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The Effect of Monetary Policy on Financial Condition Index in Iran with the Markov-Switching Approach

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Abstract:
Monetary policy is one of the important economic policies that affect the macro variables of every country. One of the composite variables that are affected by the monetary policy is the FCI. This study aimed to measure the effect of monetary policy through different channels on the FCI of Iran. Using time series data from 1991-2023 and the econometric method of PCA, the FCI was first calculated. The effect of monetary policy on the FCI of the country using the Markov-switching (MSIHA(2) AR(2)) model was calculated and estimated. The results of the estimation of the Markov-switching model indicate that the studied period can be divided into two regimes of zero and one. So that 1% increase in the FCI in regime zero will lead to a 0.02% return of the FCI in the next month and a 0.36% increase in the next two months. In addition, the increase in the FCI in regime one will lead to a 0.08% return of the FCI and a 0.10% increase in the next two months. In addition, the volume of money in regime zero and regime one also positively and significantly affects FCI. Therefore, liquidity has positive effects on the FCI. This means that a 1% increase in liquidity, 0.27% in regime zero, and 0.42% in regime one have positively affected the FCI in this studied period. Loans and facilities granted by banks in both regimes zero and one have a positive and significant effect on the FCI. So that with a 1% increase in bank facilities (bank loans), the FCI increases by 0.14 in regime zero and 0.15 in regime one. The land and housing price variable has had a positive effect on the FCI both in regime zero and in regime one. So, in regime zero, with a 1% increase in

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housing prices, the FCI increases by %0.63. In regime one, with a 1% increase in the price of housing and land, the FCI increases by %0.05. The bank deposit interest rate variable significantly and positively affects the FCI in regime zero and regime one. Thus, in regime zero, with a 1% increase in the deposit interest rate, the FCI increases by %0.05, and in regime one, with a 1% increase in the interest rate, the FCI increases by %0.27.

The stock price index variable is another variable that monetary policy affects FCI through this channel. The effect of the stock index on FCI is positive and significant. So that in regime zero, a 1% increase in the stock price index increases the FCI by %0.018. In regime one, with a 1% increase in the stock price index, FCI increased by %0.22. The exchange rate is another variable that affects the FCI of the country through this channel. This variable has a positive and significant effect on FCI. So that with a 1% increase in the exchange rate, it increases the FCI by %0.44 in regime zero and %0.11 in regime one.

The net foreign assets of the Central Bank have had a positive and significant effect on the FCI both in regime zero and in the regime. So, in regime zero, with a 1% increase in the net foreign assets of the central bank, the FCI increases by %0.09. In regime one, with a 1% increase in the net foreign assets of the central bank, FCI increased by %0.05. These results are consistent with research hypotheses and theoretical foundations, which is not far from expected considering the economic conditions.

Introduction

Monetary policies affect the macro variables of each country. One composite variable affected by monetary policy is the Financial Condition Index (FCI). It is worth mentioning that the FCI is the weighted mean of the variables of the exchange rate, interest rate, stock price, housing price, bank facilities, and net foreign assets, in which the effect and weight of each of these variables on the FCI are different. Monetary policy affects the FCI through various channels of interest rate and currency, stock price index, housing price index, and the volume of money.

The implementation of monetary policy through interest rate changes does not have a significant effect on investment. In addition, the credit channel is more important than the interest rate when the contractionary monetary policy is applied. After implementing the contractionary monetary policy, the number of bank deposits and, accordingly, the number of bank credits will decrease.

Researchers in financial markets are looking for a suitable index to measure the pressures of monetary policy on economic variables. This index includes the main price of the economy: bank interest rate, stock price, exchange rate, and housing price. Usually, they are called FCI. One of the advantages of these indices is that it shows the effects of monetary policy on financial assets and, in

turn, can predict production and inflation through the central bank's monetary policy mechanism. The International Monetary Fund and the economic conditions assessment index present price changes and production fluctuations. Although monetary policy aims to stabilize prices, maintaining economic prosperity is one of its other duties. Therefore, policymakers should not limit themselves to monetary variables but consider mechanisms such as exchange rates, asset prices, and credit volume through which monetary policy affects production and economic activity. Due to the bank-oriented economy, many economic studies have confirmed the importance of monetary policy tools in Iran.

FCI can be defined as the current state of variables that affect economic behavior and the future state of the economy. In other words, the FCI indicates the state of the economy in the future, which is reflected in these current financial variables.

The FCI is a summarized index of current financial variables capable of predicting a country's future state of economic activities.

Viren (2012 and 2012), various economists, such as Goodhart and Hofmann, designed the Monetary Conditions Index (MCI) and the broader state of this index, the FCI, for many countries as one of the key indices to determine the state of monetary policy and its effect on the economy. The above economists evaluated this matter by increasing the price of assets, specifically housing and stocks, for Great Britain and Finland. Considering the many discussions about how these variables affect the total demand. In this way, according to the role of asset prices in the money transfer mechanism through wealth and balance effects, many central banks and international institutions have reached the FCI.

Financial conditions are the conditions of financial variables in the present that affect the economic behavior of the present and future. These financial variables may include anything that determines the supply and demand associated with economic activities. Similarly, it includes a range of asset prices and asset supply and demand indices. Normally, it can be said that the FCI measures financial shocks. This index usually includes interest rate, exchange rate, housing and land price, and stock price index and the weight of these variables.

It is possible to make the financial conditions in different ways:

1. It simulates a wide scale of econometric models and then presents them as a system.
2. Principal Component Analysis (PCA) methodology is a common factor of a group that includes several financial variables.

Theoretical foundations and research background

Effects of monetary policy through the stock market channel

Tobin (1969), in his well-known general equilibrium approach, designed a model that both monetary and financial policies have important effects on asset returns. Based on this approach, the main channel of influencing policies and financial

events is the total demand by changing the valuation of physical assets relative to their replacement costs. It should be noted that with an increase in the money supply or with a decrease in the interest rate, the demand for stocks increases, so the price of stocks increases, and in this way, investment expenditures and total demand also increase (Boanin and Gianoni, 2002). The hypothesis of the efficiency of the stock market claims that all coefficients of interruptions of monetary and financial policies should not be statistically significant. That is, all the recent estimates and the estimates made in the past of the expected monetary and financial policy movements will not have any effect on the stock returns because, according to the market efficiency hypothesis, they have already been reflected in the stock returns. Therefore, under the efficiency hypothesis, only the current coefficients of monetary and financial policy variables can be statistically significant. Also, these coefficients can create new information for the company and individuals in the stock market. This study aimed to examine the process of the first stage. Implementing the monetary policy by the central bank affects a series of intermediate goals or nominal anchors by using the monetary tools at its disposal to achieve the final goals through them. The interest rate, money volume, inflation rate, and prices can be mentioned among the most important intermediate goals.

Therefore, monetary policy can directly and immediately affect financial markets, including the stock market, by influencing the return and price of financial assets through its monetary tools and intermediate goals. As a result, it causes the stability or instability of financial markets and consequently has a positive or negative effect on the real economy.

Effects of monetary policy through the exchange rate channel

The exchange rate, as a measure of the parity value of a country's national currency against the money of other countries, reflects the economic status of a country compared to other countries. Assuming the full convertibility of all types of money in a country, the exchange rate is an important monetary economy index, which greatly affects all economic fields. Due to its interrelationship with other domestic and foreign variables, the exchange rate is influenced by economic developments inside and outside the country and has significant effects on both domestic and foreign economic variables.

Taylor (1995) and Obstfeld Rogoff (1995) confirmed the importance of the exchange rate channel in the monetary transfer mechanism and emphasized that any framework for applying monetary policy should include international economic relations and areas. Before 1970, the common patterns of determining the exchange rate were based on the level of relative prices and trade flows and the elasticity of currency supply and demand. The extreme fluctuations of the exchange rate in the years after its floating gave economists the idea that these fluctuations were very similar to the asset market price.

