

## Investigating the Effect of Credit Supply Shocks on Selected Macroeconomic Variables in Iran (Application of TVP-VAR Method)

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### ABSTRACT

*Banks significantly contribute to attract and allocate resources as facilities to customers. So how credit affects the macroeconomic variables is considered among the important issues. In this regard, the main objective of this paper is to investigate the effect of credit supply shocks on the economic growth, unemployment and inflation as important macroeconomic variables by utilizing TVP-VAR during the period of 2013-2017. The empirical findings revealed that how the economic growth, unemployment and inflation were affected changed over time, with the most positive effect of the facilities on economic growth over the years 2013-2017. During the period of 2005-2007, the shocks of the facilities led to a significant reduction in unemployment. Moreover, from 2013 to 2018, the positive effect of credit supply on inflation declined. With respect to the results of this research, increasing banks' capital can be an important source of increasing the power of the banking system to reduce the limits on funds. Increasing facilities to productive sectors can play a significant role in lowering the unemployment rate in the current economic recession given the employment situation in the Iranian economy and the high unemployment rate in Iran. Keywords: inflation, economic growth, unemployment, bank credit, time-varying parameter vector auto-regression (TVP-VAR) method.*

*JEL Classification: C22, E42, O11.*

### 1. Introduction

As one of the most important and fundamental sectors of society's economy in the form of financial markets, the banking system has an important place in economic activities. The system plays a vital role in shaping the business cycles. Restrictions on the credit supply after the global financial crisis have led to many theoretical conflicts about the effect of this variable on the economy (Bijsterbosch and Falagiarda, 2014). Organizing financial markets to increase banks' competitiveness, expanding capital markets, attracting

liquidity and allocate it to production activities, and creating the opportunities for public participation are among the factors affecting the economic growth and development of any society. Understanding the impact of the positive and negative credit shocks on the housing sector due to their policy consequences and implications is of a particular importance in macroeconomics (Bijsterbosch and Dahlhaus, 2011; Darvas, 2014). Additionally, since the housing construction factors are associated with land, energy, and materials (Koebel et al., 2015), the housing sector is closely linked to household economics, local government policies, and the environment (Saiz, 2010)

The housing sector in Iran has been highly volatile over the last two decades, which has subsequently caused widespread losses to housing construction firms and the performance of other sectors of the economy and banking system. The volatility of this sector is seen as one of the major challenges of the country's economy (Gholizadeh and Bakhtiari Pour, 2012).

As the main part of the money market in the Iranian economy, banks are responsible for managing and providing liquidity and directing it to productive and investment activities, so that much of the liquidity of society must be managed by the country's banking system to invest in various economic sectors. This study was conducted aimed at investigating the effect of bank credit on selected macroeconomic variables (economic growth, unemployment and inflation) during the years 2001-2018 using the time-varying parameter vector autoregression (TVP-VAR) method.

This was the first study to examine the effect of credit on housing prices in an oil-rich credit markets-dependent country using the TVP-VAR method. For this reason, investigating the effect of credit shocks on housing prices over time in an oil revenues-dependent country was proposed as a scientific contribution of the study.

The rest of the article is organized as follows:

In the literature review, theoretical foundations and previous studies and in the third section, research methodology is presented. The results are presented in the fourth section and conclusions in the fifth section.

## **2. Literature review**

### **2.1 Theoretical foundations**

Due to its strong links with other sectors of the economy, the housing sector plays a key role in economic growth, and because of its high need for data from other sectors of the economy, it can act as a driving force for growth and development pole in the country's economy. Despite this, there have been sharp fluctuations in housing prices over the past two decades in urban areas. The volatility and widespread fluctuations in housing prices, especially in metropolises, can be considered the most prominent feature of this important economic sector of the country. Identifying the factors affecting the housing prices and its fluctuations can be very important for decision makers in this sector, both from the private sector and from policy makers.

