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## Analysis of Currency Rate Channel and Credit Channel in Monetary Policy Transmission: A Case Study of Selected Oil Exporting Countries

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### Abstract

**Purpose:** Monetary policies are among the most important economic policies, through which the country's monetary authorities try to control the supply of money in a coordinated manner with other economic policies in a way that fits the goals of that country and promotes the country's gross domestic product. For this purpose, monetary policy transmission channels are important. In this regard, the main purpose of this article is analyze the currency rate channel and the credit channel in monetary policy transmission.

**Design/methodology/approach:** The statistical population of the research is the oil exporting countries, in the end, 15 OPEC member countries including Algeria, Angola, Congo, Ecuador, Equatorial Guinea, Gabon, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates and Venezuela which have oil revenues and available data, has been selected as the final sample of the research. The period of the research is from 2010 to 2023 and the data analysis method is based on the Vector Autoregressive model (VAR).

**Findings:** The findings of the research showed that in the period of reviewing the selected countries, currency rates and bank loans are considered as the channels of influence and transmissions of monetary policy on the gross domestic product (GDP).

**Original/Value (if applicable):** Based on this, it is concluded that in the investigation of monetary policy transmission channels and their effect on GDP, the two channels of currency rate and bank loans should be given more attention, and ignoring them will lead to failure in the policy sector and shortcomings in the analysis section.

**Keywords:** Currency Rate, Credit, Monetary Policy, Transmission, Oil-Exporting Countries

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country, through which the country's monetary authorities try to control the supply of money in a coordinated manner with other economic policies in a way that fits the goals of that country. The manner of the effect of monetary transmission policies and mechanisms on economic performance should be considered to be an effective monetary policy. In this regard, the monetary transmission mechanism entered the economic literature after a lot of arguments between different economic schools about the effect of monetary policy. In other words, the transmission mechanism has been formed in arguments between Keynesians and Monetarists concerning the effective way of monetary policy and changes that have faced transformations in the economic field over time.

Lidler (1987) rendered the monetary transmission mechanism as a causal process or relation from monetary policy to nominal or monetary income. This process begins with monetary policy and ends with production and price. After arguing about the effect or lack of effect of monetary policies or shocks on economic real variables, there have been serious discussions about the impact of monetary policy channels in the past decades. Any of these schools introduced several channels of the effect of monetary policies on production based on their assumptions and attitudes toward economic issues.

In all economic points of view except real business-cycle school, monetary policies affect on economic real variables at least in short term. Therefore, this question is raised that under what mechanism and through which channels the effect of monetary policy spread and therefore it affect on production and inflation? It is necessary to discuss monetary transmission channels, which are currency rate channel, the price channel of other assets and credit channels, in order to answer properly to these above questions.

Any deficiency or friction in credit market such as the lack of equal accessibility of

large and small companies to financial sources, the asymmetry of information between applicants for loan and banks etc. leads to enhance the effect of monetary shocks on economic real variables through the cost decisions of individuals. Therefore, the transmission mechanisms of monetary policy are introduced as the credit channel of bank loan with currency rate and this issue needs to be assessed. In this regard, this research investigates currency rate channels in monetary policy transmission through bank loans in the selected oil exporting countries.

The structure of this article includes: first, the theoretical foundations of the transmission mechanisms of monetary policy are stated based on bank loans and currency rate channels. Then, the experimental literature review is reviewed. In the following, while introducing the research methodology, data analysis will be accomplished and finally the contents will be summarized.

## **1-2. The Transmission Mechanisms of Monetary Policy Based on Bank Loans and Currency rate Channel**

The main monetary transmission channels are divided into two general categories neoclassical and non-neoclassical. First category was introduced based on basic investment, consumption, and international business models in the middle of 20<sup>th</sup> century. The main channel, interest rate channel and channel related to  $q$  twin are operated in the case of investment. There are channels for consumption which are operated through changing the cost of using monetary transmission capital by wealth effect and there is straight channel for business which is responsible for the transmission of monetary policy effect through currency rate. Channels are named non-neoclassical monetary transmission mechanisms which are caused by market shortcomings other than the final one related to nominal wage and price stickiness (Benigno et al, 2023). These types of channels are assessable from the

point of governments' interference in markets and also the shortcomings of private markets which includes problems such as asymmetric information or the separation of markets and therefore, it causes limitations for the efficient performance of financial markets.

### **1-2-1. Straight channel of interest rate**

The most traditional and oldest monetary transmission channel is the effect of interest rates on the cost of using capital and through it, changing the cost of households and companies' investment (for example, investing on long-lasting consumer goods and housing). Standard non-neoclassical investment models show that the cost of using investment is the most important effective factor on investment demand which can include different types of investment in inventory, housing or long-lasting consumer goods.

