liquidity volume has a positive effect and instability of the growth of liquidity volume has a negative effect on the stock price index. The results of Fahimi's research (2016) indicate a negative relationship between monetary policy uncertainty and stock price index. Rezaei et al. (2019) indicated that monetary policy instruments do not affect stock market returns and instability.

Material and Methods:

The Markov Switching model is one of the most popular nonlinear models of the time series, first proposed by Goldfeld and Quandt (1973), then expanded by Hamilton in 1983.
Today, the Markov switching model has received much attention in economic modeling. There is ample empirical evidence that are well suited for structural, nonlinear changes and features and dynamics of many time series models. The non-linear nature of these models enables them to accurately depict individual states with foreign exchange market patterns, such as jumping

and falling in the foreign exchange market better than other models (Ansarinasab and Mohammadi, 2019)

Unlike other nonlinear methods, in which the transition from one regime to another is gradual, the transfer occurs rapidly in the Markov switching model. This pattern is also known as the pattern of regime change. The reason for using the term regime change is that a policy variable may exhibit one behavior at a time and behave differently from its predecessor, so if it is not considered in investigating the behavior of the variable, biased results will be obtained.

In the Markov switching model, the regime that occurs at time t is assumed to be invisible and depends on an invisible process (s_t). In a model with two regimes, it can simply be assumed that s_t takes the values 1 and 2. A dual-regime AR(1) model can be described as follows (Equations 2 and 3):

$$y_t = \begin{cases} \emptyset_{0,1} + \emptyset_{1,1} y_{t-1} + \varepsilon_t & \text{If} \quad s_t = 1 \quad (2) \\ \emptyset_{0,2} + \emptyset_{1,2} y_{t-1} + \varepsilon_t & \text{If} \quad s_t = 1 \quad (3) \end{cases}$$

Or briefly it can be written as (Equation 4):

$$y_t = \emptyset_{0,s_t} + \emptyset_{1,s_t} y_{t-1} + \varepsilon_t \quad (4)$$

To complete the model, the characteristics of the process should be specified. In the Markov switching model, a first order Markov process is considered. This assumption implies that it depends only on the regime of the previous period, that is, Below, we complete our model by introducing the Transition Probabilities from one situation to another (Equations 5 to 8):

$$\text{p}\,(s_t = 1 | s_{t-1} = 1) = p_{11} \quad (5)$$

$$\text{p}\,(s_t = 2 | s_{t-1} = 1) = p_{12} \quad (6)$$

$$\text{p}\,(s_t = 1 | s_{t-1} = 2) = p_{21} \quad (7)$$

$$\text{p}\,(s_t = 2 | s_{t-1} = 2) = p_{22} \quad (8)$$

In the above equations, indicates the probability that the Markov switching chain will move from position *i* at time t-1 to position *j* at time *t*. … should be non-negative and also have the following condition (Equations 9 and 10):

$$p_{11} + p_{12} = 1 \quad (9)$$

$$p_{21} + p_{22} = 1 \quad (10)$$

The above model can be generalized to a state that includes m regimes and p intervals, in which case, some general cases occur, which are reviewed as table 1.

By combining different modes, more detailed models can be obtained in which different components can depend on the regimes. Therefore, in order to be able to choose the best model from the above models, the model selection strategy will be as follows:

1. Determining whether the data pattern is linear or non-linear using LR test
2. Determining the number of regimes for different modes of the Markov switching model using Akaike information criterion and the Markov switching information criterion

Comparison of estimated modes based on three features:

- Having the most significant coefficients (especially regime-dependent components)
- Having the maximum value of the maximum likelihood function
- Having a minimum variance of disturbance terms
- Selecting the optimal model based on the above feature

Table 1. Different modes of the Markov model

Regime-dependent component	Distribution of disturbance terms	Equation	Model name
Mean	$\varepsilon_t \sim \text{IID}(0, \delta^2)$	$\Delta y_t - \mu(s_t) = \sum_{i=1}^{p} \alpha_i \left(\Delta y_{t-i} - \mu(s_{i-1})\right) + \varepsilon_t$	MSM(m)[1] -AR(p)
Intercept Term	$\varepsilon_t \sim \text{IID}(0, \delta^2)$	$\Delta y_t = \text{c}(s_t) + \sum_{i=1}^{p} \alpha_i (\Delta y_{i-1}) + \varepsilon_t$	MSI(m)[2]-AR(p)
Variance of error terms	$\varepsilon_t \sim \text{IID}(0, \delta^2(s_t))$	$\Delta y_t = c + \sum_{i=1}^{p} \alpha_i \, (\Delta y_{t-i}) + \varepsilon_t$	MSH(m)[3] -AR(p)
Autoregressive term coefficients	$\varepsilon_t \sim \text{IID}(0, \delta^2)$	$\Delta y_t = c + \sum_{i=1}^{p} \alpha_i (s_t)(\Delta y_{t-i}) + \varepsilon_t$	MSA(m)[4] -AR(p)

