The Analysis of the Impact of Monetary Policy Shocks on the Dynamics of the Flow of Funds Account with an Emphasis on the Private Sector

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Abstract
In this paper, the impact of monetary shocks on asset changes and the financial liabilities of different institutional sectors were examined. Afterwards, financial and non-financial tools of the private sector's balance sheet in the funds flow account were analyzed. For this purpose, a factor-augmented vector autoregressive (FAVAR) model is employed for the data from 1973-2017. Results show that expansionary monetary shock has led to a rise in the assets and financial liabilities belonging to institutional sectors in the first year. With regard to the private sector and the financial tools of its balance sheet, monetary shock significantly impacts this sector's long-term deposit while it has a weak insignificant impact on the short-term deposit. The monetary shock also has a strong significant impact on the private sector's taking long-term loans while it has a weak insignificant impact on the short-term loans taken by the same sector. Regarding the non-financial tools of this sector, the expansionary monetary shock has a positive effect on the construction and machinery investment in the short run. In the long run, however, the two variables' responses are reversed which indicates the negative effect of monetary shock caused by an increase in oil revenues on the private sector's investment in both the construction and the machinery sector. As a result, it can be concluded that the oil revenue reduces the private sector's relative size in Iran economy.

Highlights

- The flow of funds account outlines the financial transaction and funds flow that occurs in institutional sectors.
- In the present study, a FAVAR model is employed to analyze the dynamic response of financial assets and liabilities of the institutional sectors to monetary shocks.
- A review of the response of major non- financial balance sheets of the private sector shows that increased oil revenues lead to the reduced relative size of the private sector.

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1. Introduction

Economic operations in the flow of funds account are divided into five main economic categories of households, nonfinancial firms, financial institutions, the government and its affiliated enterprises, and the outside world. Information obtained from the flow of funds account could be used to determine from which sector and with the help of which instruments each institutional sector has financed its required funds over a given period or to which sector and through which instruments it has granted its surplus fund. (Christiano et al., 1996).

By more precisely examining the image presented by this account, we can have a clear understanding of various assets and liabilities of the acquisition structure and monitor its changes over time. In the presented tables, all the information regarding the level and the depth of using financial tools, the variety of financial tools used, their share of financial transactions, the role of financial institutions, such as banks, in equipping institutional sectors' excess and requisite resources, and the financial relations of institutional sectors can be found. (The Central Bank of Iran, 2018)

The funds flow tables demonstrate financial account and capital account. The financial account includes financial uses (assets) and resources (liabilities) while the capital account encompasses non-financial uses and resources. As one of the basic principles of the funds flow account, the subtraction of the total uses from the financial resources in the financial account equals the discrepancy of the total resources from the non-financial uses in the capital account. (The Central Bank of Iran, 2018)

To present the information related to various financial and non-financial tools in details, this account can be used to analyze the impacts of fiscal and monetary shocks on assets and liabilities in institutional sectors. The main focus of this study is on monetary shocks originating from oil revenues. Being extremely susceptible to the global oil market conditions and oil revenues has constantly influenced Iran's economic development and has played a crucial role in the domestic economic structure. Oil prices, and consequently, oil revenues, are fluctuating due to global economic conditions; the government's budget as well as the domestic economy's reliance on this resource inevitably causes extreme fluctuations in macroeconomic variables, such as private sector investments, and financial variables, such as assets and liabilities of institutional sectors.

Therefore, initially, this study briefly examines the impact of the monetary shocks on the changes of institutional sectors' assets and financial liabilities including households and non-financial enterprises (private sector), public and private banks, the central bank, and the government and foreign sector. Afterwards, it will examine major financial tools (long- and short-term deposits, long- and short-term loans, and stocks), and non-financial tools (investment in the construction and investment in machinery and equipment) of the private sector's balance sheet in the funds flow account in more detail.

Regarding the significance of this issue, the assets and liabilities' changes of different institutional sectors can lead to strengthening the influence of monetary shocks on real economic variables through this sector's financial decisions, and monetary shocks can play a critical role in transition and communication between the financial and real economic sectors. This issue can be approached in terms of two aspects:The first aspect is that monetary policies can influence real economic variables through a variety of channels; among the channels for the transfer of monetary policy, the credit channel is of particular importance, especially in developing countries (Jannsen et al., (2019); Tunc & Kilin, (2019); Raei et al., (2018); Heidari & Molla Bahrami, (2015)).

Bernanke and Blinder (1992); Gertler and Gilchrist (1993) and Bernanke and Gertler (1995) used the incomplete information assumption and other credit market frictions to explain the impacts of monetary policies on the economy. The importance of the credit channel—specifically in developing countries—is because, despite the financial innovations and development of financial markets in these countries, banks still play a prominent role in credit market as financial intermediaries. Besides, any friction or shortcoming (e.g. the lack of equal access to financial resources for small and large firms) in the credit market would result in changes in assets and liabilities of institutional sectors, which can result in reinforced impacts for monetary shocks on real economic variables through the financial decisions of various sectors.

The second aspect is that a more detailed analysis of balance sheets and the changes of institutional sectors occurred in the financial and non-financial assets and liabilities of these sectors, especially the private sector, determines the orientation of governments' policies and lead to making essential policies in expanding activities in the private sector more effectively and efficiently.

Notably, the size and the speed of the responses of assets and liabilities of institutional sectors, and in the case of the private sector, the tools forming assets and liabilities to monetary policy shocks are expected to be different. These responses vary in different institutional sectors and in different countries, including the United States, Italy, Portugal, Eurozone, and India. (See Christiano et al., 1996; Bonci & Columba, 2012; Gameiro & Sousa, 2010; Bonci, 2012; Singh, 2019).

The impacts of the monetary policy shocks on the funds flow data of institutional sectors using the VAR model were analyzed in these studies. This study's approach is generally similar to these studies. The contribution of the present research is the usage of the factor-augmented vector autoregressive (FAVAR) model presented by Bernanke et al. (2005). A major problem with the previous studies is having to choose macro variables among numerous variables leading to inefficient usage of information available in the economic statistics as well as entering the funds flow variables separately in the model due to limitation of the degree of freedom. This problem can be solved by using the FAVAR model and one or two factors optimally containing the information of multiple time series variables.

Another contribution of this paper is that in contrast to studies related to Iran examining the response of one or two institutional sectors to monetary shock, this study examines the collective, dynamic response of all institutional sectors using the FAVAR model.

Following the Introduction, the paper is organized as follows: in the second section, the literature review related to the topic will be discussed. The theoretical foundations will be laid in the third section, and the data used, along with research methodology are elaborated in the fourth. The fifth and sixth sections will address the results and conclusion respectively.