If monetary policy tools are short-term interest rates, the monetary transmission mechanism relies on the relation between short-term and long-term interest rates which are related based on several expectation of term structure. While monetary policy leads in increasing short-term interest rate, long-term interest rate tends to increase; because long-term rate depends on future short-term rates. Because of this overrun, using capital increases and capital demand decreases. The decrease of capital assets demand leads in decreasing investment costs in mentioned assets and so the decrease of costs and total demand. This type of interest channel is positioned in the analysis center of old Keynesians IS-LM which refers to Hicks works (1937). Of course, this channel has recently been shown in some new Keynesians models (Mahrooz, Mehrazad, 2020).

### **1-2-2. Interest rate channel**

When the central bank decreases interest rates, domestic return on assets decrease compared to foreign assets. So, the value of domestic assets relative to assets and other currencies decreases and domestic currency

weakens. The low value of domestic currency makes domestic goods cheaper compared to foreign goods which it lead in transferring consumer costs to the domestic economic and increasing net exports. The increase of net export is added to total demand directly. In another analysis, in the case of performing restrictive monetary policy, when domestic nominal interest rate increases compared to its foreign counterpart, rebalance in foreign currency market requires domestic currency to be weakened gradually by a rate that causes the equality of adjusted returns of various types of debt instruments. It is the equality of no overlapping rate. In traditional Keynesian models which are based on the theories of Dornbusch, Mundell and Fleming and also in new Keynesian models, this decrease requires to increase the initial value of domestic currency due to the slow price adjustment which makes domestic goods more expensive than foreign goods. The net exports of goods decreases and as a result, domestic production and employment decrease. On the other hand, the change of currency rate effects on the price of imported goods directly. Of course, the effect of currency rate on the price of imported products depends on the tendency of imports to currency rate. However, the change of imported goods has an important role in determining the general amount of changes of domestic prices regarding whether they are consumer or capital goods. Therefore, currency rate channel has an important role in the way of effectiveness of monetary policy on economic. In this regard, there are two important factors: first, the sensitivity of currency rate to the change of interest rate, and second, the measure of openness. The more open the economies, the greater the function and role of this channel (Sims, 1992; Taylor, 1999).

### **1-2-3. Bank credits channels**

Recently, the role of interest rate and currency rate in the transmission of monetary policy effect have been argued,



$$M \uparrow \Rightarrow B_d \uparrow \Rightarrow L \uparrow \Rightarrow I \& C \uparrow \Rightarrow Y \uparrow$$

$$M \downarrow \Rightarrow i \uparrow \Rightarrow \begin{matrix} P_s \downarrow \Rightarrow AS \& MH \uparrow \\ CF \downarrow \Rightarrow AS \& MH \uparrow \end{matrix} \Rightarrow L \downarrow \Rightarrow I \downarrow \Rightarrow Y \downarrow$$

Finally, the mechanism of currency rate channel on total production is ambiguous. Because the increase of the amount of money with increasing in currency rate increases exports and total demand. On the other hand, by increasing the price of imported consumer goods (decrease in total demand) and increasing the price of capital goods (decrease in total supply) and increasing the value of the external debt of companies, it causes a decrease in total production. Therefore, the net effect of currency rate channel will depend on the outcome of these changes.

#### 1-2-4. Research Background

Experimentally, we can mention below researches who studied the transmission mechanisms of monetary policy focusing on bank credit channels and currency rate. In the Iranian studies, Rahimi et al. (2023) determined the most important transmission mechanisms of monetary policy on economic growth in Iran's economy. According to the results, the most important transmission channels of monetary policy were effective real currency rate, long-term bank interest rate, unofficial currency rate misalignment from official, the growth rate of all share index, housing price index in Tehran, money volume, total liabilities of banking system and the growth rate of granted credit to the private sector.

Haghtalab et al. (2023) studied the effect of monetary policy of bank advance channel on macro factors in Iran's economy. According to the results, it can be said that most macro factors showed the most positive reaction to the shocks from bank advances as an effective channel of monetary policy. Zareinezhad et al. (2022) studied the transmission channels of the effects of monetary policies on the inflation

of Iran's economy. The results shows that In the regime of one credit channel and in the regime of two channels, housing price and stock price channel have played the main role in the transmission of the effects of money on inflation.

Bastin et al. (2022) analyzed comparatively the transmission channels of monetary policy in the inflation situation of Iran's economy. The results of this study showed that currency rate have had a negative and significant effect on economic growth which has been enforced in the high quintiles of economic growth. Also, according to other results of this study, bank credits have had a positive and significant effect on economic growth. Ghadiri et al. (2021) studied the role of credit channel and currency rate in transmission monetary policy on housing in Iran. The study of the experimental results showed that the shock of granted bank advances have positive and significant effect in short-term, medium-term and long term on the price and production of housing sector. Also, despite the slight effect of these two channels in transmitting the effects of monetary policy in housing sector, if the monetary policy is transmitted to housing sector through the lending channel of banking system, the volume of money has the greatest effect on the production and price of housing sector, and if the monetary policy is transmitted through currency rate channel to housing sector, the liabilities of banks to the central bank has the greatest effect on the production and price of housing sector.