#### **2.1.1 The effect of bank credit on economic growth**

Regarding the effect of monetary policy on the real sector of the economy, production is generally emphasized more than other variables. In this regard, inflation and interest rates are considered as the most important factors in nominal and real variables. In general, monetary policy affects the real variables in three ways: cost of credit, change in asset prices, and bank credit. According to the bank credit mechanism, which is based on financial markets, the transmission of monetary policy affects production in three ways: affecting the status of banks' financial resources (credit channel or loan perspective), affecting the in-house financing and more input for the product. According to the first method, the lending power of banks will be increased by adopting an expansionary monetary policy. So the funds needed to finance investment expenditure and subsequently the total demand increase.

According to the second method, monetary policy affects the cost of financing outside the internal resources of firms by providing the credit of commercial banks. Thus more financial resources are released and given to firms due to the difference between the cost of outsourcing and the more facilities provided to firms, and production increases as firms invest further. In the third method, the expansionary monetary policy will make more use of the production factors in the production process, so the product is expected to increase. Moreover, the position of bank credit in the financial structure of firms has a microeconomic basis. This means that at the firm level, the relationship between bank credit and investment, employment, raw

materials, and thus the production of firms is analyzed. In order to finance their investments, firms can use internal and external resources. Internal resources include depreciation reserve and undivided profits, and external resources include borrowing (loan and bond issuance) and selling new stock. Firms' investment decisions are influenced by each financial resource (Branson, 2005).

### ***2.1.2 The effect of bank credit on unemployment***

Bank credit provides job opportunities for job seekers by providing investment opportunities for producers. Depending on the priorities of the development goals, banking facilities are allocated to various economic activities. In addition, there is a direct relationship between investment and employment, so that capital stock increases as investment volume increases. As one of the production inputs, the increase in the volume of capital stock will result in the use of more labor. This means an increase in the level of employment and active workforce in the country's economy, thereby increasing investment and GDP. In most studies, the effect of using bank credit and facilities as a source of financing investment costs in improving the investment climate has been emphasized.

The relationship between investment and bank credit can be discussed in several other respects. First, one part of every economic sector, both financial and non-financial, depends on available cash that can act as a short-term constraint. Although in developing countries, firms are smaller than in developed countries, generally the financial needs of firms exceed their internal resources. In the absence of developed capital markets, short- and medium-term loans can alleviate the pressures on entrepreneurs to run the firm. Secondly, investors are almost indifferent to in-house and out-of-home financing (such as stocks and bank credits) because of the transparency of financial markets as well as the transparency of interest rates in developed countries, so that internal and external financing resources can be a substitute for each other. However, in developing countries, the firm's greater access to banking resources will be a conduit for capital accumulation due to the lack of uniform interest rates and the lack of market transparency. Firms are always looking for more and cheaper bank loans and credits as the rate of return on investment is higher than bank interest rates (Bashuki, 2017).

## **2.2 Previous studies**

### ***2.2.1 Foreign studies***

In a study by Bijsterbosch, and Falagiarda (2014), the effect of credit shocks on macroeconomic variables of Eurozone countries in the years before and after the 2008 global financial crisis was examined. Based on the results of applying TVP - VAR method, credit shock had a significant effect on business cycles and a positive effect on production growth.

GÖÇER (2013) examined the relationship between bank loans and unemployment in European countries. The results indicated that in 14 selected EU countries between 1980 and 2012, increased banking facilities had a negative impact on unemployment.

In their study, Cipollini and Parla (2018) investigated the effect of supply shocks on demand for bank credit in Italy by structural VAR method and found that credit had a significant positive effect on macroeconomic dynamics in Italy.

### ***2.2.2 Internal studies***

In a study by Samsami and Amirjan (2011), the effect of banking facilities on the value added of the industry and mining sector during the years 1977-2007 was investigated using 3SLS method. According to the results, banking facilities had an impact on the value added of the industry and mining sector and, on average, the production elasticity of this sector relative to banking facilities for fixed investment and working capital was 0.05% and 0.14%, respectively.

Tegintaji and Omidia Kia (2013) investigated the effect of banking facilities on macroeconomic variables of agricultural sector during the years 1973-2010. The results of 2SLS model estimation suggested that current and capital credits had a significant positive effect on value added, employment and investment in agricultural sector.