1- Markov-Switching Mean
2- Markov-Switching Intercept Term
3- Markov-Switching Heteroskedasticity
4- Markov-Switching Autoregressive Parameters

Result and discussion

In this research, using the Markov switching method model, the asymmetric effects of exchange rate fluctuations, monetary policies, and oil prices are investigated in the form of the following regression model on a monthly basis for the period 2008-2020 (Equation 11):

$$ly_t = \alpha_0 + \alpha_1 loil_t + \alpha_2 lex_t + \alpha_3 lM_t + \alpha_4 inf_t + \varepsilon_t \quad (11)$$

Monthly data on oil prices (Because in this study, the purpose was to examine oil price fluctuations on the stock exchange index, and on the other hand, due to the erogeneity of oil price, the only factor that causes fluctuations in oil revenues in an unplanned manner, the oil price variable was used. It should be noted that due to successive sanctions, it is not possible to plan for a stable volume of oil exports) and total index in the years 2008-2020 was extracted from the Central Bank and the Tehran Stock Exchange. Changes in oil prices in each period compared to the previous period are considered as fluctuations in oil prices, the logarithm of the total index in each period compared to the previous period is multiplied by 100 and is considered as the monthly stock return of Tehran Stock Exchange.

The variables used in the research model are as follows (Based on the fixed price of the year 2004): Ly, Stock returns, required statistics and information were extracted and calculated from the Tehran Stock Exchange; $loil$, Oil price logarithm; required statistics and information were extracted from time series bank of the Central Bank of Iran; lex, Exchange rate logarithm; which is extracted from the website of the Central Bank of Iran; lM_t, Money volume Logarithm (money plus quasi-money) in Rials, Extracted from the IMF time series bank (Central Bank of Iran); inf: Consumer price index. Necessary statistics and information have been extracted from the Central Bank of Iran time series bank and ε_t, Markov model disturbance terms. In this article, the monthly data of the variables in the period 2008-2020 were used. The trend of the indicators is investigated in the Figure 1.

As shown in Figure 1, the exchange rate has had an almost constant trend from 2008 to mid-2019. From 2012 to the end of 2017, there was an almost constant trend, but in 2018, there was a shock, and until 2020, this non stationary trend continued. As shown in Figure 2, oil prices have fluctuated widely; Sanctions imposed are the main reason for these fluctuations. In 2008 and 2015, a decreasing shock is observed. Figure 3 shows a general upward trend over the years

under review that several incremental shocks are observed since 2012. Comparing the growth of liquidity in 2013 with 2012, it is necessary to pay attention to the fact that part of the increase in liquidity growth in 2013 is due to the increase in coverage of liquidity statistics due to merging two institutions (Salehin and Pishgaman Ati) in Ayandeh Bank in November 2013 and inclusion of the statistics of 5 banks in December 2013. Claims on the non-governmental sector were the most important factor in the growth of liquidity in 2013. The net foreign assets of the banking system were another factor in the growth of liquidity in 2013.