Mahdiloo and Asgharpoor (2020) studied the role of currency rate channel in the nonlinear transmission mechanism of monetary policy in Iran. The estimated results about the role of currency rate channel in monetary transmission mechanism indicate that increasing money through currency rate channel in the zero regime did not play a role in the transmission of money to production, while in the one regime, currency rate channel had a significant contribution to money

transmission to production and the changes of money through this channel have led in decrease in production. On the other hand, the contribution of currency rate channel in money transmission to prices is more and more lasting in the zero regime (high growth of money) compared to the one regime (low growth of money).

In foreign studies, Benigno et al (2023) investigated monetary transmission mechanism in European countries during the Covid-19 pandemic. The results showed that monetary policy and its effect channels have a significant effect on production in these countries in the Covid-19 pandemic. Jahufer and Hanainy (2023) showed in an article that required actions should be done to implement suitable monetary policies in order to keep gross domestic product in a growing path and keeping gross domestic product on a progressive path increases the value of the Sri Lankan currency toward American dollar. Performing strong monetary policies to monitor bank rates carefully and commercial bank loans will lead to progressive economic growth.

Marshal and Toby (2022) studied the effect of monetary policy on economic variables in Nigeria. The results showed that there are a short-term and long-term relationship between bank advance channel and economic growth in this country. Also, the results showed that the shock of the monetary policy of bank advance has led in increasing economic growth in this country. Sadeghi et al. (2022) showed that the price index of all commodity groups increased in response to currency shocks regardless of domestic and foreign sources. The inflationary effects of foreign currency shocks with domestic sources continued in the medium and long-term, while the inflationary effects of foreign currency shocks with foreign sources were mild in the medium term and neutralized in the long term. Furthermore, the speed of modification in deviation from long-term balance after the shock of international economic sanctions is significantly more than the policy of the unification of

currency rate. Monetary policy was expanded and enforced after foreign shock and inflation expectations with domestic source and inflation expectations did not move in the same direction. On the other hand, the monetary policy was restrictive and it moderated the inflation effect of exchange shock and inflation expectations moved in the same direction.

Apanisile (2021) investigated the effect mechanism of monetary policy by using the stochastic dynamic general equilibrium model approach in Nigeria. The results stated that the performance of banking system through granting advances will lead in increasing in investments in economy. Iddrisu and Alagidede (2021) studied the effectiveness mechanism of monetary policy from interest rate channel and advances. The results of this study indicated that monetary policy shock from interest rate channel has led in decreasing production and bank advance shock has led in increasing production in this country.

Chmielewski et al. (2020) studied monetary policy mechanism in Poland. The results stated that the effectiveness of monetary policy channel on macroeconomic variables has varied over time. investigated the transmission channels of monetary policy in Vietnam with the SVAR method. The results based on the structural vector of auto regression (SVAR) method show that monetary shocks have an important effect on Vietnam's production. The results that monetary policy in Vietnam is relatively sensitive to foreign shocks. Jafari Samimi et al. (2019) in a study examine the effect of monetary policy on the distribution of economic activity and accumulated economies in a country. Considered channel for the effectiveness, the accessibility of credit for companies in different regions and its effects on the job and welfare of consumer. For this purpose, related data to producing companies located in 30 provinces of Iran gathered from 2007 to 2014 were considered. The experimental results of spatial panel data shows that regional monetary policy

implications through the unequal distribution of regional loanable bank funds appear to be a significant center-oriented force beside the conventional channel of effectiveness through the consumer and labor desirability function. It is assumed that monetary policy decrease the effect of credit limitations, but the mount of credit in regions is an important driver for the concentration of economic activities.

According to the accomplished investigations, this research is innovative and new in the following aspects; In terms of subject, no research has investigated the effects of credit currency rate channels in monetary policy transmission on production, which shows that the current research is innovative in terms of subject. In terms of location, the present research has investigated the effects of currency rate channel in monetary policy transmission for the selected oil exporting countries which shows that this research is innovative in terms of location. Finally, in terms of time period, this research uses the most up to date data in which term it is innovative.

$$\begin{array}{l}
 M \uparrow \Rightarrow \left| \begin{array}{l} \pi^e \uparrow \Rightarrow E \downarrow \Rightarrow \\ P_{im} \uparrow \Rightarrow \\ NW, NW_b \downarrow \Rightarrow L \downarrow \Rightarrow I \& C \downarrow \Rightarrow Y \downarrow \end{array} \right. \left| \begin{array}{l} NX \uparrow \Rightarrow Y \uparrow \\ \pi \uparrow \Rightarrow Y \downarrow \end{array} \right. \\
 \\
 B_d \uparrow \Rightarrow L \uparrow \Rightarrow I \& C \uparrow \Rightarrow Y \uparrow
 \end{array} \quad (1)$$