From that year onwards, the theoretical literature on determining the exchange rate was directed towards models based on the asset market, where the role of the exchange rate is as the relative price of the national money of countries instead of the price of national products. According to the Dornbusch model, monetary shocks in the short term cause the exchange rate to deviate from the long-term equilibrium. If the volume of money increases, the real supply of money immediately increases, and the interest rate decreases to compensate for the excess supply. A decrease in the interest rate causes capital outflow and an increase in the exchange rate. An increase in the exchange rate also increases the total demand with a net increase in exports (Dornbusch, 1988).

Based on the exchange rate channel, monetary policy has a greater effect on the export-oriented sector. Most of the revenue of this sector is obtained from foreign markets. Therefore, it will react more to the changes in the exchange rate caused by monetary policies.

Therefore, by applying a contractionary monetary policy, with the increase in the volume of money, the interest rate will decrease, the capital outflow will decrease, the exchange rate will increase, the foreign price of domestic goods will decrease, the value of exports and the total demand will increase.

On the other hand, the exchange rate directly affects the price level of imported goods. Of course, the extent of this effect depends on the elasticity of imports. However, changes in the prices of imported goods, whether they are consumption goods or capital goods, play a large role in determining the general level of domestic prices, affecting production and the level of domestic prices.

Effects of monetary policy through the interest rate channel

Interest rate is considered the most important change factor in nominal and real variables. In general, the ways of influencing monetary policy on real variables can be divided into interest rates, changes in asset prices, and bank credits.

Keynesians believe that the interest rate plays a fundamental role in transferring monetary policy. So that this rate is considered the link of communication and transfer of the monetary policy to the real part of the economy; this transfer will reduce the real interest rate in three ways: investment expenditures, adopting an expansionary monetary policy, consequently reducing the cost of capital, and increasing investment and total demand. Also, in the transfer through consumption expenditures of stationarity goods, it is believed that changes in interest rates, in addition to affecting investment expenditures, change the demand for stationarity consumption goods. In the transfer process through the capital account, a change in the interest rate changes capital flows.

Effects of monetary policy through the credits channel

Timing and combination of monetary policy effectiveness are not possible by relying on traditional theory. Therefore, economists use a set of paths called the

credit channel. In general, different viewpoints are based on microeconomic topics, including the role of bad choices, moral hazard, and costly supervision, which affect the nature of credit contracts and affect equilibrium rationing.
The starting point of this topic is related to the basic assumption that when obstacles such as incomplete information or high-cost contracts interfere with the smooth functioning of financial markets, a gap is expected to form between the cost of funds that are collected from abroad, such as issuing debt instruments, and the opportunity cost of funds raised internally. This gap, which Bernanke and Gettler called the cost of foreign financing, reflects the costs faced by firms. Now, accepting the credit channel with the interpretation that monetary policy not only affects interest rates but also affects the amount of foreign financing helps to better understand the composition, timing, and overall effectiveness of the monetary policy.

Effects of monetary policy through the housing price channel

Housing market developments in Iran's economy have always had a special place, and economists, politicians, and even ordinary people have always paid special attention to this sector. Of course, special attention to this sector has never been without reason. This part of the country's economic system has always had a very large contribution to the employment and production of the country and has been one of the main destinations of economic activists' capital (Mehregan, 2014). Therefore, it is not far from the expectation that the changes in this sector will affect the general state of the economy. By looking at the trend of the variables of GDP growth and the growth of the added value of the housing sector, it is easy to understand that the movement of these two variables is most of the time completely consistent, and it seems that the housing market has played an important role in the business cycles of the economy.
On the other hand, the studies and experiences of the countries have shown that the housing sector is an exogenous part of the economy, contrary to traditional notions, and is affected by other economic variables. In the meantime, after the financial crisis in developed countries, it became clear that monetary policy has a more important role in the housing market and generally affects the market trend (Hofmann, 2013).
After the financial crisis, attention was turned to the housing sector, and many studies have been conducted on the effectiveness of this sector on other sectors of the economy. Some studies emphasize that monetary policy and the housing market can be a non-linear and asymmetric relationship (TC, 2013). The capital or wealth-changing effects of the gainers or losers of housing price increases may be balanced at the aggregate level. If housing is not exchanged internationally, there is no acceptable reason that an increase in the real price of housing causes an increase in the real price. But there are some conditions under which the positive effects of wealth for owner-occupiers can overcome the negative effects

on consumption for future new buyers. The increase in housing prices has an expectation effect and a confidence effect, and optimistic expectations about its future revenue can cause a boom in the housing market.

An increase in the volume of money from the housing price channel leads to an increase in production and price levels only when the money in the housing market is absorbed, and changes in housing supply and demand cause its price to change. In addition to fundamental factors such as population, the number of registered marriages, per capita income, liquidity absorption in the housing market depends on the expected returns from the housing market and other markets, including gold, foreign exchange, stocks, and the money market.

Therefore, if the housing market conditions are favorable and the expected returns are higher, the increased volume of money is absorbed in this market, and the change in housing prices causes an increase in production and price levels. The more the volume of money increases, the less liquidity will enter the housing market. The housing price channel will have a smaller contribution to the transfer of money to production and price levels because more money will enter the markets with higher returns and affect the housing market less.

Effects of monetary policies through the volume of money

The viewpoints of different schools differ on how the change in the volume of money affects the real economic variables and the price of goods and assets. However, they all agree that the change in the volume of money, in the long run, leads to a change in the price of goods and assets, including the stock price. Keynesians and monetarists do not agree on what kind of financial assets people replace money when the volume of money increases. Keynesians' view of the effect mechanism can be stated in the following way: they usually consider assets that have fixed revenue (such as bonds and treasury) as a good replacement for money; in other words, in the Keynesian approach, the return of all assets, including stocks, is considered the same and risk-free. The mechanism of effect is such that any increase in money supply through a decrease in interest rates increases the demand for financial assets, including stocks, and as a result, increases their prices. In contrast, monetarism argues that an increase in the volume of money will, directly and indirectly, affect the flow of expenditures and asset prices. An increase in the volume of money upsets the equilibrium between the real balance and the desired balance of the money. To eliminate the excess supply, there will be excess demand for a wide range of goods and services and financial assets. On the other hand, they assume that the assets that replace the balance of money are diverse. These include various financial assets with different risks (such as bonds, treasury, mortgages, stocks, etc.). According to monetarism's theory, with the increase in demand for financial assets, including stocks, their prices increase directly (Mosaei et al., 2010).

Research background

Researchers have used different methods to construct FCI for many countries and have studied the function of FCI in predicting the inflation rate and the role of monetary policy formulation. For example, Mayes and Viren (1922) applied the reduced aggregate demand equation model to construct the FCI of 15 European countries, arguing that the FCI plays an effective role in guiding the formulation of monetary policies in European countries. Montagnoli and *Napolitano* used financial variables to take weight changes in explaining the production gap and made FCI for the United States, Canada, the Eurozone, and the United Kingdom. Swiston (2008) used Vector *Autoregression* (VAR) model and Impulse response functions (IRF) to construct United States FCI and suggested that FCI can predict growth from the real GDP analysis of the United States. Hatzius used principal components to choose the first component, called FCI, and predicted economic growth using FCI. Gomez (2011) extracted the principal components from the index such as interest rate and exchange rate and obtained the FCI for Colombia using the variance probability from the principal components based on weight. Studies have shown that FCI is an effective tool for accurate macroeconomic regulation using financial component analysis. Anglopoulo (2013) obtained the principal to study the effect of monetary policies on FCI.

Mayes and Viren (2001), who have used the reduced aggregate demand equation model in constructing the financial conditions for 17 European countries, have stated that the FCI plays a role in guiding the formulation of monetary policies of European countries.

Montagnoli and Napolitano (2005) have used the Kalman refinement algorithm to obtain the change in the weights of the financial variables in explaining the production gap and have made the FCI for the countries of the United States, Canada, Europe, and the United Kingdom. Swiston (2008) has used the VAR model and IRF to construct the US FCI and states that this index can predict the real GDP growth of the US. Hatzius (2010) used the PCA method to choose this index as the first component and predicted economic growth with this index. Gomez (2011) extracted the main factors of indices such as interest rates, exchange rates, and asset prices, and using the variance probability of the main components as weights; he made an FCI for Colombia. Studies have shown that the FCI has been an effective tool for macroprudential regulation and financial stability. Anglopoulo (2013) designed an FCI for European countries using the PCA method to study the consequences of financial policy on financial conditions.