In their study, Moradi et al. (2018) investigated the impact of the growth of banking facilities on economic growth and investment in Iran during the years 2006-2016. Based on the results of applying the VAR model with panel data, if one standard deviation of shock occurred in the changes in the growth of banking facility balance, the value added would increase further and its effect would be neutralized after ten periods. The

shock effect of changes in the growth of banking facilities on investment growth generally appeared at a standstill and neutralized after ten periods. According to the results of the ANOVA, about 14% of the changes in value added growth were explained by the growth of the banking facility balance, and this effect reached 32% at the end of the tenth period.

The effect of banking facilities on employment in different economic sectors of Zanzan province during the years 2005-2013 was investigated by Bashuki (2017). According to the results, the provision of directed facilities had no significant effect on employment and there was a significant relationship between non-directed facilities and employment in agricultural and industry sectors. However, there was no significant relationship between non-directed facilities and employment in the service sector, and the granting of non-directed facilities had no effect on employment in this sector.

### 3. Methodology

The model used in this study, based on the TVP-VAR method, has many advantages over other models used in internal and external studies, with time-varying parameter (TVP). The use of TVP leads to more accurate results because macroeconomic time series have structural breaks and cyclical changes over time (Del Negro and Otrok, 2007; Eickmeier et al., 2015; Koop and Korobilis, 2013).

In order to explain the model, it is assumed that the variable  $X_t$  for  $t = 1, \dots, T$  was a vector  $n \times 1$  of the variables to estimate the unobservable variables in the model. Moreover,  $y_t$  is a vector  $s \times 1$  of the main macroeconomic variables of the model. The TVP-VAR model was expressed as the following equation (Koop and Korobilis, 2013):

$$y_t = c_t + B_{t,1}y_{t-1} + \dots + B_{t,p}y_{t-p} + \varepsilon_{yt} \quad (1)$$

It should be noted that  $\beta_t = \beta_{t-1} + \varepsilon_{\beta t}$ . In Equation (3-12),  $(B_{t,1}, \dots, B_{t,p})$  are the VAR coefficients and  $B_t = (c_t' \text{vec}(B_{t,1})', \dots, \text{vec}(B_{t,p})')$ .  $\varepsilon_t$  is the error component with normal distribution, mean zero and covariance of time variable  $Q_t$ . In addition,  $\varepsilon_{\beta t} \sim N(0, R_t)$ . In modeling, the VAR model coefficients are extracted based on a random walk process on time. In the above function, all errors were not correlated with each other on time, so they were written as follows:

$$\begin{pmatrix} \varepsilon_t \\ \eta_t \end{pmatrix} = N \left( 0, \begin{bmatrix} Q_t & 0 \\ 0 & R_t \end{bmatrix} \right) \quad (2)$$

According to Bayesian Inference, the TVP-VAR model is performed using Markov chain Monte Carlo (MCMC) or Gibbs (Primiceri, 2005; Del Negro and Otrok, 2008) methods, where the conjugate prior is as follows:

$$p(\beta_{1:T}, Q, \Sigma | Z, Y) \propto p(Y | Z, \beta_{1:T}, Q, \Sigma) p(\beta_0, Q, \Sigma) \quad (3)$$

Accordingly, where the prior densities are standard for  $Q$  and  $\Sigma$ , the prior hypotheses are independent:  $p(\beta_0, Q, \Sigma) = p(\beta_0) p(\Sigma) p(Q)$ , definable as follows:

$$\begin{aligned} p(\beta_0) &= N(\bar{\beta}, \Xi_{\beta}) \\ p(\Sigma) &= IW(\Xi_{\Sigma}, \gamma_{\Sigma}) \\ p(Q) &= IW(\Xi_Q, \gamma_Q) \end{aligned} \quad (4)$$

Where the beta coefficient can be estimated as follows:

$$\beta = \left( \sum_{t=1}^{\tau} Z_t^T Z_t \right)^{-1} \left( \sum_{t=1}^{\tau} Z_t^T Y_t \right), \tag{5}$$