The expected inflation increases through increasing the volume of money in currency rate channel and therefore currency rate decreases. The decrease of currency rate leads in the increase of the price of imported goods and on the other hand, it leads in the decrease of the net wealth of companies and banks. By increasing the price of imported goods, net export increases and leads in the increase of production, and on the other hand, it lead in the increase of domestic inflation and the

## 2. Research Methods

The purpose of this thesis is the investigation of the existence of currency rate channel and credit channel in monetary policy transmission in the selected oil exporting countries such as Iraq. Marshal and Toby (2022) who admitted the effects of the credits channels of monetary policy in monetary policy transmission, Iddrisu and Alagidede (2021) who admitted interest rate channel and bank loan in monetary policy transmission, Ippolito et al. (2018) who have examined and admitted the transmission mechanisms of monetary policy through bank lending focusing on the currency rate channel, Mahdiloo and Asgharpoor (2019) who have examined the role of currency rate channel in the nonlinear transmission mechanism of monetary policy. Ghadiri et al. (2021) have admitted the role of credit channel and currency rate in monetary policy transmission in housing sector, the following general form is used:

decrease of production. Also, by decreasing the net wealth of companies and banks, the ability of taking loan by a company and granting loan by banks decrease and by decreasing bank advances the level of investment and consumption decrease which leads in the decrease of production. Bank deposits increase in credit channels by increasing the volume of money and the lending capability of banking system is also increases. By increasing the granting advances of banks for companies and

households, the level of investment and consumption increases and as the result its production increases.

According to the existing limitations, the vector of variables can be introduced as follows (The variables  $y$ ,  $p$ ,  $m$ ,  $cr$  are logarithmic):

$$Y' = [y \quad p^* \quad m \quad rr \quad s \quad cr] \quad (2)$$

In this relation, gross domestic product ( $y$ ) and the consumer price index of households without housing ( $p^*$ ) shows the level of domestic activity in the form of goods and service market. The credit variable ( $cr$ ) indicating the amount of granted advances to the private sector also shows the interaction between monetary policy and credits through credit channel in the mechanism of monetary transmission. Credits, as a macroeconomic variable, play an important role in guiding economic

activities. The unofficial currency rate ( $s$ ) also considers the effects of monetary policy shocks on the value of domestic currency.

In these models, the change of endogenous variables have been explained 6 components of structural disruptions: total supply shock, total demand shock, money demand shock, money supply shock, payments balance shock, and credit shock. In the following, we introduce linear relationships which relate every residual of summarized form ( $u_i$ ) to structural shocks ( $E_i$ ) through the equilibrium relationships of macroeconomic models in order to identify the model. In the case of the AB model, the relationship between the remaining components of summarized form and the structural shocks before applying any restrictions will be as follows:

$$\begin{bmatrix} 1 & a_{12} & a_{13} & a_{14} & a_{15} & a_{16} \\ a_{21} & 1 & a_{23} & a_{24} & a_{25} & a_{26} \\ a_{31} & a_{32} & 1 & a_{34} & a_{35} & a_{36} \\ a_{41} & a_{42} & a_{43} & 1 & a_{45} & a_{46} \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & a_{56} \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix} \begin{bmatrix} u_y \\ u_{p^*} \\ u_m \\ u_{rr} \\ u_s \\ u_{cr} \end{bmatrix} = \begin{bmatrix} b_{11} & b_{12} & b_{13} & b_{14} & b_{15} & b_{16} \\ b_{21} & b_{22} & b_{23} & b_{24} & b_{25} & b_{26} \\ b_{31} & b_{32} & b_{33} & b_{34} & b_{35} & b_{36} \\ b_{41} & b_{42} & b_{43} & b_{44} & b_{45} & b_{46} \\ b_{51} & b_{52} & b_{53} & b_{54} & b_{55} & b_{56} \\ b_{61} & b_{62} & b_{63} & b_{64} & b_{65} & b_{66} \end{bmatrix} \begin{bmatrix} \varepsilon^{AS} \\ \varepsilon^{AD} \\ \varepsilon^{MD} \\ \varepsilon^{MS} \\ \varepsilon^{BP} \\ \varepsilon^{cr} \end{bmatrix} \quad (3)$$

## 2-1. Total Supply Shock

Camarero et al. (2002) introduce the total supply shock based on the study of De Arcangelis (1996) about studying monetary policies in Italy by using the generalized Phillips curve for Spain:

$$\pi = \pi^e + (y - \bar{y}) - b_1 \varepsilon_t^{AS} \quad (4)$$

In this relation, inflation ( $\pi$ ) is a function of the expected inflation ( $\pi^e$ ) and the production gap ( $y - \bar{y}$ ). In the case of stable equilibrium model, the inflation and expected inflation are equal which will be  $(y - \bar{y}) = b_{11} E_t^{AS}$ . De Arcangelis (1996) states that if the production in full employment and the expectations of current production in the previous period are equal, the production gap can be considered as a disruption in the production level ( $u_y$ ).

$$u_y = b_{11} \varepsilon_t^{AS} \quad (5)$$

Therefore, total supply shock is the generated innovation in the level of production which is usually generated by created shock in the technology of production, oil shock and ....