Chinese researchers generally study the ability of the FCI to predict economic growth and inflation and also focus on the probability of using the FCI in monetary laws and policies. Dai Gukiang et al. (2009) stated that the FCI, which includes asset price information, can predict inflation promptly and effectively. Lu Jon (2008) found that the dynamic FCI can better predict the next quarter's

returns and inflation. In addition, the FCI is also used for studies on monetary policy rules, such as Xiao Qoishi (2011). A general Taylor function containing the FCI was made based on the Taylor equation.

Guthier (2004), in an article entitled FCI for Canada, examined the FCI based on the VAR model and factor analysis method during 1981-2000. The main finding shows that the FCI is a better index than the MCI.

Sustin (2008), in an article entitled FCI for the United States, examined the effect of the FCI on macroeconomic variables. Using the explanatory variables of standard loans, stocks, exchange rates, and partnership bonds, he found that most of the monetary policy effects affect the credits' supply.

Hibeaton et al. (2009), in an article entitled FCI for the United States, studied the effects of financial conditions on the economy. They also predicted the growth of economic productivity through the FCI. The results of the VAR model show that financial conditions reduce about 5% of economic growth.

Hatzius et al. (2010), in a study entitled the FCI, examined the relationship between the economic crisis and the financial situation in a fresh look after the financial crisis. They concluded that the FCI shows the effect of financial conditions on economic growth.

Vonen (2011), in the article FCI for Norway, examined the relationship between financial conditions and economic variables using the factor analysis method. Using the monthly data of exchange rates, stocks, housing prices, credits of financial firms, and credits of commercial banks, he concluded that economic growth could be predicted using financial conditions.

Bau (2012), in his Ph.D. dissertation entitled the FCI for Russia, concluded that using the method of factor analysis and VAR model, the FCI is a suitable index for the growth of GDP.

Hu and Liu (2013), in an article entitled FCI for Poland, using the factor analysis method and VAR model, concluded that the FCI is related to GDP growth and is better in the short term.

Taylor (2013) examined the relative effectiveness of central bank independence with monetary policy rules in better economic performance. The studies showed that the change in macroeconomic performance depended on the change in adherence to monetary rules and the practical independence of the Central Bank. Also, the monetary policy of the Central Bank of America in the absence of monetary rules led to unemployment and high inflation.

Taylor (2013) showed that the deviation from the regular policies that have worked well during the period of prosperity without inflation had been a factor in the deviation of macroeconomic performance in recent years in the American economy.

Manning and Shamlou (2015), in an article entitled FCI for Greece, developed an index as a monitoring tool. They examined the effect of monetary policy on

business variables using the factor analysis method and VAR model. Their findings show that the FCI is a suitable tool for economic growth.

Platt et al. (2015) examined the effect of financial development on economic growth in South Africa. Using Bayer-Hanck Cointegration approach, they examined the long-term relationship between trade openness, economic development index, and economic growth variables. The findings show that financial development is the driver of economic growth. The capital increase causes economic growth, but trade openness prevents it.

Balsilar et al. (2018), in a study entitled comparison of the ability of the FCI for South Africa, examined the FCI using the Bayesian method concerning the variables of production growth, inflation, and interest rates.

Taghizadeh et al. (2016), in an article entitled calculating the FCI, measured the FCI and the MCI using the PCA method. Using two different periods is one of the weaknesses of this research because, in the case of using the factor analysis method, at least 30 periods of information are required, which was not observed in this research.

Atrkar and Mahboobi (2016), in an article entitled the FCI for Iran, by estimating the total retrospective supply and total demand functions, concluded that during the studied period, the housing price variable (asset price variable) in the target index had a higher weight than other variables, while the effect of the coefficient of the stock index was not significant on the national production gap in any of its gaps. The findings of the research also indicate that the target index has the power to predict inflation in Iran's economy.

Mohseni et al.(2019), in an article entitled analysis of the role of unconventional monetary policy using the FCI of the Bayesian VAR, aiming to identify and analyze the monetary policy transfer mechanism, estimated the effect of the FCI on the activities of Iran's economy using seasonal data of 2006-2017. Then, the immediate action and reaction variables for the FCI have been estimated by using the prior and posterior distribution in the Bayesian VAR model. Their research findings indicate that the FCI had a negative effect on the GDP and private sector investment, and credit growth played an important role in the FCI.

Dadgar and Nazari (2013) examined financial development indices in Iran in a study entitled evaluation of financial development indices in Iran. The results showed that a relative improvement in financial development is observed whenever the financial and economic standards are paid attention to. An increase in the share of non-governmental banks in the banking industry, an increase in the share of the private sector in bank credits, a decrease in concentration in the banking sector, and an increase in the ratio of facilities granted to non-government sector deposits can be mentioned among the factors of relative improvement in financial development in the country. Also, the liquidity-to-GDP ratio, used in many studies as a financial depth index, has been increasing in recent years. In order to achieve a favorable level of financial development in the

coming years, the country needs to formulate a standard plan for financial development, pay attention to institutional reforms and create the necessary infrastructure to improve the institutional environment.

Methodology

Data collection

This research data was collected and prepared from the Central Bank website. The variables used in this research are from 1991 to 2022. The type of data is also time series. Factor analysis, as opposed to multiple regression, is a diagnostic analysis or focal correlation in which there are one or more dependent variables and several independent variables. In this technique, the studied variables are considered interdependent variables and are categorized based on the correlation and relationship between them in the form of a set of factors (Kalantari, 2016).

The main goal of factor analysis is to purify a large number of variables in a limited number of factors so that there is the least amount of lost information in this process.

In factor analysis, there are various models, among which two methods are PCA and common factor analysis. The PCA model is used when the researcher's goal is to purify the variables and achieve a limited number of factors. In contrast, common factor analysis is used when the goal is to identify factors or dimensions that are not easily recognizable (Ibid).

PCA method

One well-known and widely used method to reduce the dimension of data is PCA. The PCA method can convert some dependent variables into a smaller number of independent variables using mathematical relations. These new variables or features are called principal components. The purpose of the PCA method is to find the hyperplane on which the data image is most similar to the principal data. PCA is a transformation in the vector space that produces the greatest dimensionality reduction in the data set used. This method includes analyzing the eigenvalues of the covariance matrix of the data set. Experience has shown that feature transformation in the form of the PCA method, in most cases, leads to an increase in the accuracy of the learning model. But this method also has limitations. One of the main applications of PCA is feature reduction operations. As its name suggests, it can identify the main components and helps us to analyze a series of features that are more valuable instead of examining all the features. PCA extracts those features that provide more value.

Markov switching model

The Markov switching model is suitable for explaining the behavior of variables that change direction continuously, and their behavior changes from one state to another and returns to the previous state. The novel feature of the Markov-switching model is that the regime change mechanism in this model depends on a state variable that follows a first-order Markov chain feature. This feature completely contrasts with a model such as the *quantum* stochastic model, where regimes are independent of each other over time. The markov-switching model is also different from structural change models. In the Markov model, changes are allowed at any point in time and number of times, while in structural change models, it is only possible to apply changes at certain times and exogenously. Therefore, the Markov switching model is suitable for explaining data that show different behavioral patterns in various periods (Samadi et al., 2012). Today's economies have a common feature: economic activities in them are moving from a period of prosperity in which there is economic growth to a period of stagnation in which economic activities have negative growth.