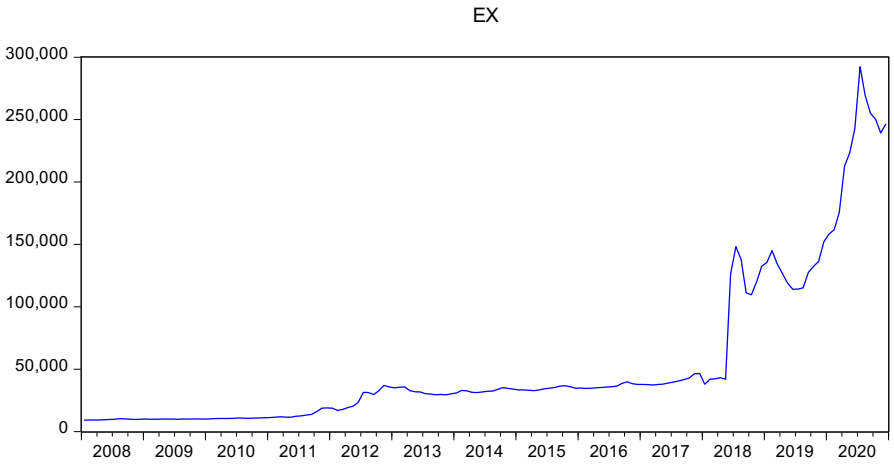

Figure 1. Informal exchange rate index of Iran

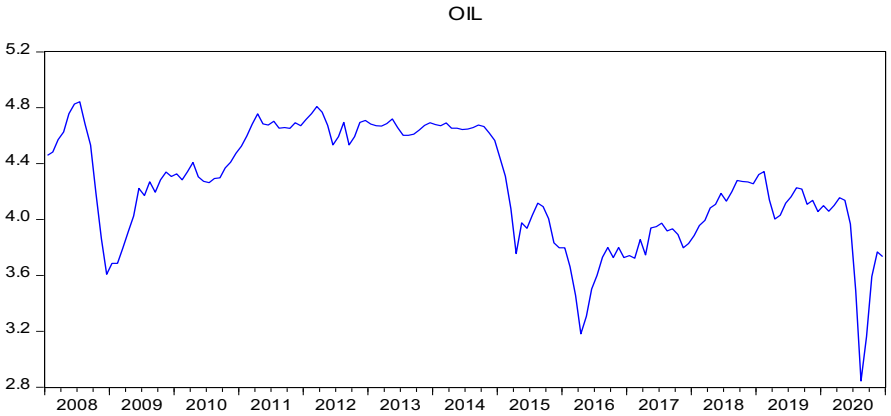

Figure 2. Oil price index in Iran

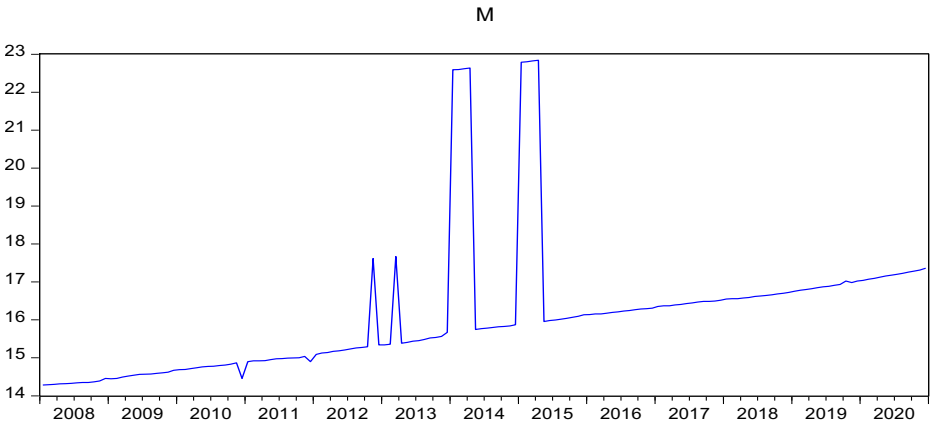

Figure 3. Iranian liquidity

The most important factor in increasing liquidity during 2015 was the net internal assets of the banking system. Receivables from the non-governmental sector (excluding interest and future income), net foreign assets of the banking system, net growth of foreign assets of the central bank and net growth of foreign assets of banks and credit institutions are the reasons for the growth of liquidity.

Figure 4 shows a relatively upward trend in the capital market. In between, there are fluctuations, some of which will be mentioned below. In 2013, the stock market index started its work with an upward trend, reflecting inflation and the increase in the price of the dollar in the financial statements of companies. This positive trend continued with more intensity with the coming to power of the 11th government and the positive nuclear negotiations since October. From January 6 onwards, with the creation of internal risks, the publication of inadequate reports on the performance of listed companies and issues related to the second phase of subsidy targeting, the overall index of the downward trend took place, which continued in 2014. The overall index rose sharply in the last quarter of 2015 due to the nuclear deal and market participants' optimism about the future of the economy.

Among the most important reasons for the decline of the capital market in 2016 can be the long-term closure of a significant number of market symbols and thus increased market risk as a result of reduced stock liquidity, weakening market demand as a result of market liquidity problems and development of debt instrument and the consequent outflow of much of the market liquidity, the adjustment of the positive expectations of capital market actors to the agreement of Joint Comprehensive Plan of Action and the result of the US presidential election. The main reasons for the growth of the total index in 2017 were the increase in oil prices, the increase in the price of basic metals, the decrease in interest rates on bank deposits and the increase in the exchange rate. In the last two months of the year, the stock market index was declining due to falling prices in world markets and approaching the official announcement of the US government about Joint Comprehensive Plan of Action.