## 2-2. Total Demand Shock: $E^{AD}$

According to curve expanded IS introduced by Branson (1979), the function of total demand can be as the following:

$$AD = c(y - t(y), A/p) + i(r) + \bar{g} + NX(y, p, \mathbf{6}) \quad (6)$$

In this function, based on the Ando and Modigliani (1963) consumption function, the net real value of household ( $A/P$ ) affects the consumption level ( $c$ ). Housing is one of the family assets that constitutes a major share of people's wealth (the net real value of a family). Also, Kiss and Vadas (2005) and Girouard and Blondal (2001), based on

their empirical studies, state that there is a positive and significant relationship between housing price (hp) and family expenses. Therefore, the wealth derived from residential property can affect family consumption expenses.

As you know, the function of investment demand (i) is a function of interest rate which shows a part of the cost of using capital while the amount of access of companies to the credit source of banks (cr) can be considered in another form of using cost of these sources which affect capital demand. Therefore, the function of total demand can be rewritten in a balance situation as below:

$$y = c(y, hp, p^*) + i(r, cr) + \bar{g} + NX(y, p^*, s) \quad (7)$$

So, the shock of total demand can be considered as generated distributions related to the level of credits and housing price. Of course, since the shock of total demand has been “normed” compared to prices, this shock can be rendered as a price or inflation shock.

### 2-3. Money Demand Shock: E<sup>MD</sup>

In the study of Shahrestani and Sharifi Ranani (2008), the function of money demand for Iran is introduced as follows, based on the study of Bahmani Oskooi and Rahman (2005) for a number of developing countries:

$$M_1 = p^* \cdot f(y, \pi, s) \quad (8)$$

In which the inflation rate shows the opportunity cost of saving money. The opportunity cost of saving money shows the difference between the rates of return on assets substituted assets replaced money. One of the most important of these assets are housing in Iran. Therefore, it can be said that money demand shock can be introduced as:

$$a_{31}\mu_y + a_{32}\mu_{p^*} + \mu_m + a_{33}\mu_s + a_{37}\mu_{hp} = b_{33}\varepsilon_t^{MD} \quad (9)$$

So, money demand shock is the result of the linear combination of disruptions in production, price level, money volume, currency rate and housing prices.

### 2-4. Money Supply Shock: E<sup>MS</sup>

As it mentioned in chapter two, according to the relations (1), (2) and (3), money supply has been formed by multiplying two variables of money multiplier and monetary basis:

$$M^s = \frac{1 + C/D}{C/D + FR/D + rr} (FACBN + GDCBN + BL + ACBRN) \quad (10)$$

In monetary basis, the foreign net assets of central bank is the function of currency rate. Also, in the money multiplier variable, the ratio of legal deposit (rr) has an important role as a political variable. Two ratios of money paper and coin in the hand of individuals to the total visual and long-term bank deposits (C/D and the ratio of bank free reserves to the total visual and long-term bank deposits (FR/D) can be considered as the indices of the amounts of banking system credits which effect on money supply through money multiplier variable. Therefore, money supply can be introduced as below:

$$a_{43}\mu_m + u_{rr} + a_{44}\mu_s + a_{44}\mu_{cr} = b_{44}\varepsilon_t^{MS} \quad (11)$$

Here, the structural shock of money supply has been normed regarding the ratio of legal deposit.

### 2-5. Balance Payment Shock: E<sup>BP</sup>

Assuming the relatively open economy of Iran, by entering payments balance, the demand side of the economy becomes more complete. Our purpose is to study the way of determining currency rate in the market. Kamaro ET.AL (2002) based on the study of De Arcangelis (1996) introduce the following relation to investigate payments balance shock:

$$NX(u_y, u_s - u_{p^*}) + NFI(u_r, u_R, u_m) + \varepsilon^{BP} = \quad (12)$$

In which NX and NFI shows net exports and net capital account and EBP is interpreted as payments balance shock. Net exports depends on the disruptions of production and real currency rate and net capital accounts also depend on the created disruption in short-term and long-term interest rate and the volume of money controlled by central bank (as the

intervention of central bank in exchange market).

Kamijani (1995) considers the net capital account as a function of the difference between global interest rate and domestic interest rate (bank advance's interest rate) and he doesn't consider the volume of money effective directly. On the other hand, there is no interest rate in Iran officially and also the capital market isn't powerful enough and has no significant relationship with the global financial markets, the net capital account of payment balance is considered as an exogenous variable. So, the relationship of mentioned disruption with payment balance shock can be stated as:

$$a_5\mu_y + a_5\mu_p + u_s = b_{55}\varepsilon_t^{BP} \quad (13)$$

In this relation, payments balance compared to currency rate is normalized.