2. Literature Review

Christiano et al. (1996) used the shock inflicted on the federal funds rate and the non-borrowed reserves as monetary policy shock criteria and concluded that following the contractionary monetary policy shock, net funds raised (financial liabilities - financial assets) by the business sector rose for approximately one year and then, started to fall due to the economic downturn caused by the political shock.

This reflects the increase in the short-term financial liabilities of the business sector, mostly related to large companies and business enterprises, and a rise in the financial assets of this sector; the increase in the financial liabilities is more than the increase in the financial assets.

In Italy, Bonci and Columba (2012) obtained similar results, but Christiano et al. presented ambiguities in their results regarding the public and financial sector. The non-financial enterprises sector reduces the acquisition of new assets and issuance of financial liabilities for a year after the shock and, eventually, the net fund raised in this sector experiences a slight rise. Unlike the study of Christiano et al. (1996), there is no solid evidence in favor of financial frictions to prevent companies from adjusting their nominal costs.

In Portugal, Gameiro & Sousa (2010) conclude that in case of contractionary shock, non-financial companies and households initially increase the net fund raised. It shows an increase in financial assets and liabilities for non-financial companies, with the liabilities showing a sharper increase. The same conclusion can be reached about the United States, indicating that some degree of friction hampers the speedy adjustment of the companies' costs after the shock. In particular, it may reflect limitations imposed on them by existing contracts, which prevent them from adjusting the inventory level quickly to lower than the demand level, forcing them to resort to foreign financing.

In the Eurozone, Bonci (2012) observed that with the occurrence of contractionary monetary policy shock, the public budget deficit increased; companies reduced their demands for bank loans and replaced a part of them with intercompany loans and increased their liquidity to compensate for the decrease in revenues related to a downturn in economic activities. Households decreased the net borrowing and increased the precautionary savings in the short term. With

an increase in the rate of interest, banks experience a short-term reduction of credit growth.

In India, in the descriptive report of its flow of funds account, the Reserve Bank of India (2017) concluded that the economic financial resource gap in 2014-15 declined in an environment characterized by ongoing financial consolidation, dwindling global commodity prices and adjustments to net capital formation.

Narayan et al. (2017) also observe in their study that the public sector has the largest net financial deficit, and households have the greatest net financial surplus. Yet, the private companies sector now has a larger gross domestic product deficit than ever before, indicating greater trust in the foreign credibility of other sectors.

Singh (2019) has also examined the mobility of capital among the sectors of the Indian economy using the data of the flow of funds account. The statistical sample co-integration breakdown tests at the end of the period indicate a co-integration breakdown between savings and investment in all the sampled periods for the household sector and financial institutions, but not for the public sector.

Serkan (2021) analyze the balance sheet channels of depreciation of the Turkish non-financial corporations for 2003–2015. Having constructed a novel, hand-collected firm-level dataset on the composition and term structure of foreign currency assets and liabilities, he show that foreign currency debt and mismatch has a significant negative balance sheet effect on capital investment following a depreciation. The results remain same even after controlling for foreign currency assets and exports. This implies that the contractionary net worth effect of depreciation dominates its expansionary competitiveness effect. The result is more pronounced for the firms with short-term foreign currency exposures.

In their study, using a model based on the experimental work of Kashyap and Stein (1995), Taghavi and Lotfi (2006) concluded that the monetary conditions index (MCI) (legal interest rate) has a negative but negligible impact on the growth rate of bank deposits and the balance of their granted facilities. By assuming the legal interest rate as a policy variable, Komijani and Sharifi Renani (2015) also concluded that in both the medium- and long-term, the exchange rate channel has been the most effective in communicating the monetary policy to nominal gross domestic product (GDP); however, in the short-term, the role of the house price index channel has been more pronounced in communicating changes in the monetary volume.

By comparing the results obtained from the SVAR model with the prices of the assets, such as housing prices, gold coin prices, stock prices, and exchange rates with the SVAR model without asset prices in the 1988-2013 period, Mohseni Zonouzi (2016), in his paper, shows that by adding asset prices (housing prices, gold coin prices, and stock prices) to the model, the effect of monetary policy shocks is significantly intensified through liquidity shocks imposed on production volatility. This confirms the significance of the balance sheet channel (financial accelerator) of the credit perspective in the monetary transfer mechanism in the Iranian economy.

In their paper, using the dynamic stochastic general equilibrium (DSGE) model, Heydari and Mollabahrami (2015) concluded that, on the one hand, a positive shock to the deposit interest rates reduces the demand for investment in physical and financial assets, and on the other hand, it increases the final cost through the channel of higher financing costs.

The results of some of the studies conducted in a non-Iranian context are summarized in Table 1.

Table 1. Summary of the result of studies conducted on the impact of contractionary monetary shock on the household and non-financial corporations

	US Christiano and et al. (1996) sample (1961-1992)	**Italy** Bonki and Columba(2008) sample (1980-2002)	**Portugal** Gameiro and Sousa (2010) Sample (1998-2009)	**Euro area** Bonki (2012) Sample (1991-2009)
	Response	Response	Response	Response
Nonfinancial corporations				Increase
Financial liabilities	Increase	Decrease	Increase	Increase
Financial assets	Increase	Decrease	Increase	
Households				
Financial liabilities	Small decrease	Decrease	Decrease	Decrease
Financial assets	Not significant	Increase	Decrease	Decrease

Source: Research findings

In general, according to the results of earlier studies, it can be observed that the impact of monetary shocks on financial assets and liabilities' changes of institutional sectors varies in different countries and examining the impact of monetary shocks on the flow of funds account can give a new insight about financial decisions of institutional sectors in the mechanism of monetary policies transmission.

3. Theoretical Foundations

In this section, we lay the theoretical foundation on the impact of monetary policy shocks on assets and liabilities in institutional sectors (households, non-financial enterprises (private sector), banks, government, and foreign sector). The effect of monetary shocks on the financial decisions of stated institutions is described through monetary policy transmission channels.

Monetary policy transmission channels are divided into two categories: neoclassical channels (rate of interest and exchange) which is based on the completeness of financial markets and in which banks have no role in the amount

of money supply and the extent of monetary policy's influence on economic activities (Bernanke and Gertler, 1995) ; Non-neoclassical channels (bank lending and balance sheet) based on incompleteness in financial markets and the assumption of the existence of asymmetric information known as the credit view. Bernanke and Gertler (1995).