In addition, the estimated coefficient of variance (CV) is as follows:

$$V(\beta) = \frac{1}{\tau - (1 + m.p)} \left( \sum_{t=1}^{\tau} Z_t^T \left( \sum_{s=1}^{\tau} \varepsilon_{Y,s} \varepsilon_{Y,s}^T \right)^{-1} Z_t \right)^{-1}, \tag{6}$$

The Gibbs simulation for the conjugates prior Q and Σ is as follows:

$$p(\Sigma | \beta_{0T}, Q, Z, y) = IW \left( \Xi_{\Sigma} + \sum_{t=1}^T (y_t - Z_t \beta_t)(y_t - Z_t \beta_t)^T, T + \gamma_{\Sigma} \right) \tag{7}$$

$$p(Q | \beta_{0T}, \Sigma, Z, y) = IW \left( \Xi_Q + \sum_{t=1}^T (\Delta \beta_t)(\Delta \beta_t)^T, T + \gamma_Q \right)$$

Where Δ donated the first-order interrupt operator.

With the data set of the set y for the period t and the conjugate prior of this variable, the estimated coefficients for the period t can be obtained:

$$p(\beta_{tT} | \Sigma, Q, y^T) = p(\beta_T | \Sigma, Q, y^T) \prod_{t=1}^{T-1} p(\beta_t | \beta_{t+1}, \Sigma, Q, y^t) \tag{8}$$

Where:

$$p(\beta_T | \Sigma, Q, y^T) = N(\beta_T, P_T) \tag{9}$$

$$p(\beta_t | \beta_{t+1}, \Sigma, Q, y^t) = N(\beta_{t|t+1}, P_{t|t+1})$$

The conditional probability distribution is as follows:

$$\beta_{t|t-1} = E(\beta_t | y^{t-1}, \Sigma, Q) \tag{10}$$

$$P_{t|t-1} = V(\beta_t | y^{t-1}, \Sigma, Q)$$

**4. Results**

The variables examined in this study were growth of banking facilities, GDP growth (excluding oil, 2004 = 100), unemployment and inflation measured by consumer price index (CPI) during 2001-2018. Data were obtained from the Central Bank of the Islamic Republic of Iran.

**4.1 Reliability test**

The Augmented Dickey-Fuller (ADF) unit root test was performed for all model variables considering the importance of the variables reliability in time series studies. The results of the test can be seen in Table 1.

**Table 1. Reliability test results**

With the intercept and including process			With the intercept and excluding process			Test type
Result	Prob	Statistic	Result	Prob	Statistic	
Reliable	0.01	-4.18	Unreliable	0.1	-2.57	Credit growth
Reliable	0.00	-9.45	Reliable	0.00	-13.4	GDP growth
Reliable	0.00	-3.03	Reliable	0.05	-2.85	Inflation
Reliable	0.01	-3.96	Reliable	0.00	-3.88	Unemployment growth

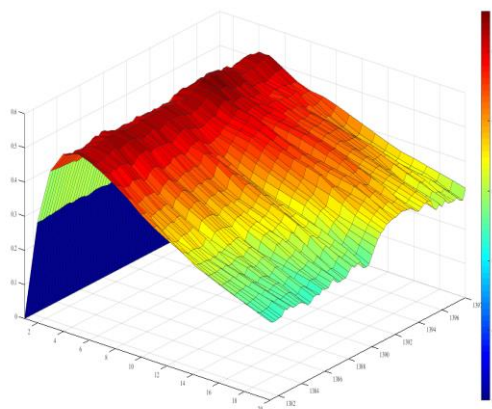
Source: Findings by the researcher

According to Table 1, the test statistic for all variables was greater than the critical value at 95% level. As a result, all variables were reliable.

**4.2 Model estimation**

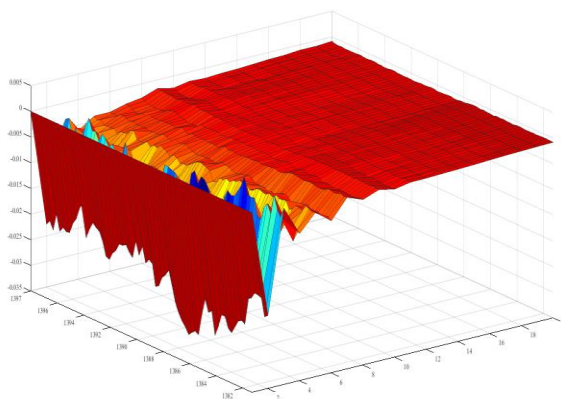
In the following, how the banking facilities affect the economic growth, unemployment and inflation is explained using the reaction curves.