## 2-6. Credit Demand Shock: $E^{cr}$

A variable which is entered to complete the function of investment demand in the model is the real granted credit of banking system to the private sector. Regarding this variable, interaction between monetary policy and credit can be studied by the credit channel of monetary transmission mechanism. Credits is one of important macro variables which has a crucial role in effecting economic activities. Ehrmann (2003) in his study about the role of banking system in monetary transmission in the European region, introduces the amount of granted loans by banking system as a function of nominal interest rate as a tool of monetary policy, real gross domestic product and inflation rate. In this relation, political variable interest rates and production and inflation show the level of economic activity.

$$cr = g(r, y, \pi) \quad (14)$$

Therefore, credit shock can be considered as a result of generated disruptions in production, the level of price, the political variable of the ratio of legal reserves and the amount of granted credits of banking system to private sector.

$$a_6\mu_y + a_6\mu_p + a_6\mu_{rr} + u_{cr} = b_{66}\varepsilon_t^{cr} \quad (15)$$

Here, credit demand shock compared to the granted credits of banking system to private sector has been normalized.

The variables used in this study are as follow (Table 1).

The statistical population relates to the study hypothesis testing of oil exporting countries which are finally 15 OPEC member countries including Algeria, Angola, Congo, Ecuador, Equatorial Guinea, Gabon, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, UAE The United Arab Emirates and Venezuela, that both have oil revenues and available data, have been selected as the final sample of this research. The applied method in this research is descriptive-analytical method which is used in order to adjust economic theories to the reality of society, causal relationship between variables using required statistics and numbers and after adjusting to theories, the acceptance and rejection of the presented theories test by using deductive statistics and econometric method of families (VAR). The methodology of this research is library research and internet search of articles from various databases, as well as gathering information from the website of the World Bank, International Monetary Fund, etc. The research time period is from 2010 to 2023.

## 3. Results and Discussion

### 3-1. Durability Test

The durability test of Im, Pesaran and shin has been used to test the durability of variables. The results of durability test have been presented in the following table (Table 2).

According to the obtained possibility level for the variables of research that is less than the error level of 0.05, it can be concluded that the research variables is in the error level of 5% and differencing is not required.

### 3-2. Estimation of VAR model

The first step of estimating VAR model is the determination of the number of optimal

pauses. To determine the optimal pause, Akaike (AIC), Hannan-Quinn (HQ) and Schwartz Bayesian (SC) statistics have been used (Table 3):

According to Akaike, Hannan-Quinn and Schwartz Bayesian criteria, 2 pauses has been selected as optimal pause. In the following, the estimation of VAR model is performed based on the number of 2 pauses.

### 3-3. Estimation of Model

In the VAR model, all variables are considered endogenous, the model is estimated based on the number of available variables (gross domestic product, prices general level, money demand, banks liabilities to the central bank, currency rate and bank loans), that in each model, one of the variables is considered as dependent variable and the other variables and their pauses are considered as independent variables. Due to this issue that in the VAR model, some coefficients are significant and some are not, there is no possibility to determine the relation of research variables according to the VAR pattern. Because it is possible that some coefficients are not significant in a pause but the simultaneous existence of them creates a significant relationship. So, in order to determine a significant relationship between the variables of research purpose such as currency rate and bank loan with gross domestic product some tests are used through variance analysis which shows a significant and large effect of a variable on another variable. Haug et al (2005) test is included these tests which is similar to Granger causality test. This test is performed by an optimal pause of 2 and its results are presented in table (4).

The results of Hurlin and Dumitrescu test show that the zero theory has been rejected for both currency rate variable and gross domestic product variable in the error level of 0.05 and therefore, currency rate and gross domestic product as well as bank loans and gross domestic product have two-way communication with each other. Although this result confirms the existence

of simultaneous effect of two variables, but it cannot determine the direction of these two variables. In order to see the resultants of the dynamic effect of variables, the amount of their effect's reaction was calculated in relation to each other, which is presented in the following diagrams (Figures 1 and 2).

As observed, In the case of a shock to currency rate variable, gross domestic product will start to increase sharply until the second period, after that it will start to decrease until the 4<sup>th</sup> period, and after that it will increase until the 10<sup>th</sup> period so that after the 10<sup>th</sup> period currency rate shock raises gross domestic product to a higher level than the first condition and therefore these effects are stable.

For bank loan variable, it can be observed that a shock to bank loan variable will lead in a huge jump in gross domestic product at first, however its intensity decreases after this jump but finally, and after the 10<sup>th</sup> period, the level of gross domestic product is balanced at a higher amount than its first level which indicates the stability of the effects of bank loan shock on gross domestic product.

The following results can be observed about other variables (Figure 3).

As it can be seen, in the case of shock in the general level of prices variable, gross domestic product start to decrease and finally it also show its decrease of stability (Figure 4).

A shock to money demand variable, also like the general level of prices shows negative and stable effects on the gross domestic product level of investigated countries (Figure 5).

Finally, it can be seen that a shock to bank liabilities to central bank, the gross domestic product level of investigated countries undergoes a noticeable and stable decrease.