According to the credit channel theory, monetary policy not only affects general interest rates but also influences the costs of external finance. This transmission and movement in external finance costs can better explain the magnitude, timing, and composition of the impact of monetary policy. Accordingly, two mechanisms for the impact of monetary policy on internal finance costs in credit markets were explained by Bernanke and Gertler (1995), namely balance sheet channel, sometimes referred to as net worth, and bank lending channel. In the balance sheet channel, the potential impact of monetary policy on balance sheets of borrowers and their income statements, such as borrowers' net worth, cash flow, and liquid assets, is examined, while in the bank lending channel, more focus is placed on the effect of monetary policy on loan supply by depository institutions such as banks.

3.1 Balance Sheet Channel

The balance sheet channel addresses the role of firms on the transmission of monetary policy effects. This channel is also called the "financial accelerator channel" or "broad credit channel." In this view, a firm's financial condition plays an important role in transmitting the impact of monetary policy.

The main view on this channel was presented by Gertler and Gilchrist (1993), and Bernanke and Gertler (1995). The balance sheet channel is created because of information asymmetry in credit markets. Information asymmetry issue in credit markets causes the costs of a firm's external finance (via loans) to be higher than the internal finance (through firm's resources). This difference in finance costs is called external finance premium. Borrowers' external finance premium is specified by their net wealth. The lower the borrowers' net wealth is, the lower their mortgage on the loan will be. Bernanke and Gertler (1995) believe that the relationship between asset prices and the real economy acts through the balance sheet channel because cash flows and balance sheet conditions are determinants of firms' access to loans due to frictions in the credit market. For example, firms and households may take loans by mortgaging their assets. In this situation, a reduction in the price of assets decreases the mortgage wealth and consequently limits potential borrowers' access to loans.

This reduction in potential borrowers' access to loans affects the total demand and expenditures in the short run and total supply in the long run by reducing capital creation. In addition, it may cause intensifying effects by reducing sales and employment and further declining the total demand. The increased net worth of the firm highlights two issues, namely "moral hazard" and "adverse selection." More clearly, contractionary monetary policy (increasing the interest rate) reduces firms' net worth (credit worth) and increases the external

finance premium, forcing firms to reduce investment. This issue is called adverse selection. On the other hand, lower worth of the firm entails investment with higher risks. This issue is called moral hazard. Adverse selection and moral hazard problems, referred to in the credit channel, along with information asymmetry, heightens external finance premium and demotivated investment in the firm. (Bernanke, 1995)

In this channel, it is assumed that the expansionary monetary policy improves firms' balance sheets position by reducing nominal interest rates and raising firms' cash flows. Larger cash flows increase firms' liquidity. Consequently, loan suppliers can more easily assess firms' ability to repay liabilities. Therefore, adverse selection and moral hazard lose their importance, and loan supply and consequently investment and production gain significance. (Mishkin, 1995).

3.2 Bank Lending Channel

Besides affecting borrowers' balance sheets, monetary policy influences external finance costs through credit supply transmission of commercial banks, known as the bank lending channel. Regarding, bank-based channels, the bank lending channel and bank capital channel are often differentiated. The bank lending channel emphasizes the particular nature of bank credits and the role of banks on the financial structure of the economy. In the bank lending approach, banks play a crucial role in transmitting the monetary policy to the real economy, and bank loans are a defective substitute for other financing instruments.

If the policy operation affects the status of bank reserves, it leads to adjustments in interest rates and elements of the bank system's balance sheets. The effects on bank reserves and interest rates affect bank credit supply and the asset side of the balance sheet. Under the contractionary monetary policy imposition by the central bank, if banks cannot compensate for the reduction in reserves by adjusting stock assets or increasing capital, the bank loan supply decreases. Walsh (2010) points out that if borrowers do not find close substitutes for capital, a change in bank loan supply may affect total expenditure independently. Reducing bank loan supply for any reason causes bank-dependent borrowers to incur costs for finding a new lender. Since many banks face information acquisition problems, and most borrowers are dependent on bank loans, a reduction in bank credit supply relative to other credits leads to higher external finance costs and weaker real economic activities. In contrast, under the expansionary monetary policy, bank reserves and deposits enhance.

This supplies the required resources for the loans and improves the firms' access to bank loans, causing investment and consumption expenditures and consequently the total demand to rise. This issue was highlighted by Stein (1995). When banks do not have an appropriate substitute for bank deposits and cannot finance through capital and cash, the bank's finance costs increase. Consequently, loan supply decreases, bank-dependent borrowers are forced to leave the banking

system, and external finance costs increase. Accordingly, the contraction of bank loans compels firms to contract activities.

The presence of bank lending and balance sheet channels has been confirmed by several empirical research such as Gertler and Gilchrist (1993), Pearsman (2011), Dahlhaus (2014), Taqavi and Lotfi (2006), Raei et al. (2018), komijani and alinejad (2012), and Shah Hosseini and Bahrami (2016), while it has been questioned by some other studies such as Taqavi and lotfi (2006) and Kashyap and stein (1995). Lown and Morgan (2002) also concluded that the bank lending and balance sheet channels are relatively small to change the monetary policy.

This research uses an alternative approach unlike the mentioned studies, we discuss the effect of monetary shock on funds flow dynamics in all institutional sectors during interaction. In other words, changes in the assets and liabilities of these sectors are investigated after the monetary shocks. Then, the important parts of financial and non-financial assets and liabilities of the private sector, as an important institutional sector, are assessed. Since changes in assets and liabilities of the private sector can significantly affect macroeconomic variables such as investment and GDP, this study focuses on the private sector.

In Table 2, the structure of the flow of funds account, institutional sectors, and Components of financial and non-financial assets and liabilities of these sectors are summarized. The bold items are variables on which the impact of monetary shocks is investigated in this study.

Table 2. Structure of the flow of funds account
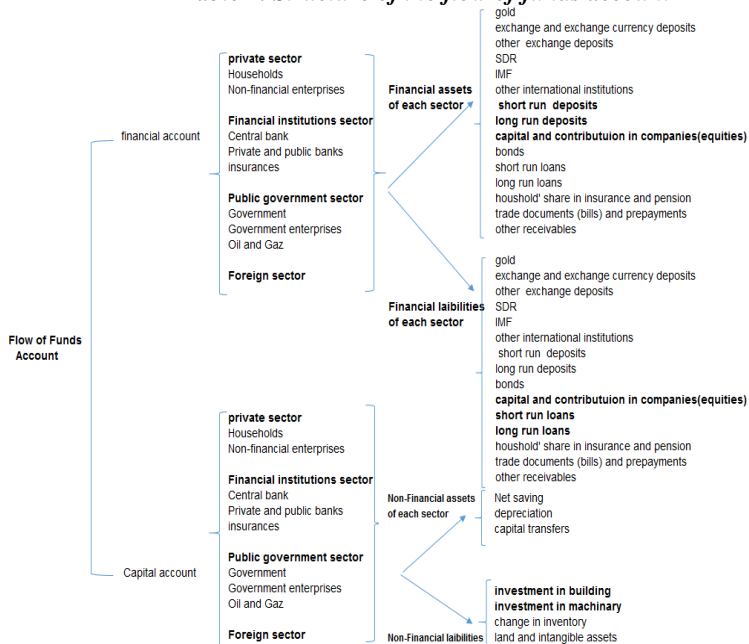
Source: *Research findings*

4. Model
4.1 Data

In this research annual data on the flow of funds account (including 46 variables[1]), which has been prepared for all institutional sectors during 1973-2017 by the Central Bank's flow of funds department was used. Besides, data on macro variables (including 20 variables) were collected from the websites of the Central Bank of Iran[2] and the Iranian Ministry of Economic Affairs and Finance[3] for the same period. The reason for the selection of this period is that the data on the flow of funds account are not continuously published in Iran and are updated every few years. The latest update of this data was on June 2020 encompassing the data of the years 1973-2017.