In Markov rotation models, the behavior of the variable yt, in addition to εt and independent variables, depends on the state variable st. Due to the change of regime over time and the difference of parameters in the models related to each regime, the conditional mean values of the variable yt, the disturbance component related to each regime, and the variance of the model related to each regime can be different. Therefore, assuming that εt follows a normal distribution with zero mean and variance $\sigma 2(st)$, the probability of yt occurring in different regimes is as follows:

$$f(yt|st,\Omega t-1)=1/\sigma(st)\sqrt{2\pi}\exp(-(yt-\Phi(st)2\ /\ 2\sigma 2(st))$$

Where, $\Phi(st)$ and $\sigma 2(st)$ are the conditional mean and variance of the variable yt, respectively, both of which follow the state variable st. Therefore, the probability of the occurrence of the random variable yt at any point in time will depend on the random, latent st and dependent variables. Considering that the distribution st depends on its past values, in other words, the probability of occurrence st is not independent; there is a common probability between the occurrence yt and all st ($(yt|st, \Omega t-1)$. Based on this feature and the property of maximum likelihood functions based on maximizing the probability of co-occurrence of random quantities in the sample in order to maximize the probability of occurrence of the examined sample in the statistical population, these functions can be used to estimate all the random quantities of the model that are specified are not; therefore, we can write:

$$L=(yt|st=j,\Omega t-1)=\sum\sum(yt|st,\Omega t-1)p(st=j|st-1=i,\Omega t-1) \qquad (1\text{-}3)$$

As stated in the above equation, st is a random variable that follows the Markov chain with the transition matrix $\{st=j|st-1=i\}$=pij. Also, the disturbance term εtr is an uncorrelated random variable with mean zero and normal distribution and as $\varepsilon tr\sim(0,\sigma r2)$. In this regard, in the next section, we will first introduce two

policy rules to examine the performance of monetary policy and financial leverage on the growth rate of private sector credits. Then, to estimate both policy rules, firstly, the test of how to specify the model and check whether the model is linear versus non-linear have been examined. If the model parameters are shown from a non-linear process, using a linear model will obviously lead to misleading results and vice versa.

In order to estimate the Markov switching model, the maximum likelihood method is used. Therefore, the likelihood logarithm function can be written as the following equation:

$$L=\sum_{t-1}^{T} \text{Log}\,(P_{1,tf(FDI:\,St=1+(1-P_{1,t})f(FDI:\,St=2)} \qquad (2\text{-}3)$$

So that f(FDI: St=i) is the conditional distribution of the FCI to condition regime i at time t (The symbol : indicates the condition that)

On the other hand, considering that in these models, the studied time series is accompanied by regime changes, the assumption of constant parameters in VAR models is not justified.

The complete Markov switching model in the following equation, where the mean and variance are dependent on regimes (three regimes), can be stated as follows:

$$(Y_t-\mu_s = A_1 S_t \left(Y_{t-1} - \mu S_{t-1} + \cdots + A_p\,(S_t)\left(Y_{t-p}\right) - \mu\left(S_{t-p}\right)\right) + \varepsilon_t \qquad (3\text{-}3)$$

Where, Yt, μ, Ap(to A1), and εt are the time series vector, mean vector, model parameters vector, and model residuals vector, respectively, which have a normal distribution (Krolzeig, 1997).

Considering that St is a random variable and its changes cause changes in the equation's structure, it is better to identify how the state variable St changes. Therefore, in MS models, it is assumed that the state variable follows the first-order Markov chain, in which the current regime is dependent on the regime of the previous period and is as follows:

$$(P_r(S_t = j \mid S_{t-1} = i, S_{t-2} = K, \ldots) = P_r(S_t = j \mid S_{t-1} = i) = P_{ij} \qquad (3\text{-}4)$$

Stationarity test of variables and their results

The variables should be checked before estimating the stationarity model. This work helps to ensure that the results of estimations are not falsified; the non-falsity of regression is studied in different ways. In this research, the augmented *Dickey–Fuller* (ADF) *test* was used to check the stationarity of the variables used. The test results are shown in Table (1-4).

Table (1-4): Phillips-Perron test with Intercept mode and time trend at 0.05 level for all variables

Test result	PP statistics	Critical value	Variables
Non-stationarity	-2/4	-3/56	IRD
Non-stationarity	-0/86	-3/56	EXR
Non-stationarity	-1/44	-3/57	LOAN
Non-stationarity	-3/51	-3/56	BSC
Non-stationarity	0/74	-3/56	STOKE
Non-stationarity	-2/16	-3/56	LHPHA
Non-stationarity	-1/23	-3/56	M2

Source: Research findings

According to the results, it has been determined that all research variables are non-stationarity. Therefore, ADF test was conducted with one time difference for all research variables.

Table (2-4): Phillips-Peron test results with a one-time difference

Test result	PP statistics	Critical value	Variable
Stationarity	-5/4	-1/95	IRD
Stationarity	-3/08	-1/95	EXR
Stationarity	-5/3	-1/95	LOAN
Stationarity	-9/8	-1/95	BSC
Stationarity	-3/5	-1/95	STOKE
Stationarity	-5/55	-1/95	LHPHA
Stationarity	-4/2	-1/95	M2

Source: Research findings

According to the results of Table (2-4), all the research variables were non-stationarity, with a one-time difference; all were stationarity at the level of 0.05. It is worth mentioning that using the difference of variables causes the loss of information about the main values of the variables. To solve this problem, the cointegration test is proposed. Therefore, Johanson and *Juselius's* cointegration test is used to check the cointegration of the model. Null hypothesis means no cointegration. Based on the results of this test, the presence of cointegration at the 0.05 level has been confirmed. Therefore, the null hypothesis of no cointegration is rejected. The results of this test are shown in Table (3-4).

Cointegration test

It is worth mentioning that using the difference of variables causes the loss of information about the main values of the variables. To solve this problem, the cointegration test is proposed. Therefore, the Johanson and *Juselius* cointegration test is used to check the cointegration of the model. Null hypothesis means no cointegration. Based on the results of this test, the presence of cointegration at the

0.05 level has been confirmed. Therefore, the null hypothesis of no cointegration is rejected. The results of this test are shown in Table (4-4).

Table (4-4): The results of the Johanson and *Juselius* cointegration test

Maximum eigenvalues test	Effect test	Relations
111/6 (0/0)	386 (0/0)	No relation
93/5 (0/0)	274 (0/0)	Maximum of one relation
70 (0/0)	181 (0/0)	Maximum of two relation
88 (0/0)	110 (0/0)	Maximum of three relation
37 (0/0)	51 (0/0)	Maximum of four relation

Source: Research findings

Before calculating the FCI using the factor analysis method (PCA method), it is necessary to use the KMO and Bartlett test to ensure the adequacy of the chosen sample.

Performing calculations related to factor analysis requires a large amount of data. These two tests are scientific methods to ensure the adequacy of the chosen sample. Before using the factor analysis method (PCA method), it must be ensured that the sample size is adequate. The sample size is a determining factor in the accuracy of element clustering with the factor analysis method. One of the methods to check sample adequacy for factor analysis is to calculate the sample adequacy index. Kaiser, Meyer, and Olkin invented the sampling adequacy index, which is denoted by the symbol KMO. This index should be between 0.5 and 0.7.

Table (4-5): KMO and Bartlett test results

KMO statistics	0/5
Chi-square statistic (Bartlett's test)	295/2
Probability	0/00

Source: Output of SPSS software

According to the obtained statistic (0.5), its value is almost acceptable and indicates the adequacy of the sample size for the research.

According to the theoretical foundations and what was said about the FCI, this index can be written as an equation as follows:

$$FCIt = \omega \text{ ir } ( ) + (exrt\ ) + \omega len(lent\ ) + \omega \text{BAL (BAL}t\ ) + \omega stock\ (stockt) + \omega \text{ LAHPA (LAHPAt)}$$

Where FCI, irt, exrt, lent, and BAL represent the financial condition index, the real interest rate at time t, the real exchange rate at time t, the bank lending channel for the facilities of banks and credit institutions, and the balance sheet channel (net foreign assets of the banking system in billions of Rials), respectively; and stocht and LAHPA represent the asset channel, where stockt is the stock market index and LAHPA is the land and housing price index) of all urban areas.