In the following, the contribution of shock variables in the explanation of gross domestic product variable is discussed (Table 5).

According to the presented data in the table of variance analysis which shows the contribution of each variable in the explanation of the variation of gross domestic product, it can be observed that for example, in the second period, 95/15% of variations are explained by Y variable itself, after it, there are variables P\*, M, CR, L AND E with determined contribution in the table. This procedure of explanation has been presented until the 10<sup>th</sup> period.

### 3-4. Patterns Stability Test

Lutkepohl method has been used for the stability test of patterns in the end of data analysis and the estimation of relationship between variable by VAR method. In this test, two real and virtual vectors are calculated based on the data and by their result, a module is created for stability test. The hypothesis of pattern stability will not be rejected if the modulus amount is less than one. The result of calculations is presented in table (6).

The results of calculations show that since the amount of module is less than 1 in the time period of 2010 to 2023, so the estimated model is stable.

### 4. Conclusion

The purpose of this research is to analyze currency rate channel and credit channel in transmission monetary policy in 15 oil exporting countries from 2010 to 2023 based on Vector Autoregressive model (VAR). The findings of the research showed that currency rate channel considers as a canal of monetary policy transmission and the effect on gross domestic product. In this relations, it is concluded that every framework should include international economic fields and relationships in order to perform monetary policy. Before 1970s, the usual patterns of determining currency rate were based on the level of relative prices and business flows and the tensions of currency demand and supply, the intense variations of currency rate in the years after its floating rise this idea in the mind of economists that

its variations are so similar to prices in asset market and it seems that it is affected by monetary situation. After those years, the theoretical literature of determining currency rate tended to patterns based on asset market in which exchange rate has a key role as the relative price of national currency rather than the price of national products. According to the model of Dornbusch, monetary shocks in short-term cause the derivation of currency rate from long-term balance (purchasing power equality), for example, if money volume increases, immediately real money supply increases (because prices are stable in short-term), in order to compensate for excess supply in monetary market, domestic interest rate decreases, decreasing domestic interest rate causes capital outflow and an increase in currency rate. The increase of currency rate along with the increase of net export value leads in increasing total demand. According to currency rate channel, monetary policy effects more on export-oriented sectors. Most of revenues in these sectors are obtained from foreign markets, therefore, it will react more intense to the changes in exchange rate due to apply monetary policy. So, by applying an expansionary monetary policy, increasing money volume, currency rate decreases which leads in decreasing capital outflow and increasing currency rate. The increase of currency rate leads to the increase of the price of foreign goods and the decrease of domestic goods which causes the increase of export value and the decrease of total demand in economy. This conclusion match the obtained findings by Zareinezhad et.al (2022), Benigno et al. (2023) and Chmielewski et al. (2020).

Other findings showed that bank loans is considered as an effective channel of monetary policy in the studied countries. In this regard, also it is concluded that credit channel effects on monetary policy transmission by two channels which are: bank lending channel and new Keynesians balance sheet channel. For the first time,

based on the asymmetric information and credit market frictions hypothesis, they proposed credit channel as a new mechanism for transmitting the effects of monetary policy. According to the credit market hypothesis, the direct effects of monetary policy on interest rate expand through endogenous changes in external financing rewards. The cost or reward of external financing is the difference between the cost of funding from the external sources of the company and the opportunity cost of funding from the internal sources of the company. Bank deposits decrease when the central bank implements a restrictive monetary policy in money supply, and commercial banks have to reduce lending in this circumstance. The result of reducing bank loans is the decrease of investment and real economic activities, this means that businesses and consumers rely on bank loans and they will not be able of financing for the purchase of long-lasting goods and capital assets by reducing bank loans. It should be mentioned that banks with different characteristics and financial strength (in terms of size, liquidity and capital) have a distinct role in the transmission mechanism of monetary policy shocks. This conclusion matches the obtained findings of Haghtalab et al. (2023), Marshal and Toby (2022) and Iddrisu and Alagidede (2021). According to this conclusion, the channels of currency rate and bank loan are presented as two canals of effect monetary policy on gross domestic product, the following recommendations are presented:

- It is suggested to the politicians in the studied countries to use the two channels of currency rate and bank loan regarding situations in order to enhance gross domestic product in economic recession.
- It is suggested to the researchers and analysts working in this field, to consider the two channels of currency rates and bank loans so that the presented analyzes become more realistic and reliable, in studying the effective factors in the transmission of

monetary policies on gross domestic production.