4.2 FAVAR Model

The major deficiency of VAR models is the lack of capacity to incorporate a large number of variables, which necessitates the development of traditional VAR models and the use of one or several factors that encompass the data of multiple time series variables optimally, as well as the introduction of the FAVAR by Bernanke et al. (2005). In the present study, we employed the FAVAR model.

Suppose that X_t and Y_t with the dimensions of M×1 are two vectors of economic variables and t=1, 2, 3… T indicates the time dimension. In fact, Y_t consists of the exogenous variables and X_t is a large set of economic data on other economic variables. It is assumed that some invisible fundamental factors or forces exist that impact the dynamic of X_t over time. These factors are demonstrated as the F_t vector with a dimension of K×1, the mutual dynamics between F_t and Y_t could be demonstrated in the form of the equation 1 according to Bernanke et al. (2005).

$$\begin{bmatrix} F_t \\ Y_t \end{bmatrix} = \emptyset^*(L) \begin{bmatrix} F_{t-1} \\ Y_{t-1} \end{bmatrix} + \gamma_t \tag{1}$$

Where L indicates the lag operator, $\emptyset^*(L)$ is the lag polynomial, and γ_t represents the disturbance term with the mean of zero and variance-covariance matrix of Q. Equation 1 could be also written as:

$$\emptyset(L) \begin{bmatrix} F_t \\ Y_t \end{bmatrix} = \gamma_t \tag{2}$$

$$\emptyset(L) = I - \emptyset^*(L)L = I - \emptyset_1 L - \cdots \emptyset_P L^P \tag{3}$$

Where lag polynomials are from the degree of P and $\emptyset_i$ is the matrix of model coefficients. Given the use of F_t as the invisible factor, Bernanke et al. (2005) named Equation (1) as the FAVAR model. The latent F_ts could be interpreted as the driving forces of the economy. Meanwhile, the relationship 4 called the dynamic factor model holds between F_t, X_t, and Y_t:

$$X_t = \Lambda^f F_t + \Lambda^y Y_t + e_t \tag{4}$$

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[1] The full names of these variables are given in Appendix 1
[2] https://www.cbi.ir/simplelist/2866.aspx
[3] https://databank.mefa.ir/data

Where the Λ^f matrix with K columns and N rows is the factor coefficients, Λ^y matrix with M columns and N rows indicates the direct relationship between exogenous variables and X_t variables. Eventually, e_t is an N-row vector of the error components with a mean of zero and can have limited temporal and cross-sectional correlations as well. Considering that K+M<<N (i.e. the number of X_t vector variables are large enough), more data is transferred from F_ts to the FAVAR model compared to the conventional VAR model. Besides, impulse-response functions could also be calculated for all the variables of X_t vector. The variables of F_t, X_t, and Y_t vectors will be discussed in the following.

In the present study, $\boldsymbol{Y_t}$ vector includes the oil revenues variable which is considered to be exogenous. Given that oil revenues are dependent on the production and global crude oil price and the fact that production has remained almost steady over the years, it could be said that this variable is determined exogenously.

Oil shocks could result in monetary shocks due to the change in the revenues of the exporting oil countries since the exchange of oil revenues into domestic currency in these countries result in larger monetary base, money supply, and ultimately, liquidity growth due to the enhanced net foreign asset growth of Central Bank.

The $\boldsymbol{X_t}$ vector includes 66 financial and macroeconomic variables (see Appendix A) such as net financial investment of institutional sectors and each of these sectors' financial assets and liabilities. Each of these sectors has subsectors, and the information and data of all economic subsectors have entered the X_t vector (46 variables[4]).

Besides, macroeconomic variables such as the inflation rate, exchange rate, added value of various economic sectors have entered the X_t vector to complete the data set and account for the macroeconomic dimensions in the model (20 variable[5]).

In the case of the F_t vector, the direct estimation of Equation (1) is impossible since F_t is latent. Λ matrixes and F_ts could be estimated using the principal component analysis (PCA) technique (see Stock & Watson, (2002)). After $\hat{F}_t$ is estimated, it could be used to estimate Equation 1. In fact, Equation 1 is a standard unrestricted VAR equation that could be estimated through the conventional methods of ordinary least squares or maximum likelihood.

4.2.1 Impulse Response Functions
If B is the matrix of structural constraints used to distinguish ε_t structural shocks from ϑ_t shocks, the estimated form of Equation 2 using structural constraints would be as equation 5:

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[4] The flow of funds account data are nominal series and the consumer price index (CPI, 2004=100) has been used to deflate them.

[5] Macro variables are entered in the Xt vector as growth rate to eliminate nonstationary and all financial and macro variables are standardized.

$$\widehat{\Psi}\,(L)\begin{bmatrix}\hat{F}_t\\Y_t\end{bmatrix} = \varepsilon_t \quad, \quad \varepsilon_t = B\nu_t \quad, \quad \widehat{\Psi}\,(L) = B\widehat{\Phi}\,(L) \tag{5}$$

In this case, the response functions resulting from structural shocks to the FAVAR equation could be written as the equation 6:

$$\begin{bmatrix}\hat{F}_t\\Y_t\end{bmatrix} = \widehat{\delta}\,(L)\varepsilon_t \quad, \quad \widehat{\delta}\,(L) = \widehat{\Psi}\,(L)^{-1} \tag{6}$$

In this case, according to Equation (4), the response of X_t vector variables to the structural shocks could be written as the equation 7:

$$X_t^{IRF} = \left[\widehat{\Lambda^f},\ \widehat{\Lambda^y}\right]\begin{bmatrix}\hat{F}_t\\Y_t\end{bmatrix} = \left[\widehat{\Lambda^f},\ \widehat{\Lambda^y}\right]\widehat{\delta}\,(L)\varepsilon_t \tag{7}$$

Bootstrapping (Killian & Lutkephol, 2017) is mainly used to construct the confidence intervals of the impulse response functions in the model so that the significance of the response to a shock could be evaluated while the other shocks remain constant.