In Figure 1, how credit growth shocks affect the economic growth is shown.



**Figure 1. The curve of impulse response of economic growth to facilities shocks<sup>1</sup>**  
 Source: Findings by the researcher

According to the figure above, economic growth had a positive reaction to facility shocks, with maximum economic growth in the fourth period of reaction following one standard deviation of the facility shock. The magnitude of this reaction was relatively higher during the years 2003-2017. In Figure 2, the reaction of unemployment growth to bank credit shocks can be seen.



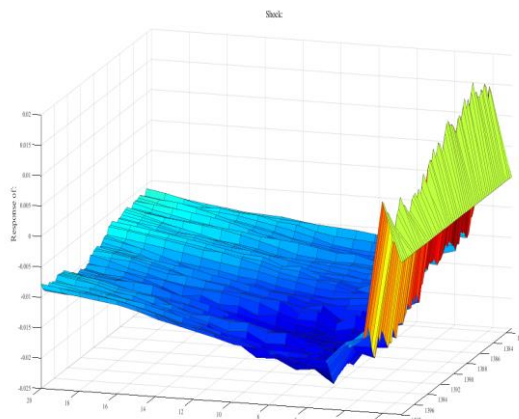
**Figure 2. The curve of impulse response of unemployment to facilities shocks<sup>2</sup>**  
 Source: Findings by the researcher

According to the results, unemployment declined as banks increased lending to the private sector. This indicated that the increase in credit was associated with a reduction in the cost of financing and led to an

<sup>1</sup>. The X-axis represents the reaction intensity of economic growth, the Y-axis represents the post-shock periods, and the Z-axis represents the time period under the study.

<sup>2</sup>. The X-axis represents the reaction intensity of inflation, the Y-axis represents the post-shock periods, and the Z-axis represents the time period under the study.

increase in employment. During the period 2005-2007, the employment decline was relatively more severe. This was due to the lack of international sanctions and the abundance of oil revenues.



**Figure 3. The curve of impulse response of inflation to facilities shocks<sup>3</sup>**

Source: Findings by the researcher

As can be seen in Fig. 3, inflation responded negatively to the facilities shocks in the first two periods. This could be attributed to an increase in liquidity and not guiding it to production. Based on the results, it was found that in 2005, facilities had the greatest impact on inflation. This effect diminished as the end of the period approached. In the third period, the reaction to inflation was negative and gradually disappeared.

### Conclusion

Banking facilities are the main bank outputs through which the wandering liquidity of society is injected into defined and targeted economic bases. This means a bank consumes resources in line with predefined goals by equipping them. The change in the credit supply had a significant impact on macroeconomic variables given the bank-centric nature of the Iranian economy. In this regard, the study provided new empirical evidence using the TVP-VAR method. The results indicated that facilities had a positive and negative effect on economic growth and unemployment, respectively. By the tenth period, inflation had a positive response to the increase in bank credit. Thereafter, the effect of credit shocks on inflation disappeared. Moreover, how the variables were affected changed over time, with the most positive effect of the facilities on economic growth over the years 2003-2017. During the years 2005-2007, the facility shocks significantly reduced unemployment. From 2013 to 1977, the positive effect of credit supply on inflation declined.

Based on the results, the following policy recommendations were suggested:

Increasing banks' capital can be an important source of increasing the power of the banking system to reduce the limits on funds. Increasing facilities to productive sectors can play a significant role in lowering the unemployment rate in the current economic recession given the employment situation in the current economy and the high unemployment rate in the country.

<sup>3</sup>. The X-axis represents the reaction intensity of unemployment, the Y-axis represents the time period under the study, and the Z-axis represents the post-shock periods.

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