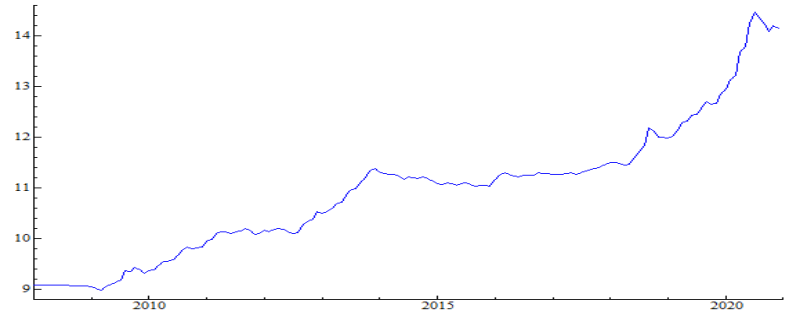

Figure 4. Iranian capital market returns

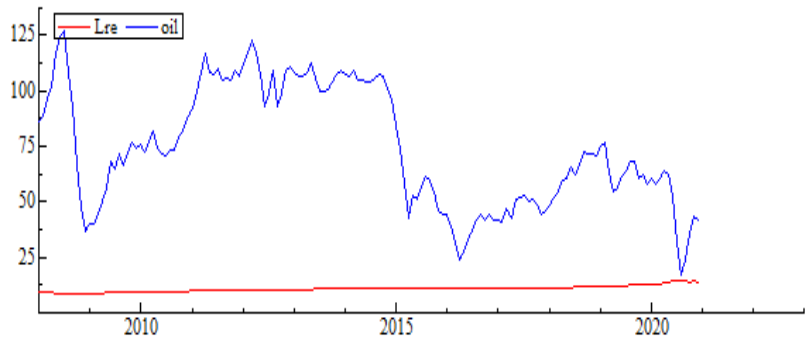

Figure 5. The trend of changes in oil prices and stock returns

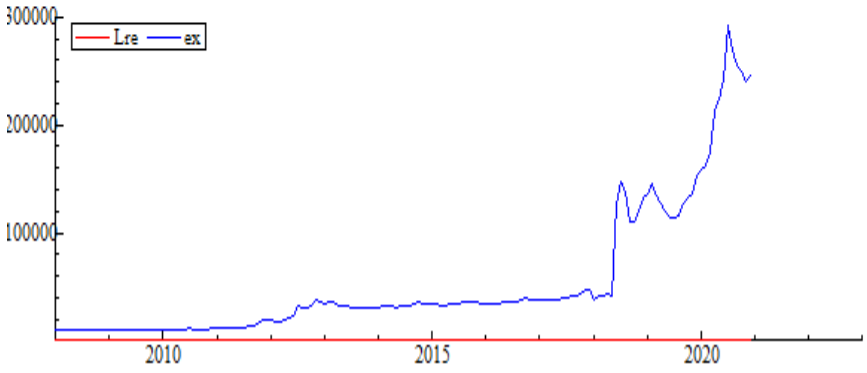

Figure 6. The trend of changes in exchange rate and stock returns

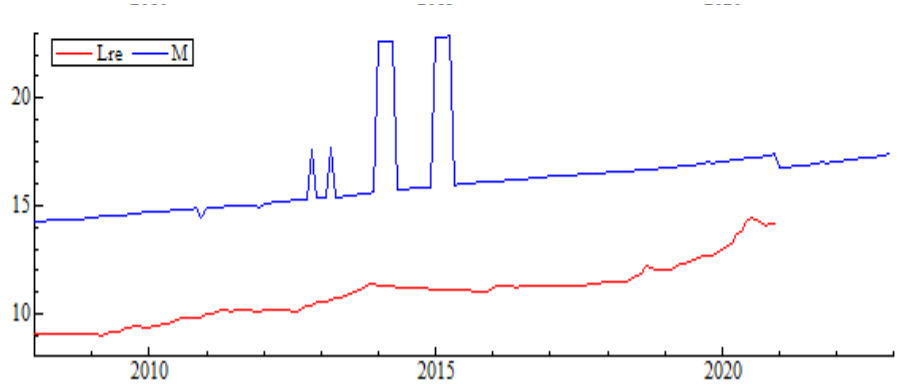

Figure 7. The trend of changes in liquidity and stock returns

Then, before estimating the model, the data should be tested for reliability, which is one of the ways to avoid false regression. There are several tests, the most important of which are the augmented Dickey–Fuller test (ADF) test, the Phillips- Perron test (PP), the GLS-DF test, the NG-Perron test, and the KPSS test. The results of the unit root test for the model variables are as shown in Table 2, and as can be seen, all the research variables are stationary at first difference:

Table 2. LLC unit root test results (with intercept and trend) (ADF)

Variable	Symbol	Statistics	Probability	Test result
Stock returns	ly	-9.01	0.00	Stationary at first difference
Oil prices	Loil	-2.99	0.03	Stationary at first difference
exchange rate	Lex	-13.41	0.00	Stationary at first difference
Liquidity	LM	-10.08	0.00	Stationary at first difference
Inflation	inf	-3.94	0.01	Stationary at first difference

The LR test is used for the suitability of the estimated nonlinear model compared to the linear model. In fact, using this test, it is examined whether the estimated nonlinear model was able to increase the explanatory power of the model compared to the linear model. The difference between the model we have estimated and the linear model is that in the linear model there is only one mean, but in the nonlinear model there is one mean for each regime. In fact, in the nonlinear model, it is assumed that the mean of the equation may vary in different states or regimes, and therefore the mean is estimated for each regime. When the means are equal in different positions, it means that the model is linear. In LR test, the null hypothesis is that the means are equal, in other words, it implies the linearity of the model and the opposite hypothesis implies the inequality of the means and the nonlinearity of the model (Miladifar et al., 2020). Now, if the value of the statistic obtained for this test is greater than the critical value of the

chi-square distribution at the 95% level, the hypothesis of equality of means or the linearity of the model can be rejected and it can be concluded that the estimated nonlinear model has higher explanatory power and it is more suitable for moldering compared to the linear model (Ang and Bekaert, 2002).