5. Empirical Results

Before estimating the model and specifying the impulse response functions, diagnostic tests of the FAVAR model must be carried out including the test for determining the number of latent factors[6], number of optimal lags[7], auto-correlation test, and model residual normality. Results of these tests have been presented in Appendix C to G.

An advantage of the FAVAR model is that it provides the possibility of estimating response functions for all vector variables in addition to the factors. Various response functions of institutional sectors resulting from the expansionary monetary shocks are discussed in the following.

5.1 The Response of Financial Assets and Liabilities of Institutional Sectors

Figure 1 demonstrates the response functions of the financial assets and liabilities of different sectors to the positive shock of oil revenues as much as a standard deviation. The gray lines represent a 90% confidence interval while the black lines show the average response rate.

As can be observed, the positive shock of oil revenues has a positive impact on the financial assets and liabilities of institutional sectors in the first year. Regarding the private sector, monetary shock increases the financial assets and liabilities of this sector in the first year.

The results of this sector are compatible with theoretical foundations. The volume of money increases following the expansionary monetary policy shock. Regarding the private sector's households, larger volume of money along with the rise in household revenue increase the volume of deposits, which leads to a rise

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[6] Using the Eigenvalue criterion, the criteria of explanatory power and Bai and Ng (2003), 5 factors were selected

[7] Using Schwartz & Hannan-Quinn information criterion, an optimal lag length of 1 was selected

in the lending ability of banks[8]. (Krylova, 2002). Also, this result is in accordance with those of Taqavi and Lotfi (2006) and Komijani and Sharifi Renani (2015).

After the first year, financial assets and liabilities begin to decline. In 2 years and 1 year, respectively, the assets trend and the liabilities trend initially reversed, and gradually returned to their equilibrium level after a few periods.

The reason behind the deduction of the financial assets volume (the majority of which is made of term deposits) after a year and, then, the negative impact of the shock on them seems to be the fact that the profit rate[9] of deposits in Iran is determined by the Central Bank and in a compulsory manner. The fixed profit rate of deposits and the inflationary perspective in the future will lead to a reduction in the real profit rate of deposits and the volume of bank deposits is expected to gradually decrease.

With regards to non-financial enterprises in the private sector, according to theoretical foundations and results derived from some experimental researches such as Shabbir (2012) and Ruslan et al. (2015), following the expansionary monetary shock and the larger net value of the companies, the received facility rate of companies will increase. It can be explained by the companies' increased credit conditions and the finance providers' better assessment of the financial conditions of the companies. Which reference to the public sector, the occurrence of expansionary monetary shock caused by higher oil revenue leads to a positive revenue shock for the government's budget and will increase the government's financial assets and liabilities.

Results obtained regarding banks are in accordance with the theoretical foundations and views of Bernanke and Gertler (1995), who believe that changes in the volume of money impacts deposits and banking facilities consequently. With the occurrence of expansionary monetary shocks, real income, and as a result, the amount of household savings in the form of bank deposits increase. This expands the free resources available to banks and banks provide more facilities to clients.

Regarding the foreign sector, exchanging Dollars received from selling oil to Rials by the government, an increase in money supply as well as in the volume of liquidity in the society will raise the expectations that the domestic nominal profit rate to decline in comparison with the real foreign interest rate. Therefore, following the expansionary monetary shock, capital outflow will take place and the foreign sector's financial liabilities increase. According to theoretical foundations, the rise in foreign interest rates will improve capital outflow, and as long as foreign interest rates rise in comparison with domestic interest rates, the capital continues to flow out. (Mundell, (1960); Fleming, (1962)).

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[8] Considering the fact that more than half of the financial assets of the household sector is made of deposits and roughly half of their liabilities is made of loans and granted facilities, deposits and granted facilities seem good indicators of the household sector's financial assets and liabilities.
[9] Rate of return is named profit rate in a free interest rate banking system.
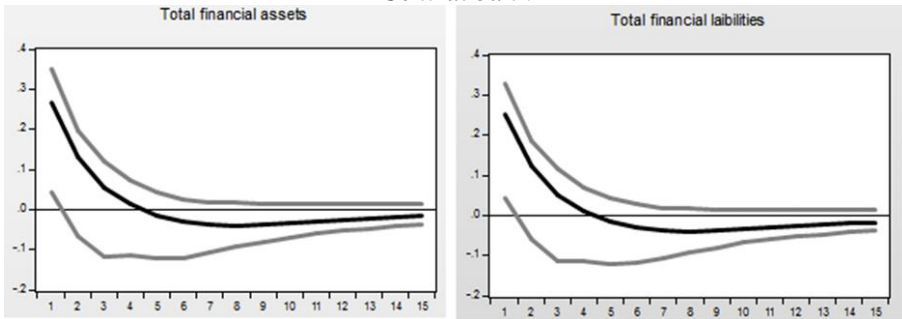
The private sector (households and non-financial enterprises)