Table (4-6): The results of the PCA for calculating the FCI

Eigenvalues: (Sum = 7, Mean = 1)					
No.	Value	**Difference**	**Proportion**	**Cumulative value**	**Cumulative proportion**
1	3/6	1/47	0/51	3/60	0/51
2	2/13	1/52	0/30	5/74	0/82
3	0/61	0/22	0/08	6/38	0/90
4	0/38	0/23	0/05	6/75	0/66
5	0/15	0/10	0/02	6/91	0/98
6	0/05	0/02	0/008	6/66	0/99

Eigenvectors (loadings):

number	variable	Pc1	Pc2	Pc3	Pc4	Pc5	Pc6
1	loan	0/38	-0/31	0/44	-0/23	0/63	0/28
2	lhpa	0/49	-0/17	0/06	0/29	0/03	-0/68
3	ird	0/39	0/22	-0/56	0/51	0/28	0/30
4	bsc	0/43	0/26	-0/19	-0/52	-0/26	0/29
5	stoke	0/01	0/56	0/63	0/42	-/10	0/22
6	exr	0/16	0/62	0/02	-0/36	0/20	-0/45

Source: Research findings

According to the calculation coefficients in the first vector mentioned in Table (4-6), it can be said that the highest correlation with the first components is, respectively, the variables of land (housing) price index, amount of liquidity (volume of money), net foreign assets of the central bank, interest rates, facilities granted by banks, exchange rates and stock price index.

The first component is the best choice because, as it shows, the first component is greater than one, and this component explains about 51% of the dispersion of the data set. In other words, this criterion shows that the choice of the first component (the first vector) is adequate, and the FCI is obtained from it.

The first vector is chosen for the reasons explained above and is called PC1 in the computer outputs, and it can be considered an FCI and used in various econometric models. By choosing this vector, the linear combination of the first component or PC1 and the main variables according to the table (12-4) is as follows.

FCI= 0/38 Loan+ 0/49 LhPA+ 0/39 IRD+ 0/43 BSC+ 0/01 Stoke+ 0/16 EXR

Housing is widely related to economic activities from the point of view of influencing employment and production and creating dynamism and mobility in the economy. Periodic changes in demand, price, and investment in the housing market and the resulting fluctuations in the financial and economic markets have affected the owners of these assets and investment.*s*

Therefore, housing is a tangible and objective asset of particular importance in creating added value, creating jobs, using internal inputs, and creating internal links between economic sectors. In the research, housing has the most weight in calculating the FCI.

The second variable that has a significant weight in determining the FCI calculation is the central bank's net foreign assets. There are two reasons for the increase in the net foreign assets of the central bank. The change in the parity rate of the rial against other currencies and the increase in the value of the gold price in the rial due to the decrease in the value of the national currency can be the first reasons for the increase in net foreign assets. The second reason can be the purchase of the government currency or the currency of the National Development Fund by the central bank. According to the monetary and banking law, the central bank is required to buy government currency, and this issue increases the currency balance of the central bank and increases liquidity.

The interest rate is the third variable contributing to the calculation of this index. Interest rate is one of the macroeconomic factors and is important in any country. The central bank determines the interest rate based on the economic conditions and conducts financial and banking affairs in line with this rate. The interest rate is used to prevent the devaluation of the money for the lender between paid money today and received in the future.

The fourth variable that effectively calculates the FCI is the facilities granted by banks (bank loans). The specific role of banks as lenders to classes of bank borrowers will increase loans that will increase investment expenditures. Therefore, the implementation of expansionary monetary policies by increasing the number of bank deposits has led to an increase in the number of bank resources and an increase in the amount of lending by banks, and this has led to the injection of bank resources into various economic sectors through loans and payment facilities that it will ultimately lead to an increase in the prosperity of production and economic growth.

The fifth variable that affects the FCI is the exchange rate. The effects of the exchange rate on real production in the economy are evident. Exchange rate changes affect inflation and the increase in the prices of goods faster than production. Therefore, with the increase in prices and revenue, producers are encouraged to produce. Fluctuations in the exchange rate affect the country's production and demand growth, so the choice of appropriate currency policies

according to the economic conditions leads to the establishment of a suitable currency system.

If the exchange rate can change, the prices in the economy may change more quickly, and these fluctuations are defined as instability and uncertainty and are considered a measure of risk, and it illustrates the uncertainty in international transactions of financial goods and assets.

The last and sixth variable affecting the FCI is the stock index. The degree of development of financial markets, i.e. (the total value of transactions and return on equity), leads to greater effectiveness of the capital market in economic growth. Most studies are related to the relationship and role of financial markets, especially the capital market, in financing and economic growth. If the capital market is summarized in two basic functions; the first function is the providing long-term financing of firms by directing savings resources with the aid of tools such as stocks, bonds, and other tools, and the second function is risk management by providing risk-covered strategies in financial markets or actual sector activities of the national economy. Today, countries are growing in their economy that is pioneering in implementing new financing strategies. Economies with a relatively advanced financial market, the capital market (stocks and bonds, etc.), play a multiplier role in firms' financing. The stock market not only provides information that is available to everyone, in addition to providing more financial options for firms in search of resources, but they also provide important signals to help allocate resources and thus contribute to the calculation of the financial conditions of the country.

Linearity LR test in research data

The most important part of the reported results is related to the Linearity LR test, which is used for the suitability of the non-linear model against the linear model. In fact, with this test, it can be understood whether the non-linear model has been able to add to the explanatory power of the model compared to the linear model.

The likelihood ratio test has been used to determine the relationship between variables. This test is defined as a chi-square distribution according to parameters. The null hypothesis is the absence of regime transition in the model. If the null hypothesis is rejected, it indicates a non-linear relationship between the variables, which occurs when the degree of freedom of the distribution is equal to the number of disturbance parameters plus the number of applied linear limitations.

In this test, the null hypothesis is the equality of the means, and hypothesis 1 is the inequality of the means and the nonlinearity of the model. Now, suppose the value of the statistic obtained is greater than the critical value of the chi-square distribution at the 95% level. In that case, the hypothesis of the linearity of the model can be rejected, and it can be concluded that the non-linear model has more explanatory power than the linear model.

Table (4-7): LR test results

LR test statistics	The value of the probability
42/08	0/000

Source: Research findings

According to the results of the research and considering that the value of the LR statistic is equal to 42.08 and the significance level of the DAVIS statistic is less than 0.05; therefore, the existence of a non-linear relationship between the variables is confirmed, and therefore multi-regime Markov switching models should be used instead of single-regime linear models.

The chosen model with the lowest limit of the Akaike criterion, MSIAH(2) AR(2) mode, was chosen from among the different modes of the Markov switching model, which is summarized in the following table.

Table (8-4): MSIHA(2) AR(2), Markov switching model estimation results

Variables	Regime zero			Regime one		
	Coefficient	T statistics	The value of the probability	Coefficient	T statistics	The value of the probability
Intercept	-6/64	-30/0	0/00	11/47	3/47	0/01
Volume of money	0/27	5/10	0/00	0/42	2/68	0/03
Loans and facilities granted by banks	0/14	0/23	0/00	0/15	0/75	0/00
Land and housing price	0/63	11/0	0/00	0/05	5/82	0/00
Bank (short-term) deposit interest rate	0/05	0/395	0/00	0/27	593/0	0/00
Net foreign assets	0/09	0/99	0/00	0/055	0/395	0/00
Stock price index	0/01	0/226	0/00	0/22	953/0	0/00
Exchange rate	0/44	4/16	0/004	0/11	434/0	0/00
First interruption of FCI	0/36	2/04	0/00	0/10	0/70	0/00
Second interruption of FCI	0/02	0/087	0/00	0/08	0/843	0/00
Standard deviation	0/02	0/005	0/00	0/23	0/039	0/00
Akaike criterion	-5/56					
Maximum likelihood	17/05					
Likelihood ratio (LR) test	The value of the probability: 0/0 T statistics value: 42/08					

Source: Research findings

The estimations of the parameters related to the model indicate that the studied period can be separated into two regimes of zero and one so that the intercept is equal to -6.64 in regime zero and 11.47 in regime one. Considering that in Markov switching models, the regime with negative intercept is the regime with low efficiency and the regime with positive intercept is the regime with high efficiency; therefore, based on this, regime zero can be called a regime with low efficiency, and regime one can be called a regime with high efficiency. On the other hand, the coefficient of the first interruption of the FCI has a positive and significant effect on the monetary policy in both regime zero and regime one. So that 1% increase in the FCI in regime zero will lead to a %0.02 return of the FCI in the next month and an %0.36 increase in the next two months. In addition, the increase in the FCI in regime one will lead to a 0.08% return of the FCI and a %0.10 increase in the next two months.