Table 3. Results of data nonlinearity test

Statistics	LR test value	Probability value	Result
Chi^2	177.32	0.00	The use of a nonlinear pattern is approved

According to the research results and considering that the value of LR linearity test is equal to 177/32 and the significance level is less than 0.05, it can be concluded that the estimated nonlinear model has more explanatory power and for modeling and is more appropriate compare with the linear model.

According to the model selection strategy mentioned in the model introduction and research method, the optimal model is MSIA (Table 4). The number of regimes is 2 (Table 5).

Table 4. Optimal model

		ac	sc
MSA	Only functional coefficients of the regime	-0.436	-0.187
MSAH	Coefficients and variance	-0.423	-0.153
MSIA	Coefficients – intercept	-0.465	-0.195
MSIAH	Coefficients- intercept -variance	-0.454	-0.164

Due to the lower value of Akaike statistics in MSIA model, this model was selected as the optimal model.

To determine the optimal regime in the MS model and due to the presence of confounding indexes in null Hypothesis, the LR test will not have a standard distribution, which makes it impossible to use this test to determine the optimal regime (Krolzig, 1997). Ang and Bekaert (2002) showed that in certain cases the asymptotic distribution of LR statistics between two regimes can be approximated using the chi-square distribution, so that the degree of freedom of this distribution is equal to the number of confounding indexes plus the number of linear constraints applied. In addition to the LR test, information criteria of HQ, SBC and ACI can be used to determine the number of regimens. The study of Psaradakis and Spagnolo (2003) indicates that in cases where the number of observations examined and changes in indexes are large enough, the use of Akaike statistics determines the correct number of regimens. However, in most experimental studies, the number of regimens is determined based on the researcher's knowledge of the variables. In the present study, the Akaike information criterion was used; The results are presented in Table 5:

Table 5. Optimal regime

regime	2	3
ACI	-0.46	-0.71

The results of ACI statistics determined the number of optimal regimens 2. The chart below shows the probability of each of the studied years in each of the two regimes. The dotted lines in the following figure (8) indicate these probabilities. As this chart shows, the sum of the probabilities of regimens one and two per year is one. The bold areas in the charts also show the year classification between the two regimes. According to this graph, it is clear that the estimated model has been able to have a good fit on the data. This figure shows the Markov switching values, the actual values, the prediction values, the errors in the two regimes.

The first Figure indicates the error terms of the difference between the actual and estimated values. And the figure 8 show the two regimes more clearly. The following Figure presents the actual values, the fitted values, the forecast for a later period, and the observations made in Regime 1. The more consistent the values (lines) of this graph are, the more descriptive the model is. The difference between the actual and fitted values are the same as the errors or disturbance terms. Table 6 shows the years in each of the regimes.