Banks

Central bank
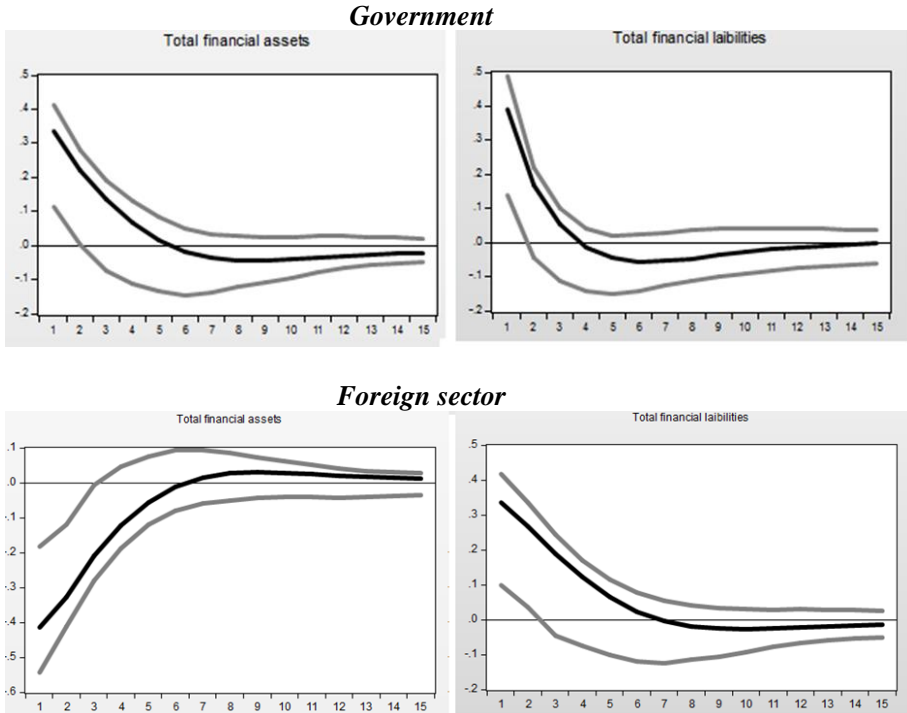
Government

Foreign sector
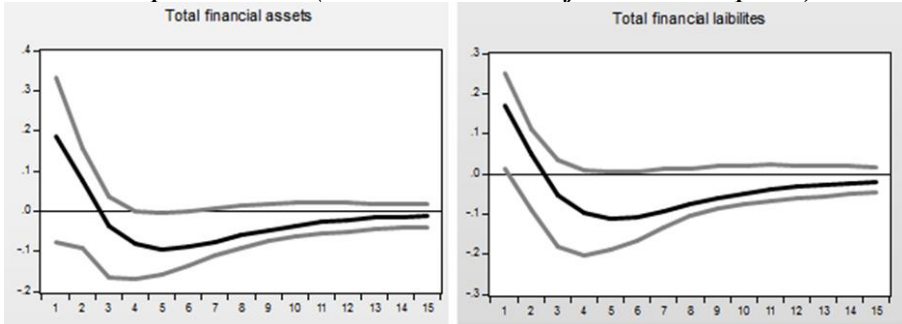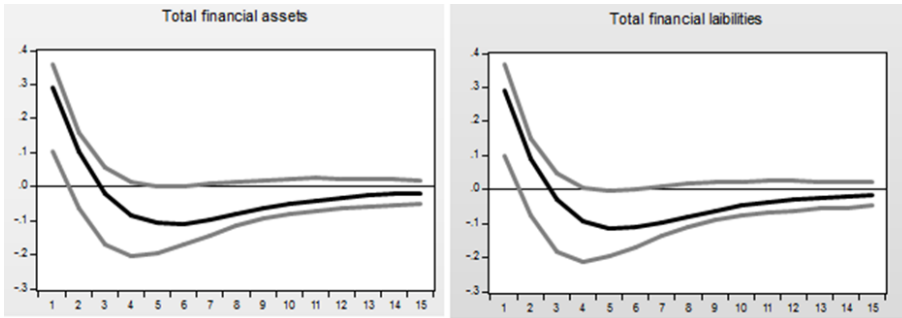
Figure 1. The response of institutional sectors to expansionary monetary shock
Source: Research findings

5.2 The Response of Important Components of Private Sector's Financial Assets and Liabilities

Figure 2 shows the response functions of financial assets and liabilities of different sectors to positive oil revenues shock as much as a standard deviation. The gray lines demonstrate a 90% confidence interval while the black lines show the average response rate. As can be seen, the positive shock of oil revenues has a weak and non-significant positive effect on short-term private sector deposits, a strong and significant positive effect on long-term deposits, and a strong and non-significant positive effect on stocks as this sector's financial assets in the first year.

In the case of financial liabilities, the monetary shock has a weak and non-significant positive effect on short-term loans, a strong and significant positive effect on long-term loans, and a strong and non-significant positive effect on stocks as the private sector's financial liabilities in the first year. A dwindling trend is observed in long-term assets after the first year and in short-term assets after the second year and then they show a reversed and negative-directed response. The trend of financial liabilities decreases after the first year and then reverses and moves in the opposite direction before returning to its equilibrium trend.

Following the expansionary monetary policy shock, the private sector initially makes maximum deposits in long-term accounts and then invests in short-

term accounts., Consequently, banks grant long-term loans due to the increase in long-term deposits.
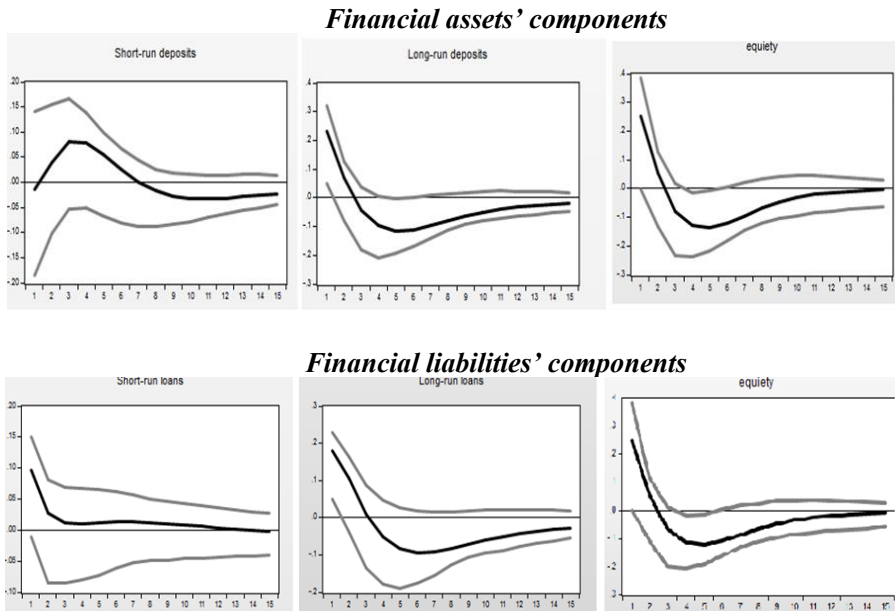
Financial assets' components

Financial liabilities' components

Figure 2. The response of the components of private sector's financial liabilities' to expansionary monetary shock
Source: Research findings

5.3 The Response of the Important Components of Private Sector's Non-Financial Assets and Liabilities

Non-financial assets tools of the private sector include gross savings and capital transfers, and the private sector's non-financial liabilities include gross fixed capital formation, changes in stock and land inventories, and intangible assets. Gross fixed capital formation is the net cost of fixed assets acquired or assigned by institutional units during a financial period consisting of two tools of investment in construction and facilities as well as investment in machinery and equipment. (The Central Bank of Iran, 2018)

Figure 3 shows nonfinancial assets and liabilities of the private sector, along with tools invested in construction and facilities, and investments in machinery, and equipment as two important components of their subset.

As can be seen, the positive oil revenues shock has a positive effect on non-financial assets and liabilities of the private sector in the first year. This effect is for insignificant assets and significant liabilities. The response of these two variables weakened after the first year and then made a reverse move in the negative direction followed by returning to its equilibrium process.