In addition, the volume of money in regime zero and regime one also positively and significantly affects financial conditions. Therefore, the amount of liquidity has positive effects on the FCI. This means that a %1 increase in the amount of liquidity, %0.27 in regime zero, and %0.42 in regime one have a positive effect on the FCI in this research period. According to the views of different schools regarding how the change in the volume of money affects the economic variables and the price of goods, they all agree on one issue the change in the volume of money leads to a change in the price of goods and assets, including stocks. Monetarism argues that the increase in the volume of money will directly affect the flow of expenditures and asset prices. In addition, the volume of money and its growth affects economic activities with emphasis on important variables such as production and employment. On the other hand, with the implementation of expansionary monetary policies, the volume of money in society increases, and it is a tool for the continuation of economic prosperity and GDP.

Loans and facilities granted by banks in both regimes zero and one have a positive and significant effect on the FCI, so with a 1% increase in bank facilities (bank loans), the FCI increases by %0.14 in regime zero and %0.15 in regime one. Because an efficient financial and banking system transfers capital from savers to recipients of bank facilities, productive financing projects increase production and economic growth. On the other hand, banks have been able to influence economic growth by providing the resources needed for real investment. The role of finance in terms of bank credits includes the channel of budget transfer from the deficit unit of the economy as a result of converting deposits into loans or credits (Adini, 2006). The obtained bank credits enable various economic factors to invest operational costs because bank credits provide a way to create and maintain a proper business. By collecting surplus resources, the banking sector helps to make credits available to investors who have brilliant ideas but lack the capital to implement their ideas (Adamou, 2006). The bank has a facilitating role for innovations and implements this role by providing credit to

production sectors. Therefore, bank facilities can lead to successful investment and ultimately be effective in economic development and improvement of financial conditions.

The land and housing price variable has positively affected the FCI in regime zero and regime one. So, in regime zero, with a 1% increase in housing prices, the FCI increases by %0.63. In regime one, with a 1% increase in the price of housing and land, the FCI increases by %0.05. When an expansionary monetary policy is established, the demand for housing is stimulated and causes an increase in housing prices, which according to the life cycle model, a permanent increase in housing wealth leads to an increase in household expenditures. The effect of wealth caused by the change in housing prices is an important channel in the money transfer mechanism. When the price of housing increases, it leads to an increase in the net value of housing, which can strengthen consumption. In general, liquidity is an important variable in increasing housing prices. Therefore, a sharp increase in liquidity leads to a sharp increase in housing prices and the emergence of severe disturbances in allocating economic resources. Therefore, if the capital market is inefficient and this market cannot absorb liquidity, the probability of its transfer to other asset markets such as housing, currency, and gold and creating a shock in these markets will arise (Arbabian et al., 2019).

The bank deposit interest rate variable in regime zero and regime one has a significant and positive effect on the FCI. Thus, in regime zero, with a 1% increase in the deposit interest rate, the FCI increases by %0.05, and in regime one, with a 1% increase in the interest rate, the FCI increases by %0.27. The increase in the bank interest rate based on McKinnon–Shaw theory, can conclude that by increasing the interest rate of bank deposits, the amount of investment will increase, ultimately leading to an increase in investment and growth. Therefore, increasing the interest rate on deposits will reduce inflation. On the other hand, the interest rate must be higher than the inflation rate; otherwise, part of the assets and purchasing power of the depositors will be lost, which means a decrease in consumption, a decrease in demand, and a decrease in investment. The increase in the deposit interest rate makes investments directed toward user technologies. Also, the bank interest rate affects the amount of capital accumulation in the country and employment and consequently the production through influencing the investment in the private sector. On the other hand, in the monetary sector of the economy, the real and financial assets market is directly and indirectly affected by the bank interest rate, and the fluctuations of these two markets also affect inflation.

The stock price index variable is another variable that monetary policy affects financial conditions through this channel. The effect of the stock index on financial conditions is positive and significant, so in regime zero, a 1% increase in the stock price index increases the FCI by %0.018. In regime one, with a 1%

increase in the stock price index, FCI increased by %0.22. This result is consistent with economic theories because one of the most important topics in theoretical economics is how the capital market affects the consumption expenditures of the private sector. A boom in the stock market can increase consumption expenditures. Because according to theories, consumption depends on the present value of lifetime revenue, and stocks represent a part of wealth. Therefore, an increase in wealth (stock market) can lead to an increase in the growth of consumption expenditures. As stocks and bonds rise, people feel rich and increase their consumption expenditures. In addition to affecting consumption, stock fluctuations can also affect investment expenditures. In fact, with the increase in stock prices, firms are encouraged to use new structures and equipment, and as a result, their total capital stock increases. Also, stock price as a part of assets can affect inflation through inclusion in expenditures. For example, an increase in asset prices through the effect of the balance sheet can increase the borrowing power of individuals and firms through collateral. The increase in the net value of assets increases the willingness of lenders to lend. Increasing the value of assets facilitates the development of public expenditures and expenditures in construction (Rizvi, 2013).

The exchange rate is another variable that affects financial conditions through this channel. This variable has a positive and significant effect on financial conditions. So that with a 1% increase in the exchange rate, it increases the financial conditions by %0.44 in regime zero and %0.11 in regime one so that the exchange rate can affect the amount of investment in different sectors of the national economy by influencing intermediate and capital goods and imported and exported raw materials. With the change in rial and dollar prices of raw materials of intermediate and capital goods, the first effect is seen in the prices and costs of production, which affects the production of domestic and foreign goods. On the other hand, the exchange rate affects the competitiveness of the countries that are parties to trade agreements, and it also affects the export and import of consumption goods, and in this way, it can provide the basis for reducing and increasing the price index. Since the real exchange rate is affected by the supply and demand of a currency in the currency market, monetary authorities can help strengthen the national money by using oil currency. With the increase in the exchange rate, consumption expenditures are transferred from foreign goods to domestic goods, and with the increase in exports and decrease in imports, the trade balance improves. This policy reduces the balance of the payments gap through export growth. In the framework of Keynesian economics, if the exchange rate can improve the net export and the balance of payments, it will affect the national revenue expenditure proportional to the multiplier coefficient.

The net foreign assets of the central bank have had a positive and significant effect on the FCI both in regime zero and in the regime so that in regime zero,

with a %1 increase in the net foreign assets of the central bank, the FCI increases by %0.09. In regime one, with a 1% increase in the net foreign assets of the central bank, FCI increased by %0.05. Whenever the net foreign reserves of the central bank increase or the net claims of the central bank from the public sector increase, or the claims of the central bank from banks increase, it causes an increase in the monetary base and the amount of liquidity. Also, when people's desire to keep banknotes decreases and they do more of their transactions with banking tools when people's desire to keep long-term non-visual and permanent deposits increases, or when the central bank imposes a lower legal reserve rate, or when the banks and credit institutions are less cautious in keeping reserves, then the ability of banks to lend and create money will increase (the multiplier coefficient of liquidity creation will increase) and the amount of liquidity will increase. In other words, we call the amount of liquidity to the monetary base ratio as the multiplier coefficient of liquidity creation, and it indicates that for each rial of money created by the central bank, finally, a few rials of liquidity have been created. The important point in the presented analysis is the relatively endogenous process of money creation, which limits the power of the central bank to control the growth of the monetary base. One of the issues raised is that the ratio of monetary quantities to GDP (for example, the amount of liquidity to GDP ratio) in Iran is much lower than in many other countries, and this means that higher economic growth can be achieved by increasing the amount of liquidity and directing it towards production. After estimating the optimal Markov switching model, it is necessary to interpret the transition probability matrix. In this matrix, the elements of the primary diameter indicate the stability of the regime, and the elements of the secondary diameter indicate the probabilities of regime change. Table (11-16) reports the obtained observations.