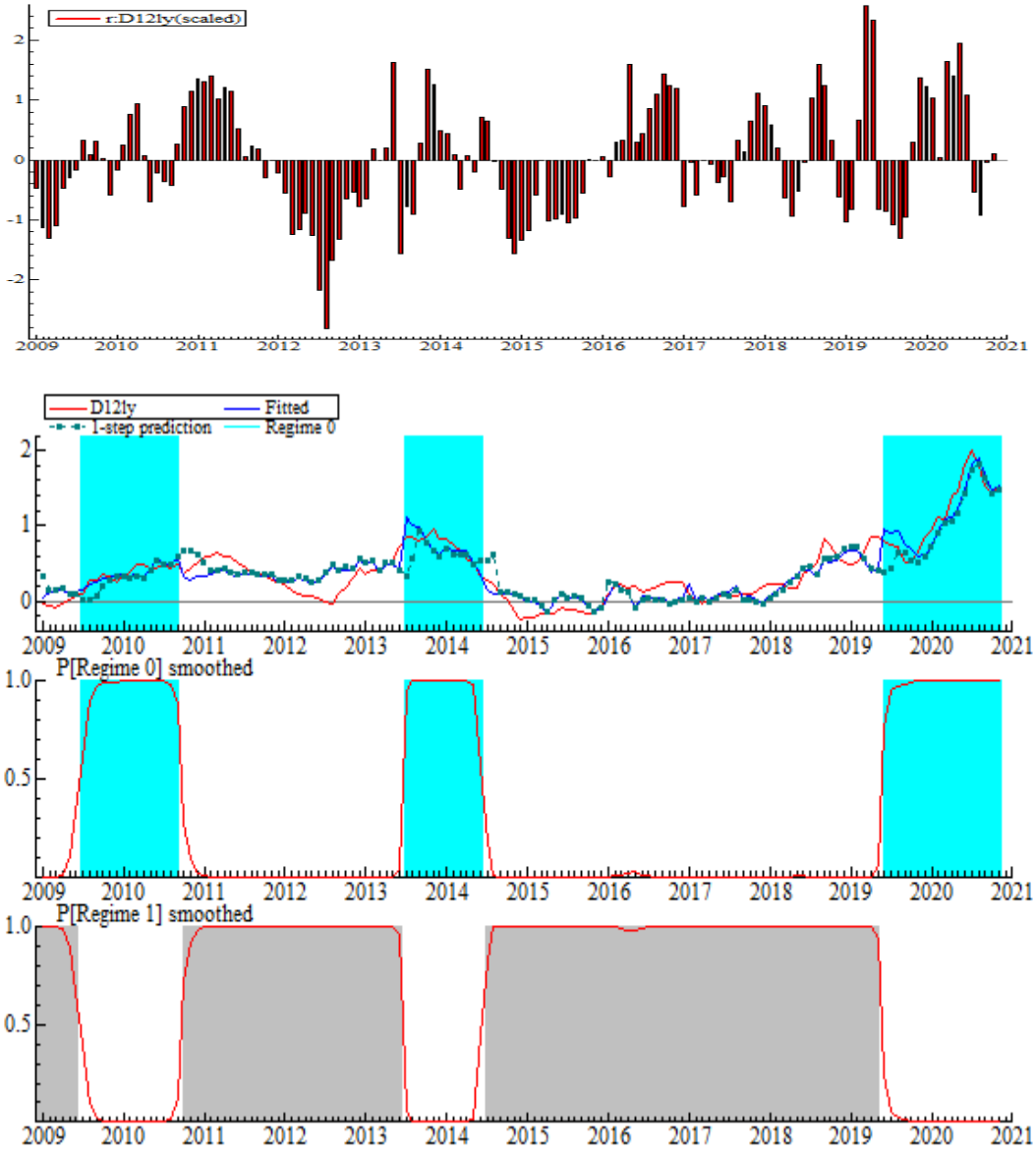

Figure 8. Probability of being in the two extracted regimes each year

As Table 6 shows, the first regime (in which stock market returns are ascending and volatile) consists of fewer years and months than the second regime (stock markets returns are descending, negative, and less volatile).

Table 7 shows the characteristics of each regime. According to the results of this table, regime 2 is more stable, because if the economy enters this regime, it will remain in this regime for an average of 31 months. Also, this regime has the highest probability, that is, if a month is randomly selected from the sample, it will be in this regime with a probability of 65.03%. The results of this table indicate that the Iranian capital market in the period under review (2008-

2020) was in a situation where stock returns were down or negative or had low volatility with an average of 31 months. As observed, the stability of the regime and the low level of the stock index in the country have been higher.

As can be seen in Table 8, the probability of estimated transitions indicates that both regimes are stable and the probability of change from one regime to another is low. The probability of staying in regime 1 (transition from regime 1 to regime 1) is 0.95 and the probability of staying in regime 2 (transition from regime 2 to regime 2) is 0.96. The magnitude of their value implies that only a severe accident can transfer stock returns or a series of stock fluctuations in stock returns from regime 1 to regime 2 and vice versa. The probability of regime change from regime 2 to regime 1 is 0.03 and the probability of transition from regime 1 to regime 2 is 0.04.

Table 6. Years and months in each of the regimes

Regime	Year	Number of months
Regime 1	2009(7)-2011(6)	24
	2013(6)-2014(7)	14
	2019(12)-2020(11)	12
Regime 2	2009(1)-2009(6)	6
	2011(7)-2013(5)	23
	2014(8)-2019(11)	64

Table 7. Characteristics of each regime

	Number of observations per regime	Probability of being in the respective regime	The average period of being in the respective regime
Regime 1	50 months	34.97%	16.67
Regime 2	93 months	65.03%	31

Table 8. Probability of transition from one regime to another

	(regime 1, t)	(regime 2, t)
(regime 1, t+1)	0.95	0.03
(regime 2, t+1)	0.04	0.96

As mentioned in the previous sections, the Markov-switching model disturbance terms should be normal and free of autocorrelation and variance heterogeneity. Below Table 9 are the results of the tests related to the mentioned characteristics.

Table 9. Tests related to disturbance terms

Test type	Test statistics value	Value of probability
Autocorrelation test[1]	10.25	0.13
Normality test [2]	3.20	0.20
Heterogeneity of variance test [3]	1.02	0.31

1. Ljung-Box Portmanteau Test
2. Jarque–Bera Test
3. ARCH Test

The results of the autocorrelation test show that at a significance level of 5%, the lack of autocorrelation cannot be ruled out, so it can be inferred that the disturbance terms are free of autocorrelation. The normality test also indicates that the disturbance terms' distribution of the estimated model is normal. The results of the variance heterogeneity test also show that the variance of the disturbance terms is the same. The table 10 shows the results of estimating the Markov switching model.

Table 10. Results of Markov switching model estimation for dependent variable of stock index return

	Regime 1				Regime 2			
Variable	Coefficient	Standard deviation	T statistics	Sig.	Coefficient	Standard deviation	T statistics	Sig.
Loil	-0.28	0.09	-3.08	0.00	0.30	0.11	2.72	0.00
LM	0.02	0.01	2.06	0.04	-0.05	0.01	-4.29	0.00
LEx	0.41	0.06	6.8	0.00	0.19	0.02	6.89	0.00
Inf	2.33	0.37	6.24	0.00	1.74	0.16	10.7	0.00

As shown in the table 10, a unit increase in the oil price variable will lead to a 0.28% decrease in the first regime and a 0.30% increase in stock returns in the second regime. Given the reliance of the Iranian economy on oil revenues, with rising oil prices, there is an expectation of economic prosperity in Iran, and this can provide the basis for increasing the stock price index. However, in some cases, it can be explained that with the continuation of rising oil prices, with a further increase in economic returns on competing assets, financial assets such as land and housing in this period, has led to the transfer of capital from the stock market to these sectors. Therefore, the stock price index of companies will have a downward trend. These results indicate the asymmetric effects of oil prices on stock returns in the two regimes.

The results show that there is a positive and significant relationship between exchange rate returns and stock returns in both regimes. Thus, a 1% increase in the exchange rate increases the stock returns by 0.41% in regime 1 and 0.19% in regime 2. In fact, increasing the exchange rate increases the Rial income from sales, especially exports, and promotes the competitiveness of manufactured products. Thus, with the increase in the exchange rate, the profit from the export of export-oriented companies - which account for the most of market value of listed industries - has increased and has shown its effects in improving the overall market price index and increasing market returns.

The results also show that an increase in monetary policy in the first regime leads to an increase of 0.02 and in the second regime leads to a decrease of 0.05 in stock returns. The share of monetary instruments as an indicator of monetary policy in changes in stock returns is less than 10%. In general, given the lack of systematic monetary policy - due to insufficient central bank authority in choosing monetary instruments - failure to achieve the objectives of monetary policy, government financial and quasi-financial dominance, bank-centered financing in the country and accumulation of about 90% liquidity in the form of quasi-money in commercial banks, most of which in the hands of a small percentage of the population, and on the other hand, due to small size, shallow market, non-competitive ownership structure, low percentage of floating stock in the stock market, regardless of type of monetary instruments, monetary policy has no particular effect on the stock market. But indirectly, it affects the stock market by influencing inflation and the exchange rate. The results of this study confirm this, because in both regimes, the inflation rate has the greatest impact on stock returns, so that in the first regime, the effect is 3.35, that is, with a 1% increase in inflation, the rate of return changes to 3.35%. In the second regime, with a 1% increase in inflation, stock returns increase by 1.69%. It can be seen that the extent of this effect is greater in the first regime than in the second. In the face of inflation, the value of replacement of corporate assets increases and the increase in the value of current assets can increase stock prices. However, over time, the quality of companies' real profits decreases and the intrinsic value of each share decreases; Also, with the increase of inflation, the discount factor reduces the price and as a result, the stock returns.

In order to comment on the symmetry or asymmetry state of the effect of oil price fluctuations and monetary and exchange rate policies on stock returns, it must be statistically confirmed, in fact, the null hypothesis should be tested. The test results reported in the table 11

indicate that the effect of oil price fluctuations and monetary and exchange rate policies on stock index returns is not the same and is asymmetric.

Table 11. Test results to examine the asymmetric effects of oil price fluctuations, monetary and exchange policies

Variable	Test statistics value	Value of probability
Oil prices	16.69	0.00
Monetary policy	19.89	0.00
Exchange rate	11.61	0.00

Conclusion and Recommendations

Economic growth and development require extensive and efficient financial markets. Since economic growth and development requires large investments and these investments can never be financed on the basis of short-term resource market (money market), creating a strong and efficient capital market constitutes the basic infrastructure of long-term financing for the fundamental plans of any country. Many variables can affect the stock market, including exchange rate variables, oil prices, and monetary policy. Therefore, in this study, using the nonlinear approach of Markov regime change, the effect of monetary policy, exchange rate and oil prices on stock market returns in Tehran was investigated. For this purpose, monthly data during the period 2008 to 2020 was used.

The results showed that monetary policy in the first regime has a negligible positive effect and in the second regime has a negligible negative effect on stock returns. To explain this behavior, it is necessary to analyze the capital market in terms of market depth, size of activity, ownership structure and management, and on the other hand, the way of implementation of monetary policy, the nature of monetary policy instruments and the role of the central bank in Iran should also be examined. An efficient capital market allocates credit resources to actors and businesses in the best possible way and plays an important role in financing them. According to available statistics, the stock market in the current Iranian economy is very shallow and has a very small role in it. Apart from the shallow depth of this market, the ownership structure of this market is another reason for its inefficiency.

Currently, most of the shares in this market belong to state and semi-state companies, according to the statistical report of the Tehran Stock Exchange in 2016, the companies in the top ten industries that have the largest market share are mainly government and quasi-government ones; In other words, 80% of this small capital market is in the hands of state-owned and semi-state-owned enterprises, and the private sector has very little access to the capital market. Therefore, it can be claimed that most of the stock market activities are owned by large legal entities. The market structure also indicates the dominance of legal entities over real ones in stock market transactions; which shows the blockchain of transactions and their concentration in the hands of legal entities that have a high information rent. Therefore, the percentage of floating stocks in the capital market is low. All these reasons cause floating stocks to have a low percentage in this market and lead to the possibility of price manipulation and interference in market prices, the risk of liquidity and more unfair corporate stock prices. On the other hand, there has been no monetary policy in Iran in the conventional sense. Because the requirement for the implementation of these policies is that the central bank has sufficient autonomy in using the tools at its disposal and by changing the tools and levers at hand, creates the desired result in terms of interest rates, inflation rates, etc. in community level. It must also have authority and control over the choice of policy instruments. While looking at the economic history of the country, it is found that the central bank has very low independence. In general, it can be said that due to the financial and quasi-financial domination of the government, the

central bank does not have an independent monetary policy and pursues fiscal policy. Therefore, due to the very low control of the central bank over its instruments, it can not follow a certain instrumental rule to implement its policy goals, and in particular, cannot use any monetary policy instruments effectively and systematically. Thus, when monetary policy does not affect market prices and returns, the stock market cannot be a channel for transmitting the effects of monetary policy on the Iranian economy. The results showed that a unit increase in the oil price variable would lead to a 0.28% decrease in the first regime and a 0.30% increase in stock returns in the second regime. Given the reliance of the Iranian economy on oil revenues, with rising oil prices, there is an expectation of economic prosperity in Iran, and this can provide the basis for increasing the stock price index. In other words, increasing government funding sources, expanding investment, boosting the external sector of the economy, and, in short, expecting economic growth from rising oil revenues can have a positive effect on economic activity. Therefore, the formation of these expectations can increase the expected profits of companies and thus increase the stock price index. However, in some cases, based on theoretical principles, it can be explained that with the continuation of rising oil prices with further increases in economic returns on competing assets, financial assets such as land and housing in this period, caused the transfer of capital from the stock market to these sectors so that the positive effects of rising oil prices on increasing monetary capital available to the public by further increasing the return on competing assets due to speculative demand in these assets increases the process of capital outflow from the stock market and its transfer to the competitors. Therefore, the stock price index of companies will have a downward trend.

These results indicate the asymmetric effects of oil prices on stock returns in the two regimes. As the results showed, there is a positive and significant relationship between exchange rate returns and stock returns in both regimes. Thus, a 1% increase in the exchange rate increases the stock returns by 0.41% in regime 1 and 0.19% in regime 2. In fact, increasing the exchange rate increases the Rial income from sales, especially exports, and promotes the competitiveness of manufactured products. Thus, with the increase in the exchange rate, the profit from the export of export-oriented companies - which account for most of the market value of listed industries - increases and shows its effects in improving the overall market price index and increasing market returns. In a situation where liquidity increases in the country, it increases the exchange rate by creating inflationary effects; Because according to the equation of purchasing power as well as the exchange rate-inflation spiral, when inflation increases in the country, the exchange rate will increase to maintain competition among domestic goods. If the foreign exchange market returns are higher than the stock market, it leads to the entry of liquidity into the currency speculation sector. In this situation, which usually occurs in the context of sanctions and reduction of foreign exchange supply in the country, in order to control the exchange rate and inflation in the country and also to finance the government budget, the government sells its shares and thus increases returns in the stock market.

According to the research results, if the goal is normal growth in the stock market, it is better that the central bank pursues a policy of explicit inflation targeting and optimal exchange rate policy that is appropriate to the specific requirements and conditions of the country and compatible with monetary policy conditions and inflationary situation, protects the stock market from instability. Also, considering that the behavior of the exchange rate in Iran is nonlinear and asymmetric, so forecasts and policies must be based on nonlinear and asymmetric behavior of this variable, because if forecasts and policies are based on linear and symmetrical behavior of the exchange rate, it will not have the necessary efficiency. The research variables showed different behavior in the two regimes, so this situation should be considered in modeling and forecasting, and the country's policies should be adopted and applied based on its time situation.

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