The higher oil revenues shock has a positive impact on private investment in the construction sector (figure 3) in the first year. Then, there was a reverse trend to the negative. Notably, the severity of this negative effect diminishes in the long run and disappears in the very long run. In fact, in the very short term (the first period), the oil revenues shock increases the demand and investment in construction.

But in the medium term, there is a dichotomy between the Dutch disease issue and speculative activities, which reduces the volume of investments in the construction sector. In fact, it is true that according to the Dutch disease phenomenon, the increase in oil revenues causes the price of non-exchangeable goods (constructions) to edge up, but given that the government allocates oil revenues in Rials, this issue is extremely inflationary and influences the money market and the exchange market to be affected. Therefore, in the post-oil-shock periods, the oil shock itself is practically eliminated, but the inflationary and exchange effects remain in the market. In fact, with the increase in money supply and inflation, the exchange rate also rises. As a result, investment in parallel markets is more appealing than constructions due to higher payoffs. The results of this sector are consistent with the study results of Khosh Akhlagh and Mousavi Mohseni's (2006).

Monetary shock has a positive effect on investment in machinery and equipment in the first year. After the first year, it has a dwindling and negative trend and then returns to its equilibrium. A rise in inflationary expectations caused by an increase in money supply due to the oil shock will increase expected profit margins of the producers and private investors and offers more incentives for private investment in machinery.

Since investment in machinery and equipment is related to manufacturing affairs and the majority of its inputs are supplied from abroad, a rise in the exchange rate caused by oil shocks in the medium- and long-term, increases the price of the imported inputs and equipment causing private investment in machinery and equipment sector to decline.

Non-financial assets' components
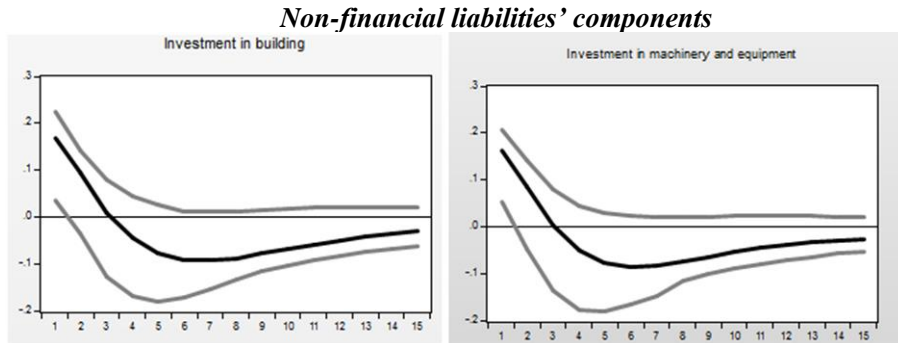
Non-financial liabilities' components
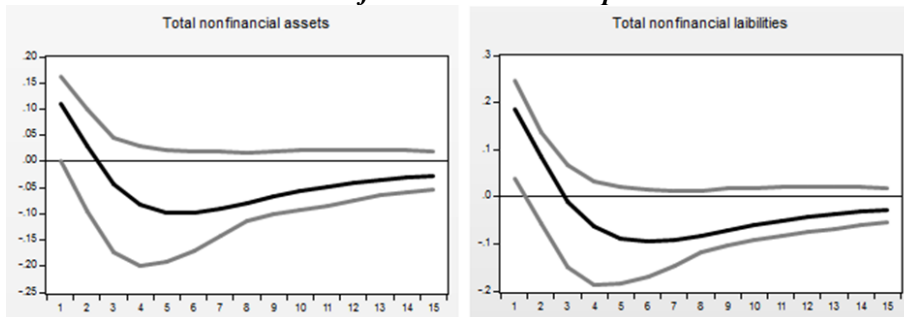
Figure 3. The response of non-financial assets and liabilities and their important tools to expansionary monetary shocks
Source: Research findings

6. Concluding Remarks

Due to the availability of financial transaction information at a more detailed level and comprehensive coverage of different institutions, the flow of funds account can be used as a basis in experimental research and for analyzing the impacts of monetary and financial policies on changes in the assets and liabilities of the institutional sectors.

In order to successfully direct their policies, monetary policymakers need a detailed assessment of the duration and manner of its effects on the economy. An understanding of how these shocks impact the changes in the assets and liabilities of institutional sectors, especially the private sector, can guide appropriate policies to influence other macroeconomic variables. Moreover, it is an ideal platform for meeting planning, forecasting, and macroeconomic policy-making requirements. Due to the response to changes in each sector's assets and liabilities, capital-savings and asset-liability flows can also be controlled and monitored, enabling optimal resource allocation to match the volume of activity and the efficiency of economic institutions. As institutional sectors differ, it is expected that the size and speed of the response of assets and liabilities of these sectors to monetary policy shocks varies.

In this research, the impact of the monetary shock on asset changes and the financial liabilities of institutional sectors including households and non-financial enterprises (private sector), public and private banks, the central bank, the government and the foreign sector were briefly examined. Afterwards, financial tools (long- and short-term deposits, long- and short-term loans, and stocks) and non-financial tools (investment in the construction and machinery sector) of the private sector's balance sheet in the funds flow account were thoroughly analyzed. For this purpose, a factor-augmented vector autoregressive (FAVAR) model is employed for the data from 1973-2017..

As can be observed, the positive shock of oil revenues has a positive impact on the financial assets and liabilities of institutional sectors in the first year.

Regarding the private sector, the monetary shock develops the financial assets and liabilities of this sector in the first year.

The results of this sector can be explained by existing theories. The volume of money increases following the expansionary monetary policy shock; regarding the private sector's households, the rise in the volume along with the rise in household revenue expands the volume of deposits, which leads to greater lending ability of the banks.

Concerning non-financial enterprises in the private sector, according to theoretical foundations and results derived from some experimental researches such as Shabbir (2012) and Ruslan et al. (2015), following the expansionary monetary shock and the larger net value of the companies, the received facility rate of the companies rises. It can be justified by the improved credit conditions of the companies and the finance providers' better assessment of the financial conditions of the companies.

Regarding the public sector, the occurrence of expansionary monetary shock caused by larger oil revenue leads to a positive revenue shock for the government's budget and will increase the government's financial assets and liabilities. Results obtained regarding banks are in accordance with the theoretical foundations and views of Bernanke and Gertler (1995), who believe that changes in the volume of money impacts deposits and consequently banking facilities. With the occurrence of expansionary monetary shocks, real income, and as a result, the amount of household savings in the form of bank deposits increase. This increases the free resources available to banks and the banks provide more facilities to clients.