Table (9-4): Results of transition probability matrix and stability of regimes in the estimated two-regime Markov model

	Regime zero and period t	Regime one and period t
Regime zero and period t+1	0/83611	0/11206
Regime one and period t+1	0/16389	0/88794

Source: Research findings

As can be seen, for example, if the FCI is in regime zero in period t, there is a probability of 0.83 that it will be in regime zero in period t+1, and with a probability of 0.16, it will be transferred in regime one in period t+1. However, suppose the FCI is in regime one in period t. In that case, there is a probability of 0.88 that it will also be in regime one in period t+1, and it will be transferred to regime zero in period t+1 with a probability of 0.11. Therefore, the above table shows that the stability of regime one is higher than regime zero. The same was

observed in the above Table (11-15), and in the model estimation, it was observed that regime one was a regime with higher efficiency.
An important issue in the topic of Markov models is that the disturbance term must be normal and free from autocorrelation and heterogeneity of variance. The following table shows the results of the related tests.

Table (4-10): The results of the relevant tests of the Markov switching model

Test statistic value and probability value	Test statistics	Test type
0/9529 (0/7215)	Chi2(2)	Autocorrelation test
1/004 (0/6050)	Chi2(2)	Normality test
0/7154 (0/4362)	F(1,5)	ARCH homogeneity variance test

Source: Research findings

According to the results of the non-autocorrelation test, normality and homogeneity variance can be seen. The error level is above 5%, and it can be expanded that the disturbance terms have no autocorrelation, the error terms are normal, the model does not have heterogeneity of variance, and the Markov switching model can be confirmed.

Conclusions and policy suggestions

In this part, using the time series data extracted from the time series data bank of the Central Bank, the FCI uses data including interest rate, exchange rate, net foreign assets, stock price index and land and housing price index, and the FCI was calculated with the PCA method. Then the effect of monetary policy using different channels of money volume, stock price index, net foreign assets, housing price index, bank deposit interest rate, and exchange rate, the effect of this important economic policy on the FCI using Markov switching economics method was measured.
The results of estimating the FCI with the PCA method show that the interest rate has a positive and significant effect on the FCI and its weight in measuring the FCI is positive, and its value is 0.39. . The exchange rate channel also has a significant effect on the FCI, because, first of all, the effect of the exchange rate on the measurement of the FCI has become positive, and because the effects of the exchange rate on the real production in the economy are evident. Exchange rate changes affect inflation and the increase in the prices of goods faster than production. Therefore, with the increase in prices and revenue, producers are encouraged to produce. Fluctuations in the exchange rate affect the country's production and demand growth, so the choice of appropriate currency policies according to the economic conditions leads to the establishment of a suitable

currency system. The value of this coefficient is 0.16 in determining the measurement of the FCI. The stock price index has a positive and significant effect on the FCI. The value of the stock index has also become positive and 0.01, because the degree of development of financial markets, i.e. (the total value of transactions and return on equity), leads to greater effectiveness of the capital market in economic growth.

The land and housing price channel have had a positive and significant effect on the stock price index. The value of this channel is positive and 0.49. According to the theoretical foundations of the research, this result was not far from expected because housing has a wide relationship with economic activities from the point of view of influencing employment and production and creating dynamism and mobility in the economy. Periodic changes in demand, price, and investment in the housing market and the resulting fluctuations in the financial and economic markets have affected the owners of these assets and investments in them.

Loans and bank facilities have a positive and significant effect on the FCI because the value of this variable is 0.38 and has become positive. The specific role of banks as lenders to classes of bank borrowers will increase loans that will increase investment expenditures. Therefore, the implementation of expansionary monetary policies by increasing the number of bank deposits has led to an increase in the number of bank resources and an increase in the amount of lending by banks, and this has led to the injection of bank resources into various economic sectors through loans and payment facilities that it will ultimately lead to an increase in the prosperity of production and economic growth.

Net foreign assets have a positive and significant effect on measuring the FCI; its value is positive and 0.43 because, as mentioned, there are two reasons for the increase in the net foreign assets of the central bank. The change in the parity rate of the rial against other currencies and the increase in the value of the gold price in the rial due to the decrease in the value of the national currency can be the first reasons for the increase in net foreign assets. The second reason can be the purchase of the government currency or the currency of the National Development Fund by the central bank. According to the monetary and banking law, the central bank is required to buy government currency, and this issue increases the currency balance of the central bank and increases liquidity.

Monetary policy through the interest rate channel has a positive and significant effect on the FCI because the bank deposit interest rate variable, both in regime zero and regime one, has a significant and positive effect on the FCI. Thus, in regime zero, with a 1% increase in the deposit interest rate, the FCI increases by %0.05, and in regime one, with a 1% increase in the interest rate, the FCI increases by %0.27. Based on McKinnon- Shaw theory, the increase in the bank interest rate can conclude that by increasing the interest rate of bank deposits, the

amount of investment will increase, which will ultimately lead to an increase in investment and growth.

Monetary policy significantly affects the FCI through the exchange rate channel. The exchange rate is another variable that affects FCI through this channel. This variable has a positive and significant effect on FCI, so with a 1% increase in the exchange rate; it increases the FCI by %0.44 in regime zero and %0.11 in regime one. So that the exchange rate can affect the amount of investment in different sectors of the national economy by influencing intermediate and capital goods and imported and exported raw materials. With the change in rial and dollar prices of the raw materials of intermediate and capital goods, the first effect is seen in the prices and costs of production, which affects the production of domestic and foreign goods.

Monetary policy has a significant effect on the FCI through stock prices. The stock price index variable is another variable that monetary policy affects FCI through this channel. The effect of the stock index on FCI is positive and significant. So that in regime zero, a 1% increase in the stock price index increases the FCI by %0.018. In regime one, with a 1% increase in the stock price index, FCI increases by % 0.22.

Monetary policy through land and housing prices has a significant effect on FCI. The land and housing price variable has positively affected the FCI in regime zero and regime one. So, in regime zero, with a 1% increase in housing prices, the FCI increases by %0.63. In regime one, with a 1% increase in the price of housing and land, the FCI increases by %0.05. When an expansionary monetary policy is established, the demand for housing is stimulated and causes an increase in housing prices, which according to the life cycle model, a permanent increase in housing wealth leads to an increase in household expenditures.

Monetary policy significantly affects the FCI through the volume of money. The volume of money in regime zero and regime one also positively and significantly affects FCI. Therefore, the amount of liquidity has positive effects on the FCI. This means that a 1% increase in the amount of liquidity, %0.27 in regime zero, and %0.42 in regime one positively affect the FCI in this research period. According to the views of different schools regarding how the change in the volume of money affects the economic variables and the price of goods, they all agree on one issue the change in the volume of money leads to a change in the price of goods and assets, including stocks.

In choosing the monetary policy tool for the country's economic growth, the central bank must be careful because, in the form of equilibrium, a tool may not have the right effects if used incorrectly.

Banks can invest term deposits in economic projects, so if this does not happen, it will cause inflation and increase exchange rates through speculative activities.

The government must also be careful in choosing the combination of monetary and financial policy because if the government's policies do not succeed, it will

eventually lead to inflation and an increase in the exchange rate. For example, the combination of construction costs or the net capital cost, which, if not optimal, leads to a large inflationary burden, such as the Mehr housing project in 2012 and 2013.

The independence of the central bank can positively affect economic growth; therefore, policymakers should consider providing the necessary legal and political conditions to increase the central bank's independence. Also, monetary policy in Iran can affect economic growth. Therefore, it is suggested that central bank policymakers consider the effects of monetary policies before applying them. On the other hand, it can be said that central bank policymakers should avoid momentary decisions because any monetary policy can cause macroeconomic variables to fluctuate, which will reduce economic growth.