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## Tables

**Table 1. Defenition of Variabels**

Variable	Symbol	Type of variable	Scientific description-practical variable	Variable measurement	Scale
Gross domestic product	Y	Dependent	Gross domestic product to the stable price of 2015	Gross domestic product to the stable price of 2015	Dollar
Prices general level	P*	Independent	Consumer price index of families without housing	Consumer price index of families without housing	No measure
Money demand	M	Independent	Money volume	Money volume	Dollar
Bank liquidities to central bank	Cr	Independent	The amount of granted advances to private sector	The amount of granted advances to private sector	Dollar
Currency rate	E	Independent	Unofficial currency rate	Unofficial currency rate	No measure
Bank loan	L	Independent	Bank loans volume	Bank loans volume	Dollar

**Table 2. results of Durability test**

Variable	Description	statistic	Possibility	Result
Y	Gross domestic product	-3/09	0/0009	Durable
P*	Prices general level	-2/71	0/0023	Durable
M	money demand	-2/88	0/0019	Durable
CR	Bank liabilities to central bank	-2/64	0/0025	Durable
E	Currency rate	-10/46	0/0000	Durable
L	Bank loan	-5/24	0/0000	Durable

Source: the findings of research.

**Table 3. The results of determining optimal pause**

The number of pause	Akaike criterion (AIC)	Hannan-Quinn criterion (HQ)	Schwartz Bayesian criterion (SC)
Without pause	48.63538	48.80203	48.70258
With 1 pause	42.62346	44.79004	44.09390
With 2 pause	42.47755*	43.64405*	43.35121*
With 3 pause	42.90851	46.07493	44.18539

Source: the findings of research.

**Table 4. The results of Hurlin and Dumitrescu test.**

Number of pause	Statistic w	Statistic z	Possibility
Relationship between currency rate variable and gross domestic product variable			
Without pause	9/45	5/25	0/0000
With 1 pause	8/71	4/40	0/0000
With 2 pauses	5/41	3/25	0/0002
Relationship between bank loan variable and gross domestic product variable			
Without pause	7/96	4/85	0/0000
With 1 pause	5/52	4/10	0/0000
With 2 pauses	3/22	3/53	0/0001

Source: the findings of research.

**Table 5. the results of variance analysis test**

Period	Y	P*	M	CR	E	L
1	100.000	0.000	0.000	0.000	0.000	0.000
2	95.154	4.558	4.201	0.834	0.065	0.189

3	69.302	2.540	2.913	1.343	11.764	0.138
4	68.153	2.522	2.306	1.302	17.513	0.205
5	65.210	2.602	2.283	1.266	19.278	0.361
6	63.522	2.531	2.161	1.244	18.664	0.345
7	61.998	2.756	2.148	1.240	18.127	0.312
8	60.670	2.848	2.103	1.229	17.746	0.303
9	59.584	2.851	2.072	1.220	17.209	0.290
10	58.499	2.915	2.013	1.204	16.818	0.273

Source: the findings of research.

**Table 6. The results of Lutkepohl stability test**

Module	Real vector	Virtual vector
0.21293	0.08239	0.06527
0.21721	0.13589	0.11449
0.22363	0.35417	0.10058
0.19046	0.22042	0.107
0.15087	0.00321	0.11342
0.57031	0.00535	1.88213
0.05885	0.03317	0.19902
0.36059	0.08239	0.14873
0.36915	0.00428	0.09202
0.36059	0.02354	0.00642

Source: the findings of research.

## Figures

Response to Cholesky One S.D. (d.f. adjusted) Innovations



Figure 1. the reaction of gross domestic product to currency rate shock. Source: the findings of research

Response to Cholesky One S.D. (d.f. adjusted) Innovations



Figure 2. the reaction of gross domestic product to bank loan shock. Source: the findings of research.

Response to Cholesky One S.D. (d.f. adjusted) Innovations

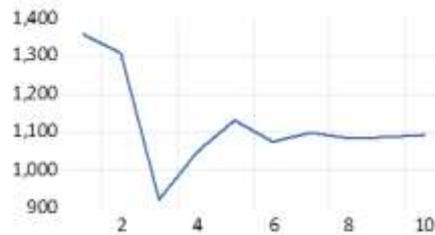


Figure 3. the reaction of gross domestic product to the general level of prices shock. Source: the findings of research

Response to Cholesky One S.D. (d.f. adjusted) Innovations

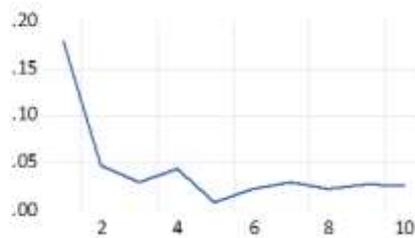


Figure 4. the reaction of gross domestic product to money demand shock. Source: the findings of research.

Response to Cholesky One S.D. (d.f. adjusted) Innovations

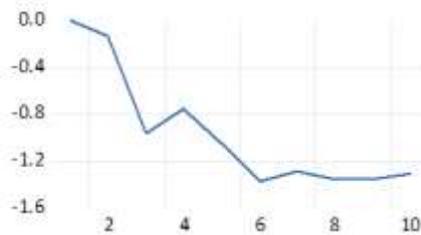


Figure 5. the reaction of gross domestic product to the shock in bank liabilities to central bank. Source: the findings of research.

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