With respect to the foreign sector, exchanging Dollars received from selling oil to Rials by the government, an increase in the money supply and in the volume of liquidity in the society will raise expectations to lower domestic nominal profit rate in comparison with the real foreign interest rate. Therefore, following the expansionary monetary shock, capital outflow will take place and the financial liabilities of the foreign sector increase.

The positive shock of oil revenues has a weak and non-significant positive effect on short-term private sector deposits, a strong and significant positive effect on long-term deposits, and a strong and non-significant positive effect on stocks as this sector's financial assets in the first year. In the case of financial liabilities, the monetary shock has a weak and non-significant positive effect on short-term loans, a strong and significant positive effect on long-term loans, and a strong and non-significant positive effect on stocks as the private sector's financial liabilities in the first year. A dwindling trend is observed in the long-term assets after the first year and in the short-term assets after the second year. Then, they show a reversed and negative-directed response. The trend of financial liabilities decreases after the first year and then reverses and moves in the opposite direction before returning to its equilibrium.

Afterwards, we analyzed the response of non-financial assets and liabilities of the private sector, along with tools invested in construction and facilities, and

investments in machinery, and equipment as two important components of the private sector's non-financial liabilities to the monetary shock.

Regarding the non-financial tools of this sector, the expansionary monetary shock has a positive effect on the construction and machinery investment in the short run. In the long run, however, the two variables' responses are reversed, which indicates the negative effect of monetary shock caused by an increase in oil revenues on the private sector's investment in both construction and machinery sectors. As a result, it can be concluded that the oil revenue reduces the private sector's relative size in Iran economy. Since the oil revenues of the government reduce the demand for private investment, it is suggested that the government gradually decrease the share of oil revenues in its budget. This study recommends that future researchers evaluate the response of the net financial investment of institutional sectors, which is obtained through the difference between the financial assets and liabilities of the same sectors in the funds flow account, to the monetary shocks.

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Appendix
Appendix A: Names of variables

Table 1. Variables information

No	Variables	Source
1	Net financial investment of private sector	CBI
2	Total financial assets of private sector	CBI
3	Total financial liabilities of private sector	CBI
4	Total nonfinancial assets of private sector	CBI
5	Total non- financial liabilities of private sector	CBI
6	Net financial investment of banks	CBI
7	Total financial assets of banks	CBI
8	Total financial liabilities of banks	CBI
9	Total nonfinancial assets of banks	CBI
10	Total non- financial liabilities of banks	CBI
11	Net financial investment of central banks	CBI
12	Total financial assets of central banks	CBI
13	Total financial liabilities of central banks	CBI
14	Total nonfinancial assets of central banks	CBI
15	Total non- financial liabilities of central banks	CBI
16	Net financial investment of insurances	CBI
17	Total financial assets of insurances	CBI
18	Total financial liabilities of insurances	CBI
19	Total nonfinancial assets of insurances	CBI
20	Total non- financial liabilities of insurances	CBI
21	Net financial investment of government	CBI
22	Total financial assets of government	CBI
23	Total financial liabilities of government	CBI
24	Total nonfinancial assets of government	CBI
25	Total non- financial liabilities of government	CBI
26	Net financial investment of government firms	CBI
27	Total financial assets of government firms	CBI
28	Total financial liabilities of government firms	CBI
29	Total nonfinancial assets of government firms	CBI
30	Total non- financial liabilities of government firms	CBI
31	Net financial investment of oil and GAZ sector	CBI
32	Total financial assets of oil and GAZ sector	CBI
33	Total financial liabilities of oil and GAZ sector	CBI
34	Total nonfinancial assets of oil and GAZ sector	CBI
35	Total non- financial liabilities of oil and GAZ sector	CBI
36	Net financial investment of foreign sector	CBI
37	Total financial assets of foreign sector	CBI
38	Total financial liabilities of foreign sector	CBI
39	Short run deposits	CBI
40	Long run deposits	CBI
41	Short run loans	CBI
42	Long run loans	CBI
43	Equity (private sector's asset)	CBI

Table 1 (Continued). Variables information

44	Equity (private sector liabilities)	CBI
45	Investment in construction (private sector)	CBI
46	Investment in machinery and equipment (private sector)	CBI
47	Value added of agricultural group, 2004 = 100	CBI
48	Value added of industrial group, 2004 = 100	CBI
49	Value added of the mining group, 2004 = 100	CBI
50	Value added of the oil group, 2004 = 100	CBI
51	Value added of water, electricity and gas, 2004 = 100	CBI
52	Value added of the construction, 2004 = 100	CBI
53	Value added of the service group, 2004 = 100	CBI
54	Accrual fee, 2004 = 100	CBI
55	Private consumption expenditures, 2004 = 100	CBI
56	Public consumption expenditures, 2004 = 100	CBI
57	Export of goods and services, 2004 = 100	CBI
58	Import of goods and services, 2004 = 100	CBI
59	Liquidity	CBI
60	Exchange rate	CBI
61	Inflation rate	CBI
62	Current payment	MEFA
63	Construction payment	MEFA
64	Deficit(-)/surplus(+)	MEFA
65	Crude oil export	MEFA
66	Non-oil GDP, , 2004 = 100	MEFA
67	Real oil revenue	MEFA
68	Consumer price index (CPI), 2004 = 100	CBI

All variables except real oil revenue are used for drawing out latent factors in FAVAR model. CBI is the abbreviation for Central Bank of Iran, MEFA is the Ministry of Economic and Finance Affairs of Iran

Appendix B

The results of determining the number of factors in FAVAR model using Bai and Ng (2003) criterion and cumulative proportion

Table 2. The results of determining the number of factors in FAVAR model using Bai and Ng (2003) criterion

	IC1	IC2	IC3	PC1	PC2	BIC3
0	27,3794	27,3794	27,3794	1,5430	1,5513	7,7756
1	25,8502	25,8697	25,5783	1,5430	1,2060	1,6174
2	25,6547	25,6936	25.5783	1,1894	1,2060	1,3358
3	25,4648	25,5231	25,3501	0,9510	0,9760	1,1671
4	25,2871	25,3649	25,1342	0,7979	0,8312	1,0814
5	25,0964*	25,1935*	24,9051*	0,692*	0,7342*	1,0412*

Source: Research findings

Table 3. The results of determining the number of factors in FAVAR model using cumulative proportion

Eigenvalues: (Sum = 66, Average = 1)

Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion
1	18.87348	9.259264	0.2860	18.87348	0.2860
2	9.614211	3.714273	0.1457	28.48769	0.4316
3	5.899938	1.228972	0.0894	34.38762	0.5210
4	4.670966	1.413105	0.0708	39.05859	0.5918
5	3.257861	0.331646	0.0494	42.31645	0.6412

Source: Research findings