References

1- Gojarati, D., (2018). Basics of econometrics, translated by Hamid Abrishimi, second edition, Tehran University Press. (In Persian)
2- Nofarasti, M., (19989). Unit root and collectiveness in econometrics, Rasa Cultural Services. (In Persian)
3- Falahi F., & Hashemi Dizaj, A.R., (2010). Causality relationship between GDP and energy consumption in Iran using the Markov switching model, Quarterly Journal of Energy Economics Studies, 152-161. (In Persian)
4- Arbabian, Sh., & Azizi, Z., (2019). Analysis of impulses affecting housing prices in Iran, Quarterly Journal of Financial and Economic Policies, Vol. 7, No. 28. (In Persian)
5- Keshavarz Haddad, Gh.R., & Mahdavi, O., (2005). Is the stock market in Iran's economy a channel for monetary policy? Journal of Economic Research, No. 71, 147-170. (In Persian)
6- Sharifi Ranani, H., & Salehi, R., (2012). Asymmetric effects of monetary shocks on the level of real production in Iran, Journal of Economic Modeling, No. 19. (In Persian)
7- ID monetary and financial policies and stock market efficiency: empirical evidence in Iran, Quarterly Journal of Financial Knowledge of Securities, No. 20, 77. (In Persian)
8- Sharma, S. (1996); Applied Multivariate Techniques. Wiley & Sons, Inc.
9- Taylor, J. (1995). The Monetary Transmission Mechanism: An Empirical Framework. Journal of Economic Perspectives. 9, 11-26.
10- Walsh, C.E. (2010). Monetary Theory & Policy. The MIT Press. Third Edition, London.
11- Dornbusch, R. (1980). Exchange Rates and the Current Account. American Economic Review, 70, 960-971
12- Boivin Jean and Giannoni Marc (2002), Assessing Changes in the Monetary Transmission Mechanism: A VAR Approach, FRBNY Economic Policy Review.
13- Darrat, A. F. (2010). On Fiscal Policy and the Stock Market. Journal of Money Credit and Banking.
14- Bernanke, B, Gertler.M, (1996), The Financial Accelerator and Flight to quality, The Review of economics and Statistics.
15- Jafee, D, Rassell,T (1976), Imperfect Information uncertainly and credit rationing, Quarterly journal of economics,651-666.
16- Tsai, I. C. (2013). The asymmetric impacts of monetary policy on housing prices: A viewpoint of housing price rigidity. Economic Modelling, 31, 405-413.
17- Laopodis nikiforos (2006), fisiaL POLICY MONETARY POLICY AND STOKE MARKET QARTERY REVIEW .
18- Dornbusch R. (1980). Exchange Rates and the Current Account.American Economic Review, 70, 960-971.

تاثیر سیاست پولی بر شرایط مالی در ایران با رویکرد مارکف سوئیچینگ

چکیده:

سیاست پولی یکی از سیاست‌های مهم اقتصادی می‌باشد که بر متغیرهای کلان هر کشور اثرگذار است. یکی از متغیرهای ترکیبی که توسط سیاست پولی تحت تاثیر قرار می‌گیرد شاخص شرایط مالی می‌باشد. هدف از تحقیق حاضر سنجش تاثیر سیاست پولی از کانال‌های مختلف بر روی شرایط مالی کشور ایران می‌باشد. ما با استفاده از داده‌های سری زمانی طی سال‌های 0370-0402، و با استفاده از روش اقتصاد سنجی تحلیل مولفه اساسی ابتدا شاخص شرایط مالی را محاسبه، سپس تاثیر سیاست پولی بر شرایط مالی کشور را با استفاده از مدل مارکف سوئیچینگ (MSIHA(2) AR(2))، محاسبه و برآورد می‌کنیم. نتایج حاصل از برآورد مدل مارکف سوئیچینگ حاکی از آن است که، که دوره زمانی مورد مطالعه قابل تفکیک به دو رژیم صفر و یک است. به طوری که یک درصد افزایش در شاخص شرایط مالی در رژیم صفر منجر به 0/02 درصد بازده شاخص شرایط مالی در ماه دیگر و منجر به افزایش 0/36 در دو ماه دیگر خواهد شد. علاوه بر آن افزایش در شاخص شرایط مالی در رژیم یک منجر به 0/08 درصد بازده شاخص شرایط مالی و 0/00 افزایش در دو ماه دیگر خواهد شد. علاوه بر این، حجم پول در رژیم صفر و رژیم یک همچنین تاثیر مثبت و معناداری برشاخص شرایط مالی دارد. بنابراین حجم نقدینگی دارای اثراتی مثبت بر شاخص شرایط مالی است. بدین معنا که با افزایش یک درصد در حجم نقدینگی 0/27 درصد در رژیم صفر و 0/42 در رژیم یک تاثیر مثبتی بر شاخص شرایط مالی در این دوره زمانی تحقیق گذاشته است. وام و تسهیلات اعطایی بانک‌ها در هر دو رژیم صفر و یک دارای تاثیر مثبت و معناداری بر شاخص شرایط مالی می‌باشد. به طوری که با یک درصد افزایش تسهیلات بانکی (وام بانکی)، در رژیم صفر 0/14 و در رژیم یک 0/55 شاخص شرایط مالی افزایش می‌یابد. متغیر قیمت زمین و مسکن هم در رژیم صفر هم در رژیم یک تاثیر مثبتی بر شاخص شرایط مالی داشته است. به طوریکه در رژیم صفر با افزایش یک درصد در قیمت مسکن، 0/63 شاخص شرایط مالی افزایش می‌یابد. در رژیم یک نیز با افزایش یک درصدی قیمت مسکن و زمین، 0/55 شاخص شرایط مالی افزایش می‌یابد. متغیر نرخ سود سپرده بانکی (نرخ بهره)، هم در رژیم صفر و در رژیم یک دارای تاثیر معنادار و مثبتی بر شاخص شرایط مالی می‌باشد. به طوریکه در رژیم صفر با افزایش یک درصدی در نرخ سود سپرده، 0/55 شاخص شرایط مالی را افزایش می‌دهد و در رژیم یک با افزایش یک درصد در نرخ سود (نرخ بهره)، 0/27 شاخص شرایط مالی افزایش می‌یابد.

متغیر شاخص قیمت سهام نیز یکی دیگر از متغیرهایی هست که سیاست پولی از طریق این کانال بر شرایط مالی اثر می گذارد. تاثیر شاخص سهام بر شرایط مالی تاثیر مثبت و معناداری است. به طوریکه در رژیم صفر یک درصد افزایش در شاخص قیمت سهام 0/118 شاخص شرایط مالی افزایش می‌یابد. در رژیم یک نیز با افزایش یک درصد در شاخص قیمت سهام، 0/22 شرایط مالی افزایش می یابد. نرخ ارز یکی دیگر از

متغیرهایی است که از طریق این کانال بر شرایط مالی کشور تاثیرگذار است. این متغیر بر شرایط مالی تاثیر مثبت و معناداری دارد. به طوریکه که با افزایش یک درصد در نرخ ارز 0/44 در رژیم صفر و 0/11 در رژیم یک شرایط مالی را افزایش می‌دهد.

خالص دارایی های خارجی بانک مرکزی هم در رژیم صفر و هم در رژیم یک تاثیر مثبت و معناداری بر شاخص شرایط مالی داشته است. به طوری که در رژیم صفر با افزایش یک درصد در خالص دارایی‌های خارجی بانک مرکزی، 0/09 شرایط مالی افزایش می‌یابد. در رژیم یک نیز با افزایش یک درصدی در خالص دارایی های خارجی بانک مرکزی، 0/55 شرایط مالی افزایش می‌یابد.این نتایج با فرضیه های تحقیق و مبانی نظری سازگار می‌باشد که با توجه به شریط اقتصادی دور از انتظار نیست.

کلید واژه: سیاست پولی، شاخص شرایط مالی، تحلیل مولفه اساسی، مارکف سوئیچینگ، ایران.

طبقه بندی JEL: E